Public-Private-Partnership (PPP) and Project Finance

Development and Use of Financial Models

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To
the memory of my father
Prabir Kumar Das

Foreword

PK (as Prabuddha is generally known among colleagues and friends) has always been a "thinking" practitioner, and it is easy to feel the teacher in him. I am delighted that PK has successfully pulled together these aspects of his persona and, abstracting from long years of diverse experience, produced this very useful addition to the literature on project finance.

Public Private Partnerships (PPPs) have emerged as key components of infrastructure development around the world — including in India. Over the past 15 years, the country has seen significant progress in the use of PPPs across sectors like roads, airports, ports and power. Among National Highways alone, over 200 PPP projects involving a total investment of about ₹ 1.9 trillion have been awarded till date and the trend is one of further increase in the share of PPPs in the total investment. Two green-field airports in Bangalore and Hyderabad, and the significant expansion and modernisation projects at the Delhi and Mumbai airports have been undertaken as PPP projects. Besides the development of green-field minor ports at Pipavav, Mundra, and Gangavaram, a number of expansion projects at the major ports have been developed on a PPP basis. Some PPP action has also been seen among state highway, real estate, water supply and sewerage, and solid waste management sectors although institutional weaknesses at the level of State Governments and Urban Local Bodies remain a challenge. All these developments have been encouraged and enabled by initiatives taken by the Government of India and many state governments to make the required statutory, policy and institutional arrangements, to provide viability gap funding, and to promote creation of specialised institutions for leading private capital to infrastructure.

Going forward, there is little doubt that PPP will continue to be a key driver for infrastructure development as the country strives to achieve a sustainable investment of at least 10% of Gross Domestic Product (GDP) in infrastructure in order to keep the country on a high growth path. Creation of adequate intellectual capital to support this effort is a critical prerequisite of success. This book seeks to address that requirement.

All of us working on PPP projects have had to learn on the job and from our errors of commission and omission. The situation has improved to some extent with several initiatives being taken by the Government and multilateral agencies to undertake capacity building and to document and disseminate the learning from past experience. However, the focus of these initiatives has largely been on policy and conceptual issues. This book, on the other hand, makes an important contribution by focussing on nuts and bolts issues of public private partnerships in a practical and hard-nosed manner.

While the focus of his book is firmly on the financial model of the PPP project as a key enabler of successful implementation, PK has managed the difficult task of catering to not only those involved in developing such financial models but also to the many who make use of such models for decision making. Such users, without having to be necessarily aware of all the bells and whistles in a financial model, can use the book to understand the basics of the underlying theory and the issues and constraints inherent in financial modelling. This would help them in shaping realistic expectations from a financial model. Hopefully, this book will help to create a more level playing field by educating a wide range of stakeholders in future PPP projects.

While there have seen several successful PPP projects delivered over the last 10–15 years, there is no count of the number of still-born PPP projects. Anyone involved in this field can probably name several attempts that never took off. Irrational exuberance has been one of the principle reasons behind some of these failures. Both government sponsors as well as enthusiastic private bidders have been victims of such unjustified optimism in many cases. It would take only a few high profile failures to erode the credibility of the whole PPP approach. By equipping different stakeholders with the tools, lenses, and filters of informed financial modelling and project finance, this book should help focus the attention of decision makers on the selective use of a PPP strategy and on appropriate allocation of risks therein.

The breadth of coverage of this book also makes it potentially useful to students and fresh entrants considering a career in PPP and project finance.

I would list the following features of the book as worthy of the attention of any prospective reader:

- The identification and explanation of the PPP/Project Finance Context for financial modelling.
- The division of the book into a section that can benefit all readers (Chapters 1 to 4) and another that would be of interest primarily to those directly involved in developing financial models (Chapters 5 to 7).

The structure of the book allows for selective reading depending on the reader's own requirements.

- The extensive use of numerical illustrations, also made available as soft copies on the CD, allows for self driven learning at a pace that suits different readers. The soft copies of the sample financial model with illustrations of essential Excel functions enable even those with no prior experience of developing financial models to make a start and follow through with further learning on the job.
- The practical approach to the coverage of PPP and project finance concepts (Chapter 2) and finance theory (Chapter 3) that clearly reflects the author's own learning from conducting training programs in these areas.
- The coverage of technical aspects like circular references, conditional calculations, re-financing and income tax calculations that will be of relevance to those directly involved in developing financial models.

This book started off as an in-house manual for employees. It builds on years of work and training and I am sure will be appreciated by all involved in projects taken up in the PPP/Project Finance Context. The widespread use of this book should contribute to improved selection and structuring of PPP projects and to their ultimate success in design and implementation.

PRADEEP SINGH
Cheif Executive Officer
IDFC Projects

Endorsements

The book provides an overview of Public-Private Partnership (PPP) structures and explains in depth the application of financial modeling for development and assessment of PPP frameworks. In the process, it presents a valuable insight into PPP structuring and use of financial model with practical illustrations that is of relevance to public and private partners interested in PPP model and other stakeholders. The practical examples with regard to financial modeling add significant value to the existing body of literature on PPP and make this book unique.

A. Basu

President, Intercontinental Consultants & Technocrats Pvt Ltd

I find the book lucid, informative and more importantly, eminently readable. I commend you on the painstaking research that has gone to make it; for stakeholders and even students of this industry this is a very valuable reference in excellent narrative style.

G. Suresh

CGM (Finance), National Highways Authority of India

Infrastructure is a key to economic development, and PPPs are a key to balancing the interests of the public and the private sectors in joint infrastructure investment. Efficient structuring of the contract is a key to least cost and sound financing.

A problem with the field is that "the devil is in the details" of infrastructure partnership contracts. This book is a valuable guide to potential and actual practitioners and all those who seek to achieve quality outcomes from transparent public and private sector joint investments. Prabuddha (PK) makes the normally intimidating field of such infrastructure finance and PPP contracts accessible to interested readers at all levels of expertise.

M. G. Porter

Research Professor of Public Policy, Deakin University

A very readable and useful book for anyone involved with PPP projects involving project finance. Along with exhaustive coverage of the many issues related to financial models for those directly involved in developing such models, Prabuddha also caters to the many who contribute to such models and use these for decision making.

P. S. Srinivas

Lead Financial Economist, Finance & Private Sector Development, World Bank

The sections on different sectors of infrastructure, show financial modeling in the context of PPP/Project Finance, starkly bringing out the various sector-specific concordances and discordances to the best-advantage of the reader.

S. S. Chakraborty

Chairman-cum-Managing Director, Consulting Engineering Services (I) Pvt Ltd

Preface

How this Book Evolved

This book initially took shape as an in-house manual on financial models for Public-Private-Partnership (PPP) projects intended for use by the company's employees while the author was employed with IL&FS Infrastructure Development Corporation Limited (IIDC), a company engaged in the development of such PPP projects. Given the wide range of educational backgrounds and past experience of IIDC's employees, the idea was to provide a set of common guidelines that were consistent with finance theory while being flexible enough to be used across various infrastructure sectors and PPP project structures. Further, since such PPP projects typically evolved over fairly long project development cycles, the idea was also to ensure that the financial model developed could evolve to encompass greater detailing of the project features as technical studies were carried out and features of the PPP project structure fell into place over time.

As many of the author's colleagues at IIDC were planners and engineers without formal training in finance and accounts, coverage of the basics of finance theory was included right from inception. Moreover, the planned coverage of the "manual" also drew upon the author's own experience of reviewing financial models prepared by various teams across different sectors and conducting training sessions for his colleagues on the development of financial models in his role as a designated thought leader for such financial models within the company. This experience provided a good understanding of the common problems faced by those developing and using such financial models and this understanding guided the author's choice of the manual's content.

However, the manual was far from complete when the author moved on from IIDC in September 2007 – what existed at that point was seventy odd pages of text, representing enough expended effort to create an incentive to develop it further for publication as a book. As luck would have it, the author continued to play a similar thought leadership role with regard to financial models in his next job with the infrastructure advisory arm of CRISIL, conducting in-house training programs for his colleagues besides leading teams working on financial models for PPP projects across various sectors. These factors provided enough continued learning and impetus to convert the initial initiative into the book that you now hold.

A significant expansion in the scope of the book occurred during this period when a partially completed draft manuscript was shared with the publisher for acceptance/approval. The peer review process conducted by the publisher threw up a couple of key suggestions that led to this change in the book's scope. Firstly, the reviewers felt that there should be some coverage of the basic concepts of "PPP" and "Project Finance" in the book. This was missing in the draft shared with the publisher earlier given the original intent of preparing an in-house manual for IIDC employees who were by and large well aware of these concepts. This suggestion immediately appealed to the author. As a professional working on consulting and project development assignments in the PPP and project finance space for over ten years at that point in time, the author was well aware of the wide range of stakeholders involved in such projects. Further, it had also become clear to the author that the lack of a shared understanding of the concept of PPP among these stakeholders often emerged as a significant barrier to the successful implementation of projects. Moreover, this lack of clarity about PPP coupled with the strong association of the term "PPP" with proactive and visionary administration often led to a waste of resources on the formulation of projects with limited chances of success in the PPP framework. Ensuring greater clarity about PPP and project finance thus appeared to be a worthwhile objective for the book. Fortunately, his involvement as a trainer in various programs relating to PPP and project finance meant that the author was in a position to address this suggested addition to the scope of the book without much difficulty.

The second suggestion from the reviewers was to include illustrations from different infrastructure sectors. This also struck a chord – while many of his colleagues opted for specialisation along specific infrastructure sectors, the author had consciously chosen to focus on functional specialisation in the area of financial modelling and analysis and enjoyed the challenge of applying this functional knowledge to different infrastructure sectors. Besides, it was clear to the author that ensuring that the ideas covered in the book were applicable to different sectors would help to develop and broaden the appeal of these ideas to a great extent.

Accordingly, the author accepted both suggestions though this obviously entailed additional effort and time to bring the book to the market. As a result, the earlier narrow focus of the book on the development of financial models for PPP and project finance was replaced by a broader appeal to both developers and users of such financial models with the inclusion of a chapter covering the basic concepts of PPP and project finance. Based on his own experience in this field, the author views this broader scope to be of great importance – unless the many stakeholders involved in a typical PPP/Project Finance transaction have a minimum level of understanding regarding financial models, the contribution of such financial models to the successful implementation of projects gets limited and the models prone to abuse by vested interests. To that extent, widening the scope of the book appeared to be an objective well worth the additional effort required.

However, the widening of this book's coverage and its potential audience as described above also came with its own set of challenges, the two primary ones being the need to define the coverage or subject matter of this book without ambiguity and structuring the book for a wider audience, keeping in mind the fact that it may not be essential for all categories of readers to undertake a "cover-to-cover" reading of the book. This preface outlines the response to these challenges and the suggested use of the book by different categories of readers.

What this Book is About

In brief, this book is about developing and using financial models of a specific type or class that are associated with projects undertaken in what we may refer to as the "PPP/Project Finance Context". The coverage in this book has been structured based on the recognition that not all potential readers will be directly involved in development of financial models in the PPP/Project Finance Context. In fact, a larger number of readers are likely to be those who are involved as stakeholders in a project being implemented in the PPP/Project Finance Context. Such readers are expected to contribute inputs based on their area of expertise to the development of the financial model and/or use such a financial model for decision making. At a broad level, we may thus distinguish between two categories of readers with distinct requirements – "Developers" and "Users".

It may be said that in addition to conceptual clarity regarding the PPP/Project Finance Context the "Developers" also need a good understanding of the nuts and bolts of the financial model, the issues and challenges involved in the process of developing the financial model and a firm grasp of finance theory as it relates to the output of the financial model. While "Users" can do without such knowledge of the nuts and bolts of the financial model, they certainly require a good understanding of the PPP/Project Finance Context, the implications of this context for financial models and the basic features as well as potential pitfalls of the output produced by such financial models.

Even within the category of "Users", there exists a broad range of educational backgrounds and experience profiles. Understanding of finance theory and the basics of accounting depending on educational background and previous experience of projects in the PPP/Project Finance Context are two aspects of particular importance that have been considered in structuring the content of this book as outlined below.

Use of the Book by Different Reader Categories: A Note on Structure

It is recognised that the terms "Financial Model", "PPP" and "Project Finance", especially the last two, are characterised by considerable breadth and complexity. Thus, even the simple definition of this book's subject matter stated earlier may be prone to differing interpretations. To look at it differently, the expectations and requirements of a potential reader picking up the book and looking at its title may vary considerably. To address this, some effort has gone into first defining the three terms "Financial Model", "PPP" and "Project Finance" in a generic manner in the opening chapter. This has been followed by the development of a more rigid definition of the "PPP/Project Finance Context" for the class of financial models covered by this book. All readers may find it essential to thus spend some time on the opening chapter of this book to understand clearly the term "Financial Model in a PPP/Project Finance Context", which forms the core subject matter of the book. Beyond that, the balance six chapters all represent optional reading for readers belonging to either of the two broad categories of "Developers" and "Users", depending on their requirements. As mentioned earlier, such requirements will be driven by educational background and experience profile of the reader in question.

For readers with limited prior exposure to a project in the PPP/Project Finance Context, Chapter 2 (The PPP/Project Finance Context Explored) provides further detailing of the PPP/Project Finance Context. Both the underlying concepts, i.e. "PPP" and "Project Finance" are examined in greater detail as compared to Chapter 1. Particularly, various aspects related to PPP, the broader of the two concepts, are covered in some detail. The chapter concludes by listing some of the implications for the financial model in the PPP/Project Finance Context.

For readers, typically "Users", who do not have the benefit of formal classroom training in finance theory Chapter 3 (Finance Theory – Basic Concepts) covers the essentials of finance theory required for an appreciation of the output of the financial model. The focus is on time value of money and its application to projected cash flows in the form of Present Value, Net Present Value and Internal Rate of Return. The fundamentals of risk and the linkage of the appropriate discount rate for use in any discounted cash flow analysis to the level of risk associated with these cash flows are also covered. Some basic concepts related to double entry accounting are also discussed. Though the coverage of this chapter is not comprehensive to the extent that it can replace a standard text book on finance theory, readers going through the chapter should be well placed to understand the output of the financial model and issues related to such output.

Chapter 4 (Financial Model – Components, Outputs & Development) is the first of the "practical" chapters that directly addresses the development of the financial model. The first two sections of this chapter can be considered essential reading for both "Developers" and "Users".

The last section of Chapter 4 (Section 4.3) and the three subsequent chapters (Chapters 5, 6 and 7) are intended primarily for the "Developers". "Users" may refer to these only on a need-based basis. Readers directly involved in developing financial models are expected to refer to the soft copy of a sample financial model provided on the CD that comes with the book while going through these chapters, especially in case of Chapter 4 where the sample financial model is frequently referred to through illustrations. Chapter 5 (Essential Best Practices for Financial Models) covers best practices that should be followed in developing any financial model, with the focus being on understanding the rationale underlying such best practices. Chapter 6 (Miscellaneous Aspects) covers some typical issues that arise in the course of development of a financial model. Chapter 7 illustrates the application of the concepts covered in the book to various infrastructure sectors to supplement the sample financial model of a road project that is provided on a CD with the book.

Defined Terms Used in the Text

Certain terms pertaining to the core subject matter of this book appear frequently in the text and are distinguished as a matter of convention by being capitalised and appearing in bold and italics, for example, ***Financial Model***. Such a term is a defined term, implying that its meaning is specific to the context of this book and whenever used, the defined term has the meaning attributed to it in the book. This essentially draws on a practice that is commonly used in legislation and contracts and has been adopted here to ensure clarity, to focus the attention of readers on key concepts related to the subject and ensure continuity over the course of the book. The author makes no claim that the defined terms as used in this book are in any way part of standard usage and commonly understood to convey the meaning defined here. In fact, it is this very lack of such standards and the need to ensure continuity over the course of the text with regard to key concepts that provided the primary impetus for the adoption of the defined terms by the author.

On the first occurrence of a defined term (or the concept it represents) in the book, the fact that it is thereafter represented in the text as such is indicated by the defined term including the distinguishing features (capitalisation, bold and italics) being placed within quotation marks in parentheses and preceded by the word "hereafter", for example, (hereafter "***Financial Model***"). The defined terms are explained in detail at the appropriate places in the text. Such an explanation may not follow immediately on first occurrence as some of the concepts represented by the defined terms need to be developed at length for conceptual clarity. Moreover, some of the defined terms are inter-linked and a proper understanding of a given defined term may be possible only with reference to another defined term. However, a broad understanding of all the defined terms is ensured in the opening chapter itself. In some instances, a defined term may also be used in a more general sense or form part of another term or phrase, including as a special case the plural form of a defined term. Such usage is distinguished by the defined term in question not being capitalised and also not appearing in bold and italics when used in a more general sense, except where the defined term is used in the plural form.

For the convenience of the readers, a list of the defined terms arranged in alphabetical order is provided below along with a brief description of the meaning attributed to that defined term in this book. The brief description provided here is primarily for ease of reference and more detailed and complete explanation of each defined term is provided at appropriate points in the book.

Defined Term	Brief Description of Meaning in this Book
Financial Model	A project-specific financial model in the ***PPP/Project Finance Context***, i.e. the type/class of financial models covered in this book. The term has been used in preference to "Financial Model in the PPP/ Project Finance Context", which would be a more complete description, in the interest of conciseness. All that the reader has to bear in mind is that the term ***Financial Model*** whenever used in the text represents the specific type/class of financial models that is the subject matter of the book. A ***Financial Model*** comprises three distinct components – ***Input***, ***Model Core*** and ***Output***.
Input	A set of 'n' ***Project Variables*** representing data or assumptions regarding various aspects of the project in question and defined by the developer of the ***Financial Model***.
Model Core	A series of processes involving basic arithmetic and logical operations commencing with the ***Input*** and involving the generation of intermediate values that may in turn feed into other processes to produce the final ***Output***.
Output	Output values produced by the ***Model Core,*** these being either (a) expressed in monetary terms and forming part of projected accounting statements covering the ***Project Time-Line***, or (b) single value measures derived from such monetary values in line with finance theory.
PPP	An abbreviation for Public-Private-Partnership, denoting a class of projects based on a partnership between (at least) one Government/ public entity and a private sector entity, where both the primary public and private parties contribute resources and take on significant responsibilities and risks related to the project in order to deliver predetermined project outcomes. Moreover, the partnership between the parties is contractual, being based on a ***PPP Project Contract***.
PPP Project Contract	The contract underlying a ***PPP*** project that typically defines the allocation of risks, responsibilities and returns among the parties entering into the contract.
PPP/Project Finance Context	The basic setting for the type of financial models covered by this book, characterised by: a) A contractual relationship between Government and a private sector implementing/operating entity based on partnership whereby both parties contribute resources and share significant risks related to the project in order to achieve defined outcomes. Moreover, the private party bears significant risks in relation to the implementation and/ or operation of the project assets and has its return linked to the outcomes generated by operation of the project assets; and b) A project specific entity (the Special Purpose Vehicle or SPV) responsible for implementation of the project and its operation over a given period of time in line with the ***PPP Project Contract*** as defined above, with recourse to the sponsors/promoters (equity investors) of the SPV limited by and large to the equity invested by the sponsors/promoters in the SPV.

PPP Project Structure	The overall allocation of rights, responsibilities and risks between the stakeholders in a ***PPP*** project as determined by the ***PPP Project Contract***. Several generic ***PPP Project Structure***s exist and these can be usefully arranged according to the level of risk and responsibility borne by the private sector implementing/operating entity. However, the scope for variations within a given generic ***PPP Project Structure*** can be wide.
Project Finance	Type of debt financing of a project where the lenders' security interests are largely restricted to the assets and/or cash flows of the project – thus, lenders do not generally have recourse to the promoters/sponsors unlike in traditional corporate finance where all assets on the balance sheet of the borrowing corporate entity and even other assets owned by the promoters/sponsors may be provided as security for loans. Typically, such transactions involve the incorporation of a company for the specific purpose of housing and implementing the project, thereby limiting the risk of the promoters/sponsors to the equity capital invested by them in the project specific company.
Project Time-Line	A key ***Project Variable*** that denotes the effective life of the project over which the cash flows of the project have to be projected in the ***Financial Model***. In turn, the ***Project Time-Line*** is a key driver for the values of most ***Project Variables***.
Project Variable	Any of a set of variables reflecting different aspects of the project that are reflected in the ***Financial Model***. These variables reflect physical as well as financial aspects of the project. Each variable has a value in every period covered by the ***Financial Model***, with these values being determined by data, assumptions or functions relating two or more variables as specified by the developer of the ***Financial Model***.
Sample Financial Model	The financial model of a road project used to illustrate various concepts in this book. A soft copy of the same is provided in the CD that comes with the book for reference.

Learning Aids

To do full justice to the practical nature of this book and recognising the breadth of the subject matter, this book incorporates a number of features to enable learning from the text as well as further learning beyond the text for interested readers. The most important of these is the soft copy of a ***Sample Financial Model*** that is provided on the CD that comes with the book. Readers, especially those directly involved in the development of ***Financial Models*** will need to refer to the ***Sample Financial Model*** when going through the later chapters, especially Chapter 4. In effect, the Sample Financial Model represents an application of most of the concepts covered in the book. Further, since detailed coverage of the formulae used as part of the Model Core is not practical as part of the text, those "Developers" interested in looking at the design of such specific formulae have to use the ***Sample Financial Model*** extensively.

Apart from the ***Sample Financial Model***, the enclosed CD also contains for reference soft copies of all the numerical illustrations contained in the text, of which there are many given the subject matter. Further, the CD also contains a note on important Excel functions that readers may either print out or refer to as per their requirement. The illustrations covered in this note are also provided in the form of soft copies. Readers should refer to Appendix A for instructions on use of the CD.

Recognising that several concepts touched upon in the book can be studied in much greater detail, the text includes some text boxes titled "Going Beyond the Obvious" that provide interested readers with some indication of the potential for advanced study. However, the average reader can easily skip these text boxes without the general flow of the text and his/her learning from the same being in any way adversely affected. Given the breadth of the subject covered by the book, many readers may wish to further their knowledge about specific aspects of ***PPP***, ***Project Finance*** and finance theory touched upon in the book. To encourage and enable such initiatives, the book concludes with a list of references (Appendix B) as well as a list of websites that may be of help to the interested reader (Appendix C).

PRABUDDHA K. DAS
August 2012

Contents

CHAPTER 1

Introduction

INTRODUCTION

This opening chapter is an introduction to the book and sets the context by defining the three key terms in the book's title – these terms being "Public-Private-Partnership (PPP)", "Project Finance" and "Financial Model". By the end of the chapter, readers should have a clear understanding of what is meant by Financial Model in the PPP/ Project Finance Context.

Key Topics Covered in this Chapter

- General definition of a financial model
- The *Financial Model* in the *PPP/Project Finance Context*, covering:
  - The key characteristics of this type of Financial Model
  - The key features, components and typical *Output* of this type of *Financial Model*
- Basic definitions of *PPP* and *Project Finance*
- The *PPP/Project Finance Context* defined
- The importance of the *Financial Model* in the *PPP/Project Finance Context*.
- The typical evolution and different uses of a *Financial Model* in the *PPP/Project Finance Context*
- The need for a standard framework and set of tools/practices for development of *Financial Models*, with the requirement of flexibility in the *Financial Model* identified as a key theme of this book.

1.1 FINANCIAL MODEL

1.1.1 Financial Model in the PPP/Project Finance Context: The Approach Adopted for Developing the Concept

This section builds a shared understanding of what is meant when we refer to a ***Financial Model*** in the rest of this book. After starting with a general definition of a financial model, we then define the basic features of the type of ***Financial Model*** covered by this book. Key components of the ***Financial Model*** such as ***Project Variables*** and ***Output*** are then explained. The shared understanding of what is meant by ***Financial Model*** is further consolidated by developing a schematic representation of the ***Financial Model***, followed by a simplified illustration of such a ***Financial Model***.

It may be noted that taking up the definition of the ***Financial Model*** before defining the terms ***PPP*** and ***Project Finance*** requires the temporary assumption on the part of the reader that:

(a) Such a context for the ***Financial Model*** actually exists;
(b) That context, hereafter referred to as the ***"PPP/Project Finance Context"***, can be reasonably explained in terms of the two concepts of ***PPP*** and ***Project Finance*** once these are defined; and
(c) The ***PPP/Project Finance Context*** is relevant and important enough to justify this book.

This approach is of course necessary in order to avoid a "chicken-and-egg" type of dilemma. In the author's opinion, the explanation of the ***Financial Model*** *that* before defining the ***PPP/Project Finance Context*** does not have any major adverse consequence. The reader should just remain aware while going through this section (Section 1.1) to understand the meaning of ***Financial Model*** that there is a temporary gap in his or her appreciation of this book's coverage that has to be ultimately addressed. As it happens, this gap is then immediately addressed in Section 1.2, which starts with the basic definitions of the two concepts of ***PPP*** and ***Project Finance***. These basic definitions provide an adequate foundation for a more comprehensive understanding of the two concepts developed over the balance of this opening chapter and then detailed further in Chapter 2 of the book. The basic definitions of ***PPP*** and ***Project Finance*** are also used for explaining what is meant by the ***PPP/Project Finance Context***. Some space is naturally devoted to explaining the various uses of the ***Financial Model*** in the ***PPP/Project Finance Context*** and the consequent importance of the ***Financial Model***s in the ***PPP/Project Finance Context.*** That explanation in effect addresses the raison d'être of this book or in other words, the question why such a book is required at all is answered.

1.1.2 General Definition of a Financial Model

A financial model is essentially an abstract representation of a situation that requires a financial decision to be made. A financial decision at its most basic and most common form is the decision whether to invest (or not) by a potential equity investor or promoter/sponsor of the project in question. However, once the terms ***Project Finance*** and ***PPP*** are explained, it will become clear that the financial decision in case of our ***Financial Model***s may be in other forms. For example, the decision may be about how much to bid for a ***PPP*** project that is awarded on the basis of competitive bidding with a whole range of possible financial bid parameters being available for such award of a project through such competitive bidding. Similarly, the relevant decision from a lender's perspective may be a simple yes or no decision, that is, whether to lend to a specific project or not. These along with other possibilities such as determination of the tariff to be charged for a project's output or whether to acquire an operational project are examples of alternative financial decisions common in the ***PPP/Project Finance Context***. We take a look at the alternative financial decisions or uses of the ***Financial Model*** in the ***PPP/Project Finance Context*** later in this chapter (Sections 1.2.6 and 1.2.7).

1.1.3 The Class of Financial Models Covered in this Book

Rather than getting caught in a chicken-and-egg dilemma at this stage because the ***PPP/Project Finance Context*** is yet to be defined, let us first look at refining the above general definition of the financial model to identify specific features of the type of ***Financial Model*** covered in this book. In doing so, we are temporarily taking for granted that there exists such a ***PPP/Project Finance Context*** that is relevant and moreover, important enough to justify the focus of an entire book. Once a broad understanding of the ***Financial Model*** is established, we then turn to the definition of ***PPP***, ***Project Finance*** and the ***PPP/Project Finance Context*** in the next section of this chapter, at the end of which the subject of this book, i.e. ***Financial Models*** in the ***PPP/Project Finance Context*** should be fairly clear to the reader though the concepts ***Project Finance*** and ***PPP*** are explored in greater detail in Chapter 2.

While the first-cut definition of a ***Financial Model*** given above is fairly general, we can define or restrict the scope and coverage of this book significantly by noting that for the purpose of this book:

- *The situation in question is a specific project being implemented in the PPP/Project Finance Context; and*
- *The* abstract representation of the project that we will deal with in this book is essentially a spreadsheet model *that produces as Output the projected financial performance of that project over the Project Time-Line* to enable decisions regarding the project.

Thus, the objective of our ***Financial Model*** is to enable a financial decision in respect of a project being implemented in the ***PPP/Project Finance Context***, based on the projected financial performance of the project over its effective life, hereafter referred to as the ***Project Time-Line***. In other words, the spreadsheet models we are concerned about will involve the projection of a set of ***Project Variable***s associated with the project over a ***Project Time-Line*** that corresponds to the effective life of the project. We are thus concerned with a ***Financial Model*** that is temporal (i.e. time bound or linked to time). In a sense, the ***Project Time-Line*** corresponding to the project life cycle provides the common link for all the ***Project Variable***s.

We can further develop our understanding of the ***Financial Model*** by noting the following:

- There are **three basic components** of the ***Financial Model***, i.e. the input, the calculations performed using that input and the output produced by these calculations (hereafter, referred to as "***Input***", "***Model Core***" and "***Output***" respectively).
- The concept of the ***Input*** of the ***Financial Model is best understood*** as a set of 'n' project-specific variables (hereafter, "***Project Variables***") related to various aspects of the project in the form of data, assumptions and functions that may have other ***Project Variable***s as arguments. The ***Project Variable***s are defined or specified by the developer based on past experience with similar projects, inputs from functional/sectoral experts and project-specific studies/reports that may be available when the ***Financial Model*** is developed. A key feature of the ***Project Variables*** are that these are linked to the life cycle of the project in question, i.e. the ***Project Time-Line*** of (say) 'N' periods. Thus, ***Project Variables*** are best thought of as an array of values in an n X N matrix as shown below:

ILLUSTRATION 1.1

Generic Representation of Project Variables of a Financial Model

***Project Variable*s**	***Project Time-Line* of N periods**			
	Period 1	**Period 2**	**...**	**Period N**
***Project Variable* 1**	Value_{11}	Value_{12}	...	Value_{1N}
***Project Variable* 2**	Value_{21}	Value_{22}	...	Value_{2N}
...	...	...	...	..
***Project Variable* n**	Value_{n1}	Value_{n2}	...	Value_{nN}

- The concept of the ***Model Core*** can be defined as a series of processes involving basic arithmetic and logical operations commencing with the ***Input*** and involving the generation of intermediate values that may in turn feed into other processes to produce the final ***Output*** values.
- The ***Output*** of the ***Financial Model*** comprises output values produced by the ***Model Core***, these output values being either (a) expressed in monetary terms and forming part of projected profit & loss accounts, balance sheets and cash flow statements covering the ***Project Time-Line***, or (b) single value measures derived from such monetary values in line with finance theory.

With this limited definition of the ***Financial Model***, we can now take up a detailed description of the ***Project Variable*s** and ***Output*** of the ***Financial Model***.

1.1.4 Project Variables Explained

The starting point for projection of the project's future financial performance is a set of data and assumptions related to the project that has to be specified by the developer of the ***Financial Model***. Such data/assumptions will typically involve the specification of various ***Project Variable*s** related to the project, with the major ***Project Variable*s** reflecting the following aspects of the project:

- The required capital expenditure or investment for making the project operational and the time period over which this capital expenditure is incurred (i.e. the construction period).
- The expected ***Project Time-Line*** including the basis for the value of this critical ***Project Variable***. The ***Project Time-Line*** is further divided into component time-lines such as the construction period referred to above. The reason why the ***Project Time-Line*** is considered

a critical ***Project Variable*** is explained going forward as we take a closer look at ***Project Variable***s and thereafter the basic definition of ***PPP*** later in this chapter.

- The financing of the capital expenditure, i.e. how much of the required investment for making the project operational is funded by equity and debt[1]. Besides the capital structure (proportion of debt and equity in the capital invested) there are also ***Project Variables*** related to other aspects of financing. For example, whether a part of the capital expenditure is funded by zero cost capital grant or a loan carrying a lower than market interest rates, the cost of debt, over what period the loans are to be repaid (i.e. loan tenure), any moratorium on repayment of the principal component of the debt, etc. All represent ***Project Variables*** related to financing of capital expenditure.
- The revenues expected to be generated by the project assets once operational – this is turn requires data/assumptions about the form of physical output of the project, the project's capacity for producing such output, the expected demand for that output and the price expected to be paid by users for consuming the project output over the ***Project Time-Line***.
- Operating expenses that have to be incurred to generate the projected revenues.
- Taxes payable on the income/profit generated by the project, taking into account tax deductible expenses and any specific income tax related provision applicable to the project in question.

As should be clear, the broad aspects listed above may in turn be based on various underlying ***Project Variable***s that are required to generate the values of other ***Project Variable***s at a higher level in the hierarchy of ***Project Variable***s. An obvious example is the revenue generated by the project, which will depend on at least two underlying ***Project Variable***s representing (a) the physical quantity of the project's output than can be sold; and (b) the price at which this quantity of output is sold. Moreover, readers should note that the ***Project Variable***s are not necessarily monetary values – in fact, it is important to appreciate that ***Project Variable***s may span a wide

[1]The financing of part of the required investment for a ***PPP*** project through a capital grant that has no cost attached to it is also possible and is indeed highly relevant in the Indian context. This is covered in detail in later chapters – for the time being, readers should simply understand that the financing of a project in the ***PPP/Project Finance Context*** is a key ***Project Variable*** in the ***Financial Model***.

range of units and values derived from the various relevant aspects of the project including engineering/technical design, capacity for producing output, the quantity and cost of materials and other inputs required to build and then operate the project assets, the market for the project's output, the financing of the project, etc. Thus, ***Project Variable***s may include physical quantities in various units, time-line values, monetary units, percentages, etc.

Obviously, it is not enough to just specify the set of project related data/assumptions that form the ***Input*** of the ***Financial Model***. Indeed, the most significant part of the ***Financial Model*** is dedicated to manipulating the input values using a series of processes or calculation steps to ultimately produce the ***Output*** that enables the financial decision about the project. These processes may be labelled as the ***Model Core*** for the purpose of this book.

It should be noted that the temporal nature of the ***Financial Model*** means that when we refer to a particular ***Project Variable*** or to an output value, we are really referring not to a single value but to an ordered set of values with each member of the set corresponding to the relevant ***Project Variable***'s value for a specific time period, say periods[2] 1 to N, where N is the effective life of the project and period 1 the first period when cash outflows relating to the investment in the project occurs.

Of course some ***Project Variable***s (such as income tax or depreciation rates) may have the same value in every time period covered by the ***Project Time-Line*** while others may have nil values in some time periods. In other words, the ***Project Time-Line*** and its components/parts are ***Project Variable***s and also the key drivers of the values of many other ***Project Variables.*** For example, the ***Project Variable*** capital investment will typically have nil values in all time periods after the commissioning of the project and the time period required for construction is thus a time-line ***Project Variable*** associated with the ***Project Variable*** capital investment. Also, it is possible for a ***Project Variable*** forming part of the ***Input*** to be defined only in terms of a base value (say, Period 1 value) with the values for the subsequent time periods being a function of the Period 1 base value and another ***Project Variable*** forming part of the ***Input***. A good example of this is a ***Project Variable*** like selling price per unit of output, where the selling price at the commencement of the project (i.e. Period 1) may be defined (or assumed on some rational basis) and the selling price for the subsequent periods over the ***Project Time-Line***

[2]The term "period" has been deliberately used in place of the alternative term "year". Though most ***Financial Models*** have the time-line expressed in years, the more general term "period' is preferred as this covers all possible time-line units such as months, quarters, half-years, etc.

calculated based on the Period 1 selling price and another ***Project Variable*** that represents the (expected/projected) inflation rate in each period of the ***Project Time-Line***.

Alternatively, the input specified by the developer in case of some ***Project Variable***s may well be functions that relate the values of the (dependent) ***Project Variable***s in any time period to the corresponding values of one or more independent ***Project Variable***s. As mentioned, such functions may include the relevant time period as one of the arguments used for generating the values of the dependent ***Project Variable***s for any given time period. However, the calculations to obtain values of any dependant ***Project Variable*** should correctly be considered part of the ***Mode Core*** rather than being viewed as forming part of the ***Input***. It is only the function specified by the developer that can correctly be considered a part of the ***Input*** – the importance and implication of this distinction with regard to the structure of the ***Financial Model*** will become evident later in Chapters 4 and 5.

1.1.5 Output of the Financial Model

While the ***Project Variable***s forming part of our ***Financial Model*** will generally include physical measures, the key ***Output*** of our ***Financial Model*** is projected financial performance, i.e. the ***Output*** is expressed in (or derived from) monetary values over the ***Project Time-Line***.

In a more physical sense, we can envisage the ***Financial Model*** as a set of inter-linked worksheets[3] that are used to convert ***Input*** in the form of data and assumptions relating to ***Project Variable***s entered on one worksheet into ***Output*** expressed in (or derived from) from monetary values that are then presented on one or more such worksheets. The intermediate worksheets between the worksheet containing the inputs and that presenting the output values accommodate the series of operations required for the conversion of the ***Input*** (data and assumptions) into meaningful ***Output***.

Also, most worksheets forming part of the ***Financial Model*** have a time-line row representing the ***Project Time-Line***, with columns corresponding to

[3]Though the term "worksheet" is used here in relation to a spreadsheet that comprises several such worksheets, there is no harm in a reader not familiar with spreadsheets to envisage a worksheet as the electronic equivalent of a sheet of paper that comprises many cells formed by rows and columns into which the sheet of paper is divided, with each such cell being capable of containing an alphanumeric value. In other words, each spreadsheet can be thought of as a sheet of paper divided into squares of the type found in notebooks used for Mathematics in junior classes. Using this analogy, the ***Financial Model*** itself can be envisaged as a bunch of such sheets used to work out a numerical problem and clipped together.

specific periods covered by the ***Project Time-Line***. This ***Project Time-Line*** row is an important feature that enables correct linkages between worksheets such that the input (or intermediate) values for a specific period (or column) on a given worksheet are carried forward or used only for the same period on another worksheet.

The view of ***Project Variable***s forming the ***Input*** as ordered sets of values is to an extent similar in case of the ***Output***, where the output values generated by the ***Model Core*** are also in the form of ordered sets with every element of a set representing the value for a specific time period. The ***Output*** comprises values in monetary terms that are arranged in specific formats dictated by accounting principles and practices to yield the projected ***Accounting Statement***s for the project covering the ***Project Time-Line***.

For our ***Financial Model's Output*** in terms of monetary values (or measures derived from such monetary values) to be comparable across projects and to enable decisions with regard to any given project, the monetary values must be represented in standard formats. Similarly, the financial measures derived from such monetary values and used for decision-making must be based on a shared, common understanding of the underlying rationale and metrics. Such standards in case of our ***Financial Model*** have to be thus provided both with regard to the representation of monetary values in the form of:

(a) Projected accounting statements over the ***Project Time-Line***, as well as
(b) The calculation of single value financial measures for the project in its entirety, i.e. measures representative of the entire ***Project Time-Line*** or corresponding to specific periods forming part of the ***Project Time-Line***

For projected accounting statements such as the profit and loss (P&L) accounts and balance sheets over the ***Project Time-Line*** that form part of the ***Financial Model***'s ***Output***, the standard is provided by broad accounting principles. On the other hand, in dealing with single value measures that reflect the project in its entirety across the entire ***Project Time-Line***, we will necessarily have to turn to finance theory. A key aspect of such finance theory is that only cash flows are relevant and not accounting measures that are based on accounting principles or conventions. Thus, the ***Financial Models*** that we shall deal with require a clear understanding of both accounting and finance theory. However, a key premise underlying this book is that the level of understanding of these subjects, i.e. accounting and finance, is not beyond the reach of those without formal training and qualifications in accounting and finance. To that extent, this book covers the required concepts related to accounting and finance from first principles, as explained in the "Preface" to this book.

As mentioned, apart from the projected accounting statements, another key category of ***Output*** of the ***Financial Model*** are standard single value financial measures derived from monetary values that cover (or reflect) the entire ***Project Time-Line***. Typically, these standard financial measures capture:

- The returns generated by the project[4] or the value addition from taking up the project, and
- The project's capacity to cover debt servicing (i.e. interest payment and repayment of loans)

It should be clearly understood that each such financial measure has to be calculated in a manner that remains constant across projects and ***Financial Model***s in order to be of use and acceptable to all stakeholders in a given project, beside being in conformity with finance theory. These standard financial measures enable a decision to be made about any given project, with the decision rules also remaining constant across projects in the same manner as the calculation of the standard financial measures. The financial decision involved may vary across projects, but the single value financial measures are all based on finance theory. Accordingly, an entire chapter (Chapter 3) of this book is devoted to finance theory for those not entirely sure about their grasp of these aspects.

The above should not be construed as any downplaying of the importance of that part of the ***Financial Model***'s ***Output*** comprising the projected ***Accounting Statement***s in formats based on generally accepted accounting principles. Indeed, the single value financial measures forming the balance part of the ***Output*** of our ***Financial Model*** derive largely from the underlying pattern of cash flows over the ***Project Time-Line*** and being able to cast these projected cash flows in conformity with the projected ***Accounting Statement***s based on accounting principles adds to our confidence about the single value financial measures. In this connection, it may be noted that there are accounting standards specifying formats for cash flow statements. However, rather than adherence to such standards, the format for cash flow projections used in the ***Financial Model***s covered in this book is geared towards generating the key single value financial measures that reflect the project's expected financial performance. However, with the values used in this cash

[4]As discussed in considerable detail later in this book, returns may be considered for the project as a whole or purely from the view-point of those investing the equity capital used for funding the project.

flow format being drawn from the projected profit and loss accounts and balance sheets, the conformity of the projected cash flows with the broad accounting principles underlying the ***Accounting Statement***s forming part of the ***Output*** of the ***Financial Model*** continues to be ensured.

Also, given that we are ultimately dealing with a temporal ***Financial Model***, a single value financial measure while adding great value to our understanding of the project as a whole will necessarily have to be supplemented by additional details – in other words, as part of the use of a ***Financial Model***, we may need to address questions like:

- What is the project's cash flow situation in Period 6 when additional expense on periodic maintenance is called for? Will additional equity infusion be required in that year for debt servicing obligations to be met?
- How much of the initial debt funding availed for constructing the project is unpaid at the end of Period 9?
- What will be the Project Company's taxable income and the consequent income tax payable between Periods 7 and 15?

Such questions can be answered only by looking at the details of the projected ***Accounting Statement***s. Thus, one can say that both the overview provided by single value financial measures and the details in the form of the projected ***Accounting Statement***s are distinct and important components of the ***Financial Model's Output***. Readers should also note that in addition to the single value financial measures that reflect the project in its entirety over the ***Project Time-Line,*** the ***Financial Model***'s ***Output*** may also comprise other measures that correspond to a specific period of the ***Project Time-Line*** rather than representing the project in its entirety. As an example, rather than look at the project's ability to service debt over the relevant part of the ***Project Time-Line*** using a measure such as the average Debt Service Coverage Ratio (DSCR), one may choose to look at DSCR for each relevant period of the ***Project Time-Line*** in order to understand in which periods the risk of default can be considered to be relatively high.

1.1.6 Key Features of Financial Models in this Book

At this point, having looked at the components of the ***Financial Model*** in some detail, we may summarise the key features of the ***Financial Model*** covered by this book by stating that the ***Financial Model***:

- Corresponds to a specific project and is a temporal ***Financial Model*** with the ***Project Time-Line*** being the underlying common link for all the values forming part of the ***Financial Model***.

- Requires the developer to specify as ***Input*** a set of data and assumptions regarding various aspects of the project, covering physical, financial and time-line related parameters. For convenience, the entire set of data and assumptions may be labelled as ***Project Variable***s. Some ***Project Variable***s may also be specified in the form of functions that require as arguments the values of other ***Project Variable***s.
- Has a ***Model Core*** that forms a significant part – this ***Model Core*** is essentially a series of processes involving the manipulation of values using arithmetic and logical operations. The processes forming part of the ***Model Core*** commence with the ***Input*** and may produce intermediate values that feed into subsequent processes to ultimately yield output values expressed in monetary units.
- Produces as ***Output*** the projected financial performance of the project – the ***Output*** is expressed only in monetary values or derived from such monetary values. A part of the ***Output*** is in the form of monetary values organised into projected ***Accounting Statement***s that are in line with the basic principles of double entry accounting. The balance part comprises standard financial measures based on finance theory and derived from monetary values of cash flows over the ***Project Time-Line***. The most important type of such financial measures is the single value measure that reflects or summarises the financial performance of the project in its entirety, i.e. over the complete ***Project Time-Line***. However, other financial measures representative of a specific period or periods forming part of the ***Project Time-Line*** may also form part of the ***Output*** and be used.

The ***Financial Model*** in the ***PPP/Project Finance Context*** can be represented schematically as shown in ***Illustration 1.2***.

1.1.7 Simplified Example of a Project Financial Model

To establish firmly this concept of the ***Project Variables*** of the ***Financial Model*** as a set of values linked to the ***Project Time-line***, consider the simplified example of a ***Financial Model*** for a project with a ***Project Time-Line*** of five periods as shown below in ***Illustration 1.3***. This simple project requires investment spread over two periods and then generates revenues in periods 3, 4 and 5 and is general enough to represent a project in any manufacturing or infrastructure sector. The idea here is not to focus on the mechanics of the ***Financial Model*** (i.e. the ***Model Core***) but establish firmly the concepts of ***Input*** and ***Output*** of the ***Financial Model*** as discussed earlier in fairly general terms.

ILLUSTRATION 1.2

Schematic Representation of a Financial Model

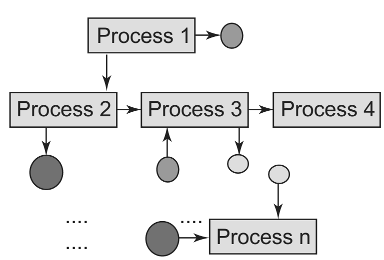
1. INPUT

PROJECT VARIABLES: A set of (n) *Project Variables* such as capital cost, funding mix, physical output, selling price, operating expenses, tax rates, etc. **in the form of data values, assumptions or functions with other *Project Variables* as arguments;** These are defined by the developer of the ***Financial Model*** based on inputs from functional experts including engineers **AND** with values linked to ***Project Time-Line*** (say N years), i.e. with the ***Project Time-Line*** serving as an argument for some functions.

Project Variables	**Yr 1**	**..**	**Yr N**
Variable 1	Value $_{11}$	..	Value $_{1N}$
..	..	..	..
Variable n	Value $_{n1}$	..	Value $_{nN}$

2. MODEL CORE

A series of processes involving basic arithmetic and logical functions commencing from the Input AND involving intermediate output values (as represented by the arrows and circular connectors below) that may feed into other processes to produce the final output values.



3. OUTPUT

(A) Projected accounting statements for the relevant time period as per accounting principles; **AND**

(B) Standard financial measures representing the entire project life-cycle and calculated using output values in monetary terms as per finance theory

Note that each of the eleven ***Project Variable**s* shown in the table above can alternatively be represented as an ordered set of five elements corresponding to the five periods of the ***Project Time-Line***, such that we can represent any ***Project Variable*** X by (X_1, X_2, X_3, X_4, X_5). Note also that some ***Project Variable**s* are defined by functions that relate values of that ***Project Variable*** to the first year value of the same ***Project Variable*** and another ***Project Variable*** – for example, both selling price (***Project Variable*** p) and fixed cost (***Project Variable*** F) are defined by functions that have as arguments the period 1 values of these ***Project Variable**s* (p_1 and F_1) and the values

ILLUSTRATION 1.3

Input for a Simplified Financial Model

	Period:	1	2	3	4	5
Project Variable 1	Capital Investment [C]	75.00	100.00	0.00	0.00	0.00
Project Variable 2	Physical Output [O]	0	0	12	15	15
Project Variable 3	Selling Price [p] (Price in Period 1, p_1=15, increasing at inflation rate) [p=f(p_1,r)]	13.00	13.65	14.33	15.05	15.80
Project Variable 4	Inflation Rate [r]	5.0%	5.0%	5.0%	5.0%	5.0%
Project Variable 5	Fixed Cost [F] (Fixed cost in Period, F_1=30, increasing at inflation rate) [F=g(F_1,r)]	30.00	31.50	33.08	34.73	36.47
Project Variable 6	Variable Cost (40% of sales realisation) [V=h(O, p)]	0.00	0.00	68.80	90.29	94.81
Project Variable 7	Depreciation Rate [d]	33.3%	33.3%	33.3%	33.3%	33.3%
Project Variable 8	Income Tax Rate [t]	25.0%	25.0%	25.0%	25.0%	25.0%
Project Variable 9	Funding - % of Capital Investment funded by debt [g]	70.0%	70.0%	70.0%	70.0%	70.0%
Project Variable 10	Funding - % of total loan repaid [l=j(Period)]	0.0%	0.0%	33.3%	33.3%	33.3%
Project Variable 11	Cost of Debt or Interest Rate [i]	12.0%	12.0%	12.0%	12.0%	12.0%

of another ***Project Variable*** r, representing the inflation rate or the rate at which nominal prices/costs are expected to increase[5].

Another ***Project Variable*** V, representing the variable cost, is defined by a function that relates it to sales realisation, which in turn is the product of two ***Project Variable***s physical output (O) and selling price (p). The percentage of the loan taken for funding the project, represented by the ***Project Variable*** I (for instalment) is effectively a function of the period – it is zero for periods 1 and 2 when the project is under construction and 33.33% in each of the three periods when the project generates revenues (i.e. periods 3, 4 and 5) such that the loan is fully repaid at the end of the five period ***Project Time-Line***. Other ***Project Variable***s such as the rates of income tax (t), depreciation (d) and interest cost of the loan (i) have the same constant value in all five periods.

At this point of the book, it would be premature to get into the ***Model Core***, even though that core is obviously much simpler than what one would require for a real life project, requiring about twelve rows on a spreadsheet to complete[6]. However, it would not be out of place to note that even with the simplified ***Financial Model***, the eleven ***Project Variable***s as shown in ***Illustration 1.3*** are adequate to produce ***Output*** similar to what one would expect from the ***Financial Model*** for a real life project. The ***Output*** for our simplified ***Financial Model*** is shown in ***Illustration 1.4***.

ILLUSTRATION 1.4

Output of the Simplified Financial Model

Projected P&L Accounts					
Periods:	**1**	**2**	**3**	**4**	**5**
Sales Realisation	0.00	0.00	171.99	225.74	237.02
Fixed Cost	0.00	0.00	33.08	34.73	36.47
Variable Cost	0.00	0.00	68.80	90.29	94.81
Operating Profit Before Depreciation, Interest & Tax (OPBDIT)	0.00	0.00	70.12	100.71	105.75
Depreciation	0.00	0.00	63.18	63.18	63.18
Profit Before Interest & Tax (PBIT)	**0.00**	**0.00**	**6.94**	**37.53**	**42.57**

(*Contd.*)

[5]In a sense, the time period is also an argument for such functions – for example, the selling price p_n in year n would be calculated as $p_n = p_1*(1+r)^\wedge(n-1)$.

[6]Interested readers may refer to the CD available with the book after going through **Appendix B: Using the CD** at the end of this book.

(**Illustration 1.4:** *Contd.*)

Interest	0.00	0.00	13.27	7.96	2.65
Profit Before Tax (PBT)	**0.00**	**0.00**	**-6.33**	**29.57**	**39.92**
Tax	0.00	0.00	0.00	7.39	9.98
Profit After Tax (PAT)	**0.00**	**0.00**	**-6.33**	**22.18**	**29.94**
Projected Balance Sheets					
As on the last day of Period:	**1**	**2**	**3**	**4**	**5**
Assets					
Gross Fixed Assets	0.00	0.00	189.54	189.54	189.54
Accumulated Depreciation	0.00	0.00	63.18	126.36	189.54
Net Fixed Assets	0.00	0.00	126.36	63.18	0.00
Capital Work in Progress	78.29	189.54	0.00	0.00	0.00
Cash & Bank Balances	0.00	0.00	12.63	53.76	102.65
Total Assets	**78.29**	**189.54**	**138.98**	**116.94**	**102.65**
Liabilities					
Equity Capital	23.49	56.86	56.86	56.86	56.86
Reserves	0.00	0.00	-6.33	15.85	45.79
Total Net Worth	23.49	56.86	50.53	72.71	102.65
Loans	54.80	132.68	88.45	44.23	0.00
Total Liabilities	**78.29**	**189.54**	**138.98**	**116.94**	**102.65**
Projected Cash Flows					
Periods:	**1**	**2**	**3**	**4**	**5**
Uses of Cash:					
Capital Investment	75.00	100.00	0.00	0.00	0.00
Interest during Construction	3.29	11.25	0.00	0.00	0.00
Interest Payment	0.00	0.00	13.27	7.96	2.65
Repayment of Loans	0.00	0.00	44.23	44.23	44.23
Income Tax Paid	0.00	0.00	0.00	7.39	9.98
Total Uses of Cash	**78.29**	**111.25**	**57.49**	**59.58**	**56.86**
Sources of Cash:					
Loans Taken	54.80	77.87	0.00	0.00	0.00

(*Contd.*)

(**Illustration 1.4:** *Contd.*)

Cash from Operations (OPBDIT)	0.00	0.00	70.12	100.71	105.75
Sources of Cash Excluding Equity	54.80	77.87	70.12	100.71	105.75
Equity Invested	23.49	33.37	0.00	0.00	0.00
Total Sources of Cash	**78.29**	**111.25**	**70.12**	**100.71**	**105.75**
Increase/Decrease in Cash Balance (Balance Sheet)	0.00	0.00	12.63	41.13	48.89
Project Cash Flows	–75.00	–100.00	70.12	100.71	105.75
Project IRR	**19.9%**				
Equity Cash Flows (Post Tax)	–23.49	–33.37	12.63	41.13	48.89
Equity IRR	**24.1%**				

1.2 THE *PPP/PROJECT FINANCE CONTEXT* DEFINED

Before proceeding any further with the ***Financial Model*** as described in the previous section, it is best to address the question that any keen reader may well be asking at this point – why do we need to focus on the ***Financial Model*** in the ***PPP/Project Finance Context***?

Most readers would appreciate the fact that ***PPP*** projects and ***Project Finance*** transactions have emerged as key drivers of infrastructure development in most countries including India over the last twenty five years or so. Though the global volume of ***Project Finance*** transactions and ***PPP*** projects have fluctuated over this period with changes in the global capital markets, the overall trend has been one of increasing volumes of such transactions. As an example, the volume of ***Project Finance*** transactions globally during calendar 2010 is estimated to have touched a new high of US$ 354.6 billion[7]. Similarly, the contribution of the private sector to investment in infrastructure assets in India is currently estimated at over 30%. During the Tenth Five Year Plan (financial years 2002-03 to 2006-07), the share of the private sector was close to 25% against the projected level of just below 20%[8]. Of course, not all of the private sector investment in infrastructure can

[7]Project Finance magazine, http://www.projectfinancemagazine.com/Article/2763491/Dealogic-Full-year-2010-League-Tables-Analysis.html?ArticleId=2763491

[8] The Secretariat for Infrastructure, Planning Commission, Government of India, *Investment in Infrastructure during the Eleventh Five Year Plan*, September 2010.

be classified as ***PPP*** – this is especially true in sectors like telecommunications and to an extent power where the share of the private sector in investment is significant at over 52% and 40% respectively during the Tenth Five Year Plan but such investment has been governed largely by licensing rather than ***PPP***. However, ***PPP*** has emerged as a significant model in sectors like roads, ports and airports. Though urban infrastructure including water supply has not seen as much action, there have been several transactions whereby the State Government or Urban Local Body has provided the land for real estate development and a private sector developer selected through competitive bidding to design (subject to norms), finance, construct and market the property developed.

As such, an increasing number of stakeholders have got involved the development and delivery[9] of such projects and the number of such people will only increase going by current trends. At the same time, it is not necessary that every reader of this book has already been exposed to such a project and this book's potential audience is not restricted to people with such exposure. Thus, it is hoped that this book will in some measure contribute to a shared understanding among stakeholders in such projects and contribute in that sense to the successful delivery of more projects in the ***PPP/Project Finance Context***.

In any case, the author based on his experience appreciates fully the fact that due to the inherent complexity and specialised aspects of project development in the ***PPP/Project Finance Context***, professionals from diverse backgrounds such as engineering, finance, general management and law typically have to work with counterparts from the Government or public sector to successfully deliver such projects on the ground. Given the wide range of stakeholders, it would thus be unrealistic to assume that all readers share a common perspective of the ***PPP/Project Finance Context***. Thus, the attempt at this point to address the question "why is focus on the ***Financial Model*** in the ***PPP/Project Finance Context*** necessary?" must necessarily start from scratch by first defining ***PPP*** and ***Project Finance***.

In attempting such a definition from first principles of widely used (and sometimes abused) concepts like ***PPP*** and ***Project Finance***, the author

[9] Unfortunately, many ***PPP*** projects do not reach the delivery stage and a prime culprit is lack of conceptual clarity about where and why ***PPP*** projects can work. In any case, those readers wishing to get a flavour of the range of stakeholders involved in the Indian context at the time of writing may refer to the web-sites listed in Appendix D to this book. However, attention is drawn to the caveats on comprehensiveness (lack of) and content (no liability of the author under any circumstance) forming part of that appendix.

recognises that some readers may not agree with at least some of what is discussed below. At the same time, it is unlikely that even experts will disagree with all of the following discussion. Further, as the pressing need and the benefit of a common platform have encouraged this attempt to define ***PPP*** and ***Project Finance***. After defining these two key terms, we can take up the explanation of the ***PPP/Project Finance Context***.

Readers should also note that both concepts are inherently complex, have broad scopes and misunderstanding is common. Accordingly, we delve into these two terms/concepts in greater detail in Chapter 2. To that extent, the definitions that follow below cover only the key features without the luxury of detailing that demonstrates the breadth of ***PPP*** and ***Project Finance*** at a conceptual level. As such, readers should be prepared for the gradual development of a comprehensive understanding of these terms over the balance portion of this chapter and the next one rather than expecting a "Big Bang" form of comprehensive clarity.

1.2.1 PPP – A Basic Definition

The term ***PPP*** is so widely used currently that a fundamental definition of the concept is not easy given that the interpretation of the term varies from person to person. Moreover, the umbrella term ***PPP*** covers a wide range of models or ***PPP Project Structure***s that are commonly used. However, while recognising these aspects, the following can be considered as a reasonable basic definition that can serve as the starting point for a complete understanding of the concept:

A ***PPP*** project involves a partnership between (at least) one Government/public entity and a private sector entity, where the parties both contribute resources and take on significant responsibilities and risks related to the project in order to deliver pre-determined project outcomes. Moreover, the partnership between the parties is contractual, being based on a contract (hereafter, ***PPP Project Contract)*** that defines the risks, responsibilities and returns for the parties entering into the contract.

The above definition needs to be looked at closely to understand the essential features of ***PPP***. While we will continue to develop our understanding of the ***PPP/Project Finance Context*** going forward, especially in terms of some of the more subtle implications, some key features that distinguish PPP projects and to that extent projects in the ***PPP/Project Finance Context*** can be pointed out even on the basis of the definition above. These are discussed below.

The key feature that can in fact be considered as the defining feature used to determine whether a given project can be termed a ***PPP*** project or not is the fact that both parties to the ***PPP Project Contract*** must share as partners the project related responsibilities, risks and returns. Moreover, the share of each party must be significant. This immediately allows us to understand that the traditional procurement of goods and services by the Government from the private sector is not ***PPP***. In such procurement from a private sector seller, there is really no partnership or sharing of significant responsibilities, risks and returns between the parties even if the transaction is based on a contract. The private sector seller has a limited responsibility to supply the goods or services as per the specifications and delivery schedule indicated by the Government buyer and accepted by him – while this implies that the private sector seller bears some risk, especially in terms of the cost at which he can actually obtain and deliver the required goods/services, such risk is in no way linked to the outcome of the use of these goods/services by the buyer.

Even this risk or indeed other risks such as delayed payment for the goods/services by the buyer are likely to be minimal as the private sector seller would typically quote a price based on a cost plus basis that ensures adequate return and would in most cases factor in payment schedules based on past experience. Nor can the credit or default risk be considered very significant in case of a Government/public buyer given that the Government at least at the national levels has a monopolist's control over money supply and has in any case strong disincentives for non-payment or delayed payment as such behaviour would tend to push up costs for all goods/services purchased by the Government.

Even where a private party selling to the Government bears some risks linked to the quality of the product or service sold, for example those linked to warranty or liquidated damages, these are in no way significant risks that differ in case of a similar commercial transaction with a private sector buyer replacing the Government buyer. Such risks are "priced in" by the seller based on past experience and cannot be considered as a sharing of risks by both parties. Similarly, contractual arrangements where the private party merely acts as an agent of the Government cannot be termed as meeting the definition of ***PPP***.

In general, it may be expected that the private party will bear risks in relation to the outcome of the project and accept returns linked to that outcome only if the private party has a role in managing that outcome. Thus, a necessary condition for ***PPP*** may be taken as the private party having at least a partial role in the management of the project outcome, which in most cases would amount to control over the project assets used to produce the outcome.

Thus, it should be clear that where a private party designs and builds assets and hands these over to the Government for operations, this cannot be termed as ***PPP*** even if the private party remains responsible for correcting deficiencies in the asset that can be attributed to it, or for that matter bears some risks in the form of warranties or provisions for liquidated damages even after completing, testing, commissioning and handing over the assets.

In brief, it may be said that it is the term "Partnership" in ***PPP*** that is critical, implying an alignment of interests through the sharing of significant responsibilities, risks and returns related to the project outcomes between the parties, rather than such alignment being achieved through contracts as is the case in traditional procurement where the interests of the parties are in any case opposed – i.e. the buyer seeks the lowest cost while the seller is interested in generating maximum profits from the transaction. This may be considered as the "acid test" to determine whether a project is in the ***PPP*** framework or not.

Given the contractual nature of ***PPP***, it is also easy to see why the ***Project Time-Line*** is important. Since the private party must share a significant part of the risks and returns associated with the project, this implies that the private party must remain involved in the operation and maintenance of the project assets – otherwise, there is no reason why the private party will accept a significant share of the project risks. This is in contrast to traditional procurement. For example, in a standard Engineering, Procurement and Construction (EPC) contract for a road, the private sector contractor has limited risks or responsibilities once the road has been constructed. At best, such responsibilities may extend for a short period after the completion of construction in the form of liquidated damages or a warranty regarding the quality of construction. The contractor will certainly not be at risk if traffic on the newly constructed road is much higher than anticipated, requiring significant expense on re-surfacing much earlier than usual.

A related point is that the ***Project Time-Line*** for a ***PPP*** project must be based on the provisions of the ***PPP Project Contract*** rather than the physical useful life of the project asset in question.

1.2.2 "Project Finance Implies Non-Recourse Funding" Explained

Having defined ***PPP*** at a fundamental and conceptual level, we can now take up the definition of Project Finance. For this, it is best to start from the definition of a related term, i.e. non-recourse financing. Non-recourse financing is the key feature and an integral part of the concept of ***Project Finance***[10]. The key feature of non-recourse financing is that the lenders to the project must rely primarily on the cash flows generated by the project assets as the basic form of security, with no recourse to the project's promoter/sponsor[11]. This is unlike the case in the more traditional corporate finance transactions where the borrower's balance sheet strength in terms of other untied assets determines the level of comfort for the lender.

Put in a different perspective, the liability of the promoter/sponsor in a ***Project Finance*** transaction is thus restricted to their investment in the project as the lenders cannot lay claims against the other assets of the promoter/sponsor in case of default. As a result, there is much greater emphasis on the ***Financial Model*** of the project as a measure of the degree of comfort and safety that lenders have in providing loans to the project and to identify the critical parameters that affect this degree of comfort and safety of the lenders. Overall, it may also be broadly stated that ***Project Finance*** enables the financing of riskier projects in sectors with limited history or other features[12] that tend to make it difficult for traditional balance sheet based corporate financing to provide the necessary capital at a reasonable cost.

A fairly common misconception regarding ***Project Finance*** is that the concept implies that the lenders have recourse only to cash flows and not

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[10]The subtle distinction between ***Project Finance*** and non-recourse financing is covered in Section 2.1 of Chapter 2.

[11]The term "promoter/sponsor" is used hereafter to denote the entity/entities investing equity capital in the project. Generally this is the bidder emerging as the winner of a competitive bidding process, with this selected bidder then routing the equity investment through a project specific company or Special Purpose Vehicle (SPV). It is this SPV that enters into the ***PPP Project Contract*** with the awarding authority (generally, a Government entity) and becomes the relevant implementing and operating entity for the project with certain rights and obligations defined by the ***PPP Project Contract***. It should be noted that the selected bidder may be a consortium, in which case each consortium member contributes to the equity capital of the SPV. Typically, lenders to the project will have no recourse or at best limited recourse to the promoter/sponsor in case of default by the SPV that borrows for implementing the project.

[12]Rapid technological change, high entry barriers due to "lumpiness" of investment (i.e. a high degree of capital intensiveness) and output considered public goods and provided only by the state in the past are all examples of such features. Many more can be identified.

the underlying assets producing these cash flows – this is also not strictly correct as the concept of ***Project Finance*** or non-recourse financing by no means restricts lenders' security interests solely to cash flows. However, for infrastructure projects in the ***PPP/Project Finance Context***, it is often the cash flows generated by the assets that are of value since the intrinsic value of the assets in question is limited by the location-specific nature of the asset and the contract-specific nature of rights required to generate cash flows from these assets, as explained later.

For all practical purpose, limiting the lenders' recourse to the promoter/sponsor is possible only when the project is housed in a SPV incorporated by the promoter/sponsor. Thus the incorporation of a SPV to invest in and operate the project assets is the essential feature of Project Finance.

1.2.3 What the PPP/Project Finance Context Represents

Though the focus of this book is on the ***PPP/Project Finance*** intersection for infrastructure[13], it should be noted that ***Project Finance*** or non-recourse financing as concepts are by no means restricted to infrastructure or ***PPP*** projects only – in fact, the concept has been used for projects as diverse as steel plants, petroleum refineries and aluminium smelters. Having said that, it makes sense to focus on ***Project Finance*** in the context of infrastructure projects developed using the ***PPP*** route as such projects account for the overwhelming majority of ***Project Finance*** transactions, at least in the Indian context. In general, the intersection of the two sets "***Project Finance***" and "***PPP***" would account for a fairly large number of projects in many countries.

The ***PPP/Project Finance Context***, as shown in the ***Illustration 1.5*** represents those projects that are (a) developed in the ***PPP*** framework; **and** (b) involve the setting up of a project-specific SPV for implementing the project.

The required debt funding (and any capital grant) as well as the equity invested by the promoter/sponsor of the project are all reflected in the SPV's books of account. Thus, ***Project Finance*** transactions that do not involve ***PPP***, such as a steel plant or petroleum refinery as well as those ***PPP*** projects that do not require the setting up of a SPV to raise ***Project Finance*** are outside the scope of the ***PPP/Project Finance Context***.

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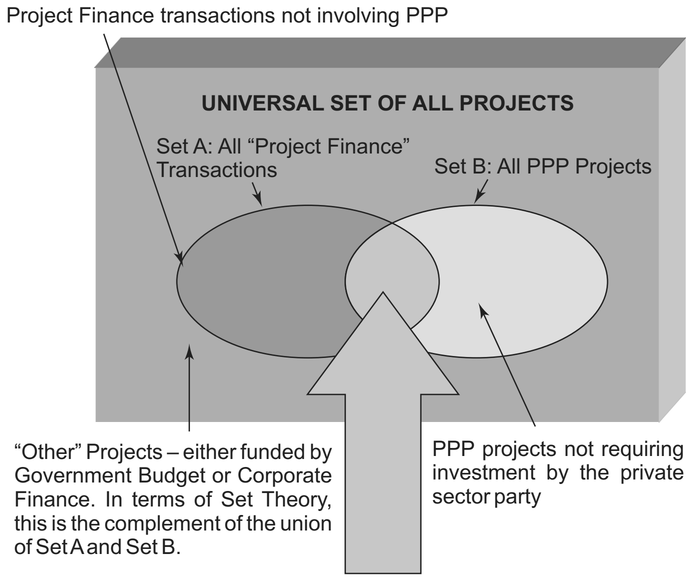
[13]One could add "in the Indian context" to that intersection of ***PPP***, ***Project Finance*** and infrastructure in reference to this book, possibly with some justification. However, it must be said that barring some country specific aspects like taxation and regulation, much of the content of this book can be applied in the context of other countries.

ILLUSTRATION 1.5

The *PPP/Project Finance Context* as the Intersection of Two Sets



> The intersection of Set A (All Project Finance transactions) and Set B (All PPP projects) represents the projects covered by this book, requiring:
> - One or more private party(ies) funding at least part of the cost of asset creation based on a partnership with one or more public/Government party(ies), with "partnership" taken to mean that both sides bear significant project-related risks;
> - A contractual relationship between the parties in the form of a PPP Project Contract that determines the roles of the parties as well as the risks borne and returns earned by the parties; and
> - A project specific company/entity (the SPV) borrowing on non recourse (or limited recourse basis

1.2.4 Less Obvious Features of the PPP/Project Finance Context

It may be noted that some of the less obvious features in relation to the ***PPP/Project Finance Context*** are as follows:

- Though the operation and maintenance (O&M) of the infrastructure asset created is not specifically made a condition associated with elements of the intersection of sets A (***Project Finance***) and B (***PPP***), this has to be viewed in light of the basic driver of ***PPP***, i.e. tapping private sector efficiencies. With the cost of capital for the private sector being higher than that for the public sector, private sector involvement only for construction will have to yield benefits only from efficiencies related to project management (including financial management). Though these can be significant especially in light of the "over-spread budget effect" that adversely affects many projects taken up by the Government/Public Sector, many projects will involve private sector involvement in O&M in order to tap efficiencies therein.

- The contractual relationship is bound by the legislative framework for the specific infrastructure sector and country in question - this in line with the general principle that a contract has to be in conformity with the law. As a simple way to appreciate that principle, consider the fact that no party A can enter into a legally enforceable contract with party B if the actions of either party under the contract involves a patently illegal act, say, murder of another party C. Of course, the issue can become more complicated than that simplistic example if one of the parties is public/Government. These complications are generally due to the layers of the Government hierarchies (Central/State/Local in the Indian context) and instrumentalities (for example, a Government owned company or an entity that is statutory, i.e. set up under a specific Act of the legislature) and may even require Constitutional Law to be interpreted. The existence of over-arching legislation/policy related to ***PPP*** or procurement in general may also have to be considered. This is of course not a significant risk where projects are following established norms/models, though that fact in the strictest sense only establishes precedence that such norms/models have not been legally challenged in the past. At the same time, any innovation based on existing norms/models has to meet the requirement of conformity of the contract to prevailing law.
- The legislative framework will in turn have to provide for and enable private funding and O&M. It has to be seen in the light of the Constitutional provisions as well as any relevant case history whether a function is "strictly sovereign" in the sense that the risks and responsibilities cannot be shared with a private party and hence largely beyond the scope of this book.

1.2.5 The Role of the PPP Project Contract

Typically, a ***PPP/Project Contract*** provides certain rights to the entity implementing and operating the project that allow this entity (i.e. the SPV) to charge users for use of the project asset and collect/retain the revenues generated by such user charges. It is this right to collect and retain the cash flows generated by the project assets that often provides the basic form of security for lenders to the project, though the exact ***PPP Project Structure*** can vary from case to case. To that extent, a ***Financial Model*** that projects the free cash flows from the project is absolutely vital for the lenders to obtain a degree of comfort about the adequacy of such cash flows for meeting the project's debt servicing requirements. Of course, the ***Financial Model*** is not the only aspect considered by lenders – typically, lenders would be equally interested in the provisions of the ***PPP Project Contract***, especially with regard to aspects such as:

- How the lenders' interests get protected in the event of any default by the parties to the ***PPP Project Contract*** leading to termination of the contract, especially with regard to the lenders' rights to step in and substitute the project implementing and operating entity by another entity to carry on implementation/operation of the project in case of default by that entity and in case of unilateral termination by the Government entity, the provisions governing termination payments payable by the Government entity and the lenders' rights over such payments;
- Any event of force majeure, especially with regard to the lenders' rights to insurance proceeds in case of such an insurable/insured event occurring and adversely affecting the project;

It may be argued that since cash flows are generated by assets, the lender is secured by such assets. However, in many infrastructure projects, the assets are highly location specific. For example, a road running from A to B cannot be relocated to connect C and D. Similarly, a new airport built to cater to hordes of tourists expected to visit pristine beaches cannot be redeployed elsewhere if the tourists stop coming when an oil spill ruins those beaches. This obviously means that there is not much of a ready market for these assets and even if these assets are provided as security against default to a lender, such a lender will need to either operate the asset himself or find someone willing to step in and able to operate the asset in order to recover the money lent to the project. In the event that the original implementing/operating entity defaults on repayment of loans because of inherent flaws in the project such as overly optimistic usage/traffic projections that do not materialise, lenders exercising the step-in rights to operate the assets will continue to face the problem of revenues that are inadequate for debt servicing.

A typical ***PPP/Project Finance*** transaction (at least in infrastructure), is also characterised by a ***PPP Project Contract*** between the project's promoter/sponsor as represented by the project-specific legal entity or SPV incorporated by the promoter/sponsor and an appropriate[14] Government authority whereby the contract provides certain exclusive rights to the implementing/operating entity to charge those benefiting from the asset and retain the proceeds, subject of course to various conditions regarding timely construction of the asset, the quality of its output, the level of demand, etc. as set out in the ***PPP Project Contract***. The project's promoter/sponsor typically bears some commercial risks but a ***PPP Project Finance*** transaction essentially involves a contractual allocation of different risks to various parties such as the Government, the project's implementing/operating entity and insurance companies. Fundamentally, it is this ***PPP Project Contract*** that provides security to the lender, provided that the rights and obligations of the project's implementing/operating entity can be transferred to the lender in the event of default on debt service obligations by the implementing/operating entity.

1.2.6 Importance of the Financial Model in the PPP/Project Finance Context

Armed with the preceding discussion on ***PPP*** and ***Project Finance***, we can now see why the ***Financial Model*** is a critical element in a typical ***PPP/Project Finance*** transaction in infrastructure with a ***PPP Project Contract*** governing the allocations of risks and rewards. In such a transaction, in addition to the standard commercial risks arising out of the uncertainties regarding the demand pattern over the project's life[15] and the choice of technology and capacity that every project involves, lenders to the project have at best limited recourse to the project's promoter/sponsor and know that the market for the project assets is thin at best and non-existent in the worst case scenario. Moreover, the ***PPP Project Contract*** will typically define rights and obligations of the different parties under possible scenarios and lenders have to seriously consider the provisions of the ***PPP Project Contract*** to understand how their exposure to the project gets protected under each such scenario.

[14] As used in this context, the "appropriate" Government authority is one that is legally empowered to enter into a contract for development of the project, considering the project's location and nature in light of the division of legislative and executive powers across different tiers of Government under the Constitution of India.

[15] For a typical project in the ***PPP/Project Finance Context***, it is better to consider the life provided for in the ***PPP Project Contract*** as the relevant ***Project Time-Line*** rather than the physical useful life of project assets. Most ***PPP Project Contracts*** allow a specific period over which the private investors can recover their investment in the project following which the benefits associated with ownership of the project assets gets transferred to the Government authority in question.

The regulatory aspects of infrastructure projects stemming from externalities and the natural monopoly[16] characteristic of many such projects adds an additional dimension of risk. Given these circumstances, it is natural for the lenders to require a detailed and exhaustive ***Financial Model*** of the project in order to take a lending decision. The project's promoter/sponsor who is investing in equity is also keen to understand the possible risks related to the project and the impact of these on the return on equity generated by the project – something that can be achieved only by developing a ***Financial Model***. Typically, most of these transactions involve competitive bidding and the bidders thus have to prepare a ***Financial Model*** in order to decide on their bids. Following the selection of the bidder, the ***Financial Model*** becomes a key driver for achieving financial closure. The financing structure as reflected in the ***Financial Model*** depicts the inherent trade-offs between higher return on equity achieved through a higher proportion of debt and the increased risk for lenders that results from this type of financing structure with high leverage. Ultimately, a ***Financial Model*** that is acceptable to both the equity investors and lenders has to emerge in order to allow financial closure.

1.2.7 Uses of the Financial Model in the PPP/Project Finance Context

It can be said that ***Financial Models*** serve a variety of uses in a typical ***PPP/ Project Finance*** transaction, the key ones being as follows:

Assessment of Feasibility: This typically involves an initial assessment of the feasibility of the project, based on a rough estimate of the capital cost and revenues, the former in turn requiring some assumptions about the level of usage/traffic and user charges/tariffs. At this stage, the Government or a potential project promoter/sponsor would be typically interested in establishing whether the project is prima facie feasible, given the best estimate of usage/traffic, acceptable user charges/tariffs and potential funding support from Government.

Financing: Development of suitable financing structure, with sensitivity analysis being used to assess the adequacy of project cash flows to meet debt service requirements and the extent of stand-by financing to be tied up in case of possible downsides materialising. At a broad level, the ***Financial***

[16]A reasonably simple definition of "natural monopoly" is that it is uneconomic to duplicate the assets – in other words, the most efficient and lowest cost of production and/or distribution is achieved with a single supplier. This aspect is re-visited in more detail in Chapter 2.

Model is used to determine the extent of equity and debt used for financing the project. Further, alternative forms of debt financing in terms of cost, tenure and/or repayment pattern may be considered and finalised to provide for a good fit between debt servicing obligations and project cash flows. A larger project will justify the greater efforts required to explore and analyse alternative financing plans, with aspects such as hedging of risks and credit enhancement through guarantees and the associated costs being factored into the ***Financial Model*** to decide on the optimum structure. Irrespective of the project size, a ***Financial Model*** will typically be required for achieving financial closure, whether as part of the project's appraisal by lenders or provided as part of an information memorandum aimed at private equity investors. In some cases, the loan agreement may itself include a ***Financial Model***, with progress and performance of the project being monitored with reference to this ***Financial Model*** and actions such as release of loan instalments being linked to the outcome of such monitoring activities.

Competitive Bidding: In case of competitive bidding for selecting a developer, a ***Financial Model*** will typically be developed and used by a bidder to arrive at the bid to be submitted. For example, a bidder for a road project may develop a ***Financial Model*** to determine his financial bid for the project. Depending on how the bidding has been structured, the financial bid parameter may be the concession period, toll rates, level of funding support sought in the form of a grant, payment to be made to the Government by the developer or extent of revenue to be shared with the Government.

Operation of the PPP Project Contract: Where the ***PPP Project Contract*** provides for a minimum guaranteed return to the selected bidder, the ***Financial Model*** submitted by the bidder may form an integral part of the agreement. The ***Financial Model*** is then considered the base case by reference to which the Government may allow for an extension of the concession period or increase in user charges in the future event of traffic/usage falling short of that projected so as to provide the developer with the same level of return as established by the base ***Financial Model*** annexed to the agreement.

Tariff Regulation: In situations where the user charges or tariffs are regulated by a regulator, a ***Financial Model*** may also be used for determining the appropriate level of tariff or user charge to be levied on those benefiting from the project assets. This ***Financial Model*** may vary from the typical cash flow based ***Financial Model*** used earlier for evaluation of the project – for example, if the tariff regulation requires return on capital to be calculated based on accounting values (book values) or involves norms regarding capital structure, operating costs, etc., the ***Financial Model*** developed earlier would have to be modified accordingly. In any case, the ***Financial Model*** developed earlier could still serve as a starting point for developing a modified ***Financial Model*** geared towards tariff setting. Alternatively, if the project pertains to a sector where tariff is regulated, the ***Financial Model*** developed for arriving at the investment decision will have to incorporate calculation of tariff based on the applicable regulations.

Acquisition/Valuation and Re-financing/Securitisation of PPP Assets: A secondary market in ***PPP*** project assets is beginning to emerge in sectors such as highways in India. Though most ***PPP Project Contracts*** impose some restrictions on the exit of the original promoter/sponsor at least till the project is operational, there has been a move towards allowing the original promoter/sponsor to dilute their holding in the equity capital of the SPV in the highway sector as many promoter/sponsors have won multiple projects and find themselves financially stretched in meeting the required equity infusion for a large portfolio of projects. Thus, allowing such promoter/sponsors to raise funding through a sale of equity in the SPVs of operational projects or alternatively inducting other equity investors into the SPVs of projects under construction is in the interest of most stakeholders, given that the alternative is delays in implementation as ***PPP Project Contracts*** are terminated and a process of re-bidding undertaken.

Private equity players have been active in acquiring such equity stakes in project SPVs, which are generally not listed on stock exchanges. Another route used by some promoter(s)/sponsor(s) to release funds locked up in completed ***PPP*** highway projects is to securitise the future toll receivables from the project, in effect raising loans against the security of the future toll revenues to be generated by the project. This is generally possible only after the project has been operational for some time and established a track record of revenue generation. Another popular transaction in case of operational ***PPP*** projects is to re-finance the debt outstanding. Re-financing is essentially aimed at increasing the value of equity in the project SPV by reducing the share of the project's value going to the lenders. This becomes possible due to the lower risk profile of the project once it is operational and has a track record of revenue generation as compared to the situation when debt funding was originally raised for funding capital expenditure in the project assets, when the risks are higher. Thus, re-financing is typically obtained at a lower interest rate reflecting the lower risk, reducing in effect the share of the project's value accruing to the lenders. All such transactions involving either a sale of equity in the project SPV, securitisation or re-financing have to be necessarily based on a ***Financial Model*** of the project.

Thus, we find that not only is the ***Financial Model*** a key driver of implementation in case of a ***PPP/Project Finance*** transaction, it has multiple uses over the ***Project Time-Line***. The importance of the ***Financial Model*** in the ***PPP/Project Finance Context***, and hence the need for a book such as this is therefore well established.

It is also seen that the degree of detail and the primary objective of the ***Financial Model*** can vary over the project development cycle and typically does. It is not essential for everybody in a project development team to be involved in development and modification of the ***Financial Model***. However, most people involved in the development of infrastructure projects should understand the basics of financial modelling and be able to work with a ***Financial Model*** in order to contribute effectively to the development of a project.

Given the wide range of educational backgrounds and work experience of people who typically work together in a team to develop infrastructure projects in a typical ***Project Finance*** structure, this required understanding of basic concepts and ability to work with ***Financial Models*** does not always exist and certainly cannot be taken for granted. As explained in the "Preface" to this book, the structure and coverage of this book takes this aspect into consideration and caters to both developers and users of ***Financial Models***.

Another key implication of the typical evolution of the ***Financial Model*** is that such models should have great flexibility in being able to accommodate greater detail as the project in question moves along the development cycle. While it may be necessary at some points to develop a ***Financial Model*** from scratch, the need to do this frequently should be avoided to the extent possible as an inefficient utilisation of resources. This can be greatly aided by a standardised approach to the design of ***Financial Models*** that also provides flexibility during the development process. The other key aspect that along with the need for flexibility underlies much of the later "nuts and bolts" chapters of this book is the need to make the ***Financial Models*** as clear and easy-to-understand as possible for a wide range of users.

1.3 REVIEW: FINANCIAL MODELS IN THE PPP/PROJECT FINANCE CONTEXT

The key concept covered so far in this introductory chapter is essentially the definition of ***Financial Model***s in the ***PPP/Project Finance Context*** (i.e. the focus of this book). This has formed the subject till this point and readers who have got so far should be fairly clear about this concept, i.e. the definition of ***Financial Model***s in the ***PPP/Project Finance Context***. To review our understanding of this concept in brief, it is noted that we have so far covered the following:

- Starting from a general definition of a financial model as an abstract representation of a situation requiring a financial decision in Section 1.1.1, we identified the features of the particular class of financial models that we are interested in over the course of Section 1.1.2, assuming for a moment that there exists a ***PPP/Project Finance Context*** that is relevant and important. The ***Financial Model*** was thus characterized as a temporal spreadsheet model of a specific project being implemented in the (to be defined) ***PPP/Project Finance Context***, developed with the objective of enabling a decision regarding the project and producing as an output the projected financial performance of the project over a ***Project Time-Line*** to enable the decision. Further, we described the ***Financial Model*** in terms of its three components, i.e. ***Input***, ***Model Core*** and ***Output***.
- The concept of ***Project Variables*** as a hierarchy of ordered values with a mix of units in the form of a matrix, including the idea of the ***Project Time-Line*** as a key ***Project Variable*** linked to the temporal nature of the ***Financial Model*** was further developed in Section 1.1.3.
- This was followed by the elaboration of ***Output*** in Section 1.1.4, whereby we characterised the ***Output*** as being either (a) Projected accounting statements over the ***Project Time-Line***; or (b) Single value financial measures derived from monetary values. Thus, we noted that the ***Output*** is entirely in terms of monetary values or measures derived from such monetary values, as opposed to the mix of physical and monetary values comprising the ***Project Variables*** representing the ***Input***. Further, we noted that for the ***Output*** to be comparable across projects, it has to be based on standard accounting principles and finance theory.
- Our understanding of the ***Financial Model*** was then developed by listing the key features of the ***Financial Model*** and presenting a schematic representation of the ***Financial Model*** in Section 1.1.5. This process was completed by looking at a simplified financial model in Section 1.1.6.
- Having defined the ***Financial Model*** over the course of Section 1.1, we addressed the gap in our understanding by taking up the definition of the ***PPP/Project Finance Context*** in Section 1.2. In order to do this, we first developed fundamental definitions for ***PPP*** in Section 1.2.1 and ***Project Finance*** in Section 1.2.2.
- In Section 1.2.3, we then defined the ***PPP/Project Finance Context*** as an intersection of two sets representing ***PPP*** projects and ***Project***

Finance transactions represented as circles in a Venn diagram, within the universe of all projects represented by a rectangle within which the two sets/circles are contained.
- Our understanding of the ***PPP/Project Finance Context*** was developed further by looking at some of the less obvious features of the ***PPP/Project Finance Context*** in Section 1.2.4. The role played by the ***PPP Project Contract*** and the importance of the ***Financial Model*** in the ***PPP/Project Finance Context*** were then discussed in Section 1.2.5 and 1.2.6 respectively. The various uses of the ***Financial Model*** and the typical evolution of the ***Financial Model*** were then covered in Section 1.2.7.

To summarise the ***PPP/Project Finance Context***, it is worth noting that for all practical purposes, we are dealing with infrastructure projects that are based on a contractual relationship between Government and a private sector implementing/operating entity in the form of a SPV, with recourse to the promoters/sponsors (equity investors) of the SPV limited by and large to the equity invested by the promoters/sponsors in that SPV. Further, both sides operate in a spirit of partnership that involves the contribution of resources, bearing of risks and assumption of specific obligations or responsibilities, these being governed primarily by the ***PPP Project Contract***. Moreover, we noted that the ***PPP Project Contract*** must provide for a significant transfer to the private entity of the risks related to the creation and/or operation of the project assets and the returns earned by the private entity should be linked to the outcomes generated by the operation of the project assets. Thus, the type of ***Financial Model*** covered in this book will be relevant in any situation where the conditions defined above are met.

Any reader who has followed the discussions till this point in the chapter can be fairly confident about his or her grasp of the definition of a ***Financial Model*** in the ***PPP/Project Finance Context***. However, readers will appreciate that the concepts relating to ***Project Finance*** and ***PPP***, especially the latter, can be fairly complex and subtle. To that extent, both these concepts are discussed in further detail in Chapter 2.

1.4 ESSENTIAL CAVEATS

1.4.1 Scope for Application

The definition of the ***PPP/Project Finance Context*** in this chapter is general enough to admit a variety of ***PPP Project Structure***s and readers with some exposure to such projects may appreciate the fact that financial modelling as covered in this book may be relevant to any such structure. The first part of the definition essentially defines ***PPP*** and though expressed in fairly general terms allows us to immediately determine whether a particular project or transaction can be considered to be ***PPP*** or not.

For example, consider a "design and build" type of Engineering, Procurement and Construction (EPC) contract awarded by Government to a private contractor for the design and construction of a highway. Further, assume that the EPC contract provides for penalties in case of delayed completion of the highway as well as incentives for early completion. Thus, we have a contractual arrangement between Government and the private party where the private party does take on some risks related to design and construction of the highway and also has its returns from the contract linked to outcomes (timely completion of construction). Though it may appear on the face of it that this qualifies as a ***PPP***, we can by reference to the definition immediately see that the private contractor bears no risk related to the operation of the highway. Nor is the return earned by the private contractor in any way affected by the post-construction use of the highway though this return is affected by the private contractor's efficiency with regard to design and construction. Thus, this cannot be considered to be a ***PPP*** project. The key point is that only when at least a part of the risks and returns related to the operation of the project assets are taken on by the private party that a project can be rightly classified as ***PPP***.

However, the definition is silent on the private party's role with regard to the financing, creation and ownership of the project assets – though the private party may well have such a role, that aspect is not to be considered as an essential condition for ***PPP***. Consequently, a management contract where the Government transfers the responsibility for the operation and maintenance of existing infrastructure assets to a private party along with the right to charge and collect fees from the users of the output produced by the operation of these assets should be rightly considered as a ***PPP*** project. All the three key elements of the definition are satisfied in this case even though the private party had no role in the creation of the project assets and does not own these assets. Firstly, there is a contractual relationship between Government and the private entity that serves as the primary instrument for the identification of the rights and obligations of the parties as well as the allocation, sharing and mitigation of risks arising from the transaction. Secondly, the private party bears significant risks related to the operation of the assets – for example, the demand risk arising from the fact that there may not be enough users willing and able to pay the level of fees required to generate a reasonable surplus/return for the private party while absorbing the entire output produced by the operation of the assets, the risk of users not paying the fees (collection risk) or the risk of a break-down of the assets leading to an interruption in cash inflows from fees are all risks associated with the operation of the assets that are borne by the private party in the transaction in question. With regard to the third and last condition, it is clear that the private party can obtain higher returns by operating the assets more efficiently while the reverse also holds. Thus, ***PPP*** is possible even without the private party taking on responsibility for the financing and creation of project assets. Even though a ***Financial Model*** may be of limited relevance for such transactions given that the primary objective of the ***Financial Model*** is to arrive at an investment decision, a ***Financial Model*** may nevertheless still be required to assess the viability of such ***PPP*** transactions that do not involve investment by the private party.

The second part of the definition thus restricts the context of our ***Financial Model***s to ***Project Finance*** transactions involving ***PPP***. As discussed earlier, the ***Financial Model*** assumes greater importance in such transactions. Also, a significant part of this book deals with aspects that typically arise only in the ***Project Finance*** context where the SPV operates specific infrastructure assets rather than being a corporate entity holding a changing portfolio of assets – for example, the fact that debt-equity ratio of a SPV varies over the ***Project Time-Line*** as opposed to the possibility of a near constant debt-equity for a typical corporate entity that takes up new projects or makes acquisitions is discussed at some length. In any case, it should also be appreciated that though a ***PPP*** project may not require investment by the private party, such as a service contract or management, a ***Financial Model*** is of limited use in such projects. Thus, it may be said that a significant part of this book deals with ***PPP*** projects for infrastructure involving investment by the private sector party. In case of any doubt about the preceding point, readers would be well advised to refer back to ***Illustration 1.5*** earlier in the chapter.

1.4.2 Other Considerations

The very act of creating, disseminating and using guidelines or best practices for ***Financial Model***s in the ***PPP/Project Finance Context***, in other words a book of this nature, may give rise to certain unjustified conclusions that the reader should be aware of. Firstly, every reader should note that no set of guidelines can cover everything there is to know about developing and using ***Financial Model***s in the course of development and/or implementation of projects in the ***PPP/Project Finance Context.*** Indeed, it would take away much of the challenge and intellectual stimuli of this field if one could reduce the ***Financial Model* in the *PPP/Project Finance Context*** to such a set of all-encompassing guidelines without any scope for discovery and innovation with every new project taken on and developed/implemented. In other words, financial modelling is not an exact science without any scope for application of judgement and continued learning. Readers would do well to keep this point in mind.

Equally important for every reader is the recognition that a robust ***Financial Model*** does not by itself result in the delivery of a project in the ***PPP/Project Finance Context*** on the ground, which is the primary objective of any effort in this regard. Attaining that objective requires far more in terms of influencing and managing stakeholders subject to multiple constraints while creating and maintaining a sustainable ***PPP Project Structure***. Competency in preparing and using ***Financial Model***s can support and facilitate, not replace all the other attributes and skills essential for successful project development. Financial modelling should, therefore, not be over-emphasised even by those who are routinely called upon to develop ***Financial Model***s and enjoy the challenge of doing so. As an extension or corollary, readers should appreciate that financial modelling is not an "ivory tower" exercise performed by a superior type of human being working away in an arcane world – a good ***Financial Model*** can only result from the modeller's involvement in various activities related to the project and appreciation of a range of aspects and issues including technical, engineering, regulatory and contractual matters all of which can affect the ***Financial Model***. The ability to work with a team of functional and sectoral experts to effectively tap their knowledge for developing the ***Financial Model*** is critical as in most other spheres of activity, experience will contribute to the reader's effectiveness as a financial modeller and his contribution to the project in question.

The ability of the sectoral and functional experts to contribute effectively to the ***Financial Model***, even though they are not directly responsible for the development of such ***Financial Models***, is also affected significantly by their appreciation of the subject matter of ***Financial Models*** at least at a broad conceptual level. Such stakeholders, along with those responsible for taking decisions based on the output of ***Financial Models*** (i.e., users) can thus benefit from this book. Such readers may refer to the "Preface" for suggested use of the book that does not involve reading from cover to cover.

There are also some caveats specific to concepts and tools covered by this book. Similarly, some of the appendices have specific caveats that should be noted. These have been incorporated at the appropriate points in the book. As a general and over-arching caveat, it is also clarified that given the nature of the topic covered by this book, the author cannot be held legally liable for the consequences (including any monetary loss) of any action taken on the basis of this book's contents. Perhaps needless to add, the moral obligation of the author to receive and incorporate in future editions any genuine and relevant feedback subject to his judgement is very much acknowledged. As has been emphasised earlier and thus possibly at the cost of repetition, the author specifically acknowledges the following two aspects:

(a) The subject of ***Financial Model***s in the ***PPP/Project Finance Context*** is a vast and dynamic field and despite the breadth of his experience across various sectors through consulting and project development assignments, there are large areas where the author considers himself to be in the learning mode rather than being anywhere close to a "learned" position, something that in his experience is often adopted as positioning but ultimately proves to be immodest and often hollow in a majority of cases. At the same time, the author has learnt from many colleagues, clients and associates over the years and the preceding sentence should not be interpreted as saying that all the "learned" experts are posers – indeed there are many genuinely learned persons that it has been the author's privilege to come across in the course of his professional experience. While such persons are too numerous to be listed here without possible errors and high probability of giving offense, the author acknowledges his debt to the many whose able shoulders he has been able to use as a foundation for this book. As usual, the responsibility for any lapses rests with the author.

(b) It should also be clearly understood that there are many ways of achieving the same end[17], not least in a ***Financial Model*** in the ***PPP/Project Finance Context***. The author makes no claim to the effect that the concepts and tools covered in this book necessarily represent the best, whether in terms of the clarity of communication to the reader or as a response to any specific issue or aspect. Rather, these are based on the author's judgement and limited by his ability as a writer. At the same time, he takes heart from the fact that the judgement itself is based on years of experience in developing and working with ***Financial Model***s in the ***PPP/Project Finance Context*** as well as training many people on the subject, both formally and informally.

[17] To loosely translate a saying attributed to the nineteenth century Bengali mystic and religious figure Shri Ramkrishna, *there are as many paths as there are opinions.* The author believes this holds true for financial modelling in our defined ***PPP/Project Finance Context*** as to life in general or ways to achieve *nirvana, which was the context in which Shri Ramkrishna made the statement in question.*

CHAPTER 2

The PPP/Project Finance Context Explored

INTRODUCTION

Chapter 2 is aimed at equipping the reader with a limited exposure to the basic concepts of ***PPP*** and ***Project Finance***, with a reasonably thorough understanding of these two concepts. Those readers who are familiar with the basic concept of limited or non-recourse financing and with past experience of PPP projects in their capacity as members of an advisor, bidder, Government entity awarding the project or a lender to such a project, are unlikely to find much that is new to them – at most, a quick perusal of this chapter may be necessary for such readers.

Key Topics Covered in this Chapter

- The concept of ***Project Finance*** and non-recourse financing
- The meaning and rationale for ***PPP*** projects and the typical context of such projects
- The typical ***PPP*** project cycle
- Key terms commonly used in ***PPP/Project Finance*** transactions and ***PPP Project Contracts***
- ***PPP Project Structure*** variants
- Implications for the ***Financial Model***

2.1 UNDERSTANDING *PROJECT FINANCE*

2.1.1 Distinction between *Project Finance* and Non-Recourse Financing

So far, we have been using the terms ***Project Finance*** and non-recourse financing in the same breath and interchangeably, which is fine in practical terms. However, there is a subtle difference in the meanings of these two terms that should be noted by the more careful reader. ***Project Finance*** refers to the long-term financing of a project with a mix of project-specific, non-recourse debt and equity from one or more promoter(s)/ sponsor(s) invested in a distinct and independent legal entity set up specifically to implement and operate that project, with no role for the balance sheets of the project's promoter(s)/sponsor(s) in such financing.

In this context, non-recourse financing is correctly limited to the debt component of such financing or any transaction where lenders do not have recourse to the promoter/sponsor's other assets – in other words, the debt funding in a ***Project Finance*** transaction is non-recourse financing. It would be wrong to extend the term to equity investment, which is by definition, risk capital, where the investor is expected to bear risks and not look for recourse to anything beyond his own judgement at the time of making the investment. Thus, ***Project Finance*** is in a sense, a broader term that subsumes non-recourse financing. As mentioned, not putting too fine a point of this distinction is perfectly valid in practical terms.

2.1.2 *Project Finance* versus Corporate Finance

The fundamental feature of non-recourse financing that distinguishes it from traditional balance sheet based corporate financing[1] is that the lenders are restricted to the assets and cash flows of the specific project being financed for obtaining repayment of the loan and do not create any security interest over other assets owned by the promoter/sponsor of the project being financed. Thus, *Project Finance* is used for specific projects, with the financing being made available for the sole purpose of executing the project – this is in contrast to traditional corporate finance where a corporate borrower may raise debt

[1]A more appropriate term for the concept that represents the opposite of non-recourse financing may be "recourse debt", which essentially means lending where the lender has recourse of all the assets and cash flows of the borrower in case of a default, rather than being limited to the specific asset(s) funded.

funding for multiple purposes without necessarily committing to the end-use of such funds, as long as it generates cash flows which are adequate for servicing this debt. Also, a corporate may raise debt funding from several sources without the lenders being in any way related. In contrast, with all the lenders in a *Project Finance* transaction being dependent on the cash flows generated by the specific project funded, they are generally bound by a common general agreement with the borrower. By definition, a *Project Finance* transaction requires lenders who have a good understanding of the project – thus, in contrast to the more general appraisal of the adequacy of a corporate entity's cash flows and balance sheet in traditional corporate finance, the lenders in a *Project Finance* transaction have to take a look closely at the technical and contractual aspects of the project in order to assess the risks. *Project Finance* thus tends to be a more specialised field with fewer lenders that have the capability to undertake the required level of in-depth analysis.

The allocation of risks to various parties lies at the heart of any *Project Finance* transaction, requiring a careful and comprehensive identification of all project related risks, followed by the sharing and allocation of such risks. Since such risk allocation and management relies mainly on contracts, the structuring of a *Project Finance* transaction with its multiplicity of contracts tends to be complicated and involves higher cost. Thus, *Project Finance* is typically feasible only for large projects with a minimum scale that justifies the higher transaction related costs.

2.1.3 Security in *Project Finance* Transactions

Readers should not make the mistake of considering ***Project Finance*** as unsecured lending. Both non-recourse *Project Finance* and traditional corporate finance are secured loans – it is simply the nature of the security that differs in case of non-recourse financing. In corporate financing, the lender can create a security interest in other assets owned by the promoter/sponsor of a project – for example, a steel company borrowing for a capacity expansion program may provide its pre-existing assets as security for this loan. Thus, the existing plant and machinery, land, etc., appearing on the steel company's balance sheet at the time when the expansion program is undertaken, may be provided as security to the lenders for the expansion program. Supposing the expansion program runs into problems because of a downturn in the global steel market and is dropped halfway through implementation, eventually causing the steel company to default on its repayment obligations on the loans taken for the expansion program, the lenders can take possession of the pledged assets comprising the pre-existing steel-making capacity of the company provided as security and dispose these assets in order to recover the money due to them.

However, if the same capacity expansion program of the steel company was to be funded through the *Project Finance* route, the security available to the lenders would be restricted to the assets pertaining specifically to the expansion program and any cash flows that may be generated using these assets[2]. In this scenario, when the steel company defaults on its repayment obligations related to the expansion program loan, the lenders cannot attempt to recover their dues by attaching and disposing the other assets of the steel company like the pre-existing steel-making capacity. At most, the lenders can step in and dispose the assets relating to the incomplete expansion program. It is very likely that the market for this partly implemented steel-making capacity would find few buyers at a time when the steel industry is in a downturn, as a result of which the lenders may be able to recover only a part of their dues through the sale of assets at a low price. This aspect will be driven by the extent of funding provided by the lenders – typically, with debt financing limited between 50% and 70% of the project cost, there is some margin available for absorbing any decline in the value of assets realised by the lenders upon default. This margin provided by the loan being limited to a certain proportion of the project cost or asset value is typically termed "over-collateralisation". However, this may not protect lenders for any asset category where a sharp decline in value of the asset is possible, a classic example being real estate.

In general, however, non-recourse financing is riskier than the traditional corporate financing transaction where the lender has recourse to pre-existing assets of the borrower that do not form part of the project for which the loan is being taken – the lender is thus protected against the failure of the project itself, at least to some extent. In fact, the assets provided as security may have no link whatsoever with the project, in which case any adverse outcome for the project will probably not affect the value realised in case the asset is disposed off by the lender. In that sense, *Project Finance* is a step in the right direction, as it forces lenders to consider the merits of the project being funded rather than lending to dubious projects promoted by the rich,

[2]While project financing of a steel plant may seem odd in the Indian context, such transactions are increasingly common in developed markets. For example, GE Commercial Finance was involved in a US$ 440 million *Project Finance* transaction for a mini steel plant set up by SeverCorr LLC in Mississippi, the company being a partnership involving steel industry veteran and former CEO of Nucor John Correnti and the SeverStal group of Russia.

who have pre-existing assets to offer as security. While protecting eccentric billionaires struck by hare-brained project ideas cannot really be considered a primary driver for non-recourse financing, there is no doubt that the lenders have a direct stake in the success of the project and stakeholder interests are better aligned in a *Project Finance* transaction to that extent.

2.1.4 The Role of the SPV in *Project Finance*

In legal terms, a *Project Finance* transaction generally involves the incorporation of company (Special Purpose Vehicle or SPV[3]) to act as the project's dedicated implementing/operating entity and thus the liability of those investing the SPV's equity capital (i.e. the project's promoter/sponsor) is restricted to the amount of such equity investment in the SPV, in line with the fundamental legal concept of a limited liability company. This is in contrast to the situation where a company takes on a project on its own balance sheet and raises the funding for the project, i.e. the typical corporate finance transaction. For such corporate finance transactions, lenders to a project have recourse to other assets on the balance sheet of the company though the ultimate liability of the equity investors in the company remains limited to the extent of their equity investment[4]. In the event of the borrowing company becoming bankrupt, the lenders can recover their money by liquidating the company's assets. Of course, some lenders may have exclusive rights over specific assets while for other assets, all lenders and creditors of the bankrupt company may have to get in a queue to get a share of the liquidation proceeds overseen by a court of law. Lenders may also differ in terms of their priority (or position in the queue) in allocation of liquidation proceeds with senior debt getting priority over subordinated debt and unsecured loans not covered by specific assets provided as security in the loan related documentation.

Some people get confused by the term "off balance sheet financing" used in the context of *Project Finance*. This does not mean that funding raised using the ***Project Finance*** route does not appear on the balance sheet — rather, it means that the liability does not appear on the balance sheet of the

[3]The term Special Purpose Company (SPC) is also used.

[4]In case of corporate entities structured as partnerships or sole proprietorship firms, lenders may well have recourse to the assets of the partners/proprietor – in that case, the liability will not be limited to equity invested. As such, the concept of limited liability partnership has been introduced in India through the Limited Liability Partnership Act, 2008. However, at the time of writing, the author has no direct experience of any SPV being structured as such.

promoter/sponsor. The most effective way to ensure that the lenders' security interests are restricted to the project's assets and cash flows is generally to incorporate the project itself in a dedicated legal entity – the so-called Special Purpose Vehicle (SPV). With the SPV being a limited liability company, the liability of the promoter/sponsor of the project becomes effectively limited to their equity investment in the SPV. The housing of the project in the SPV effectively "ring fences"[5] the project and protects the other assets and businesses of the promoter/sponsor from any negative outcome of the project. The practice of using the SPV route for ***Project Finance*** transactions related to infrastructure projects is widely used in India, which explains why many people consider non-recourse financing or ***Project Finance*** as being synonymous with "off balance sheet financing". Of course, the non-recourse loan would still appear on the balance sheet of the SPV – the relevant "balance sheet" in the term "off balance sheet financing" is thus that of the promoter/sponsor's pre-existing business. At the same time, readers should not confuse non-recourse financing with other liabilities that do not appear at all on any balance sheet, i.e. contingent liabilities that become due and payable only under certain pre-defined situations. Typically, such "pure" off balance sheet contingent liabilities emanate from contractual or regulatory arrangements.

It should also be noted that the setting up of an SPV is not necessarily a step aimed at thwarting any attempt of lenders to call upon the assets of the promoter/sponsor in case of default, which is in a sense a negative approach, as far as the lenders are concerned. It may very well be that the promoter/sponsor is subject to risks that are not acceptable to lenders – this is especially the case where the Government is involved as promoter/sponsor. For example, given the political nature of the pulls and pressures to which Indian Railways or the Irrigation Department of a State Government is subject to, particularly in respect of tariffs, lenders may consider such entities as being of poor credit quality and be unwilling to lend to such entities directly but may be comfortable with a project specific SPV that is de-linked from the parent entity within the Government. All the more so, if private sector entities also join in as the promoter/sponsor. This is in a sense a credit enhancement exercise that could also be achieved through other mechanisms such as an escrow account though it must be said that any structured obligation like lending with repayment linked to an escrow

[5] The term "bankruptcy remote" is also used frequently in the same context though this is possibly more relevant where the intent is to de-link the ***Project*** from the promoter/sponsor in a positive sense – i.e. where the promoter/sponsor has weaknesses that could adversely affect the ***Project***.

account with "over-collateralisation" would still fail if the parent entity fails to keep afloat in which case the cash flows into the account may cease altogether. For example, even if a loan to a State Electricity Board (SEB)[6] (or a bond issued by such an entity) were to be structured such that payments from high volume industrial customers were routed into an escrow account with the first priority given to debt service for the loan in question, such an arrangement would still break down if the SEB became bankrupt and stopped payments to suppliers of coal, power or services including its own employees, with the consequence that the high volume industrial customers would not receive any power and the payments into the escrow account would dry up. A SPV for a power generation project with some equity participation by the SEB may still be able to raise debt funding in a *Project Finance* transaction, provided of course that the SPV was "bankruptcy remote" and did not have the SEB as its only or prime customer and/or the SPV could easily find an alternative buyer for the power it produced in case of a deterioration in the financial position of the SEB or defaults by the SEB, with such provisions clearly defined in the ***PPP Project Contract***.

In the global context, *Project Finance* is popular among multi-national companies for entering into emerging markets where the country risks are otherwise high. Typically, the multi-national promoter/sponsor will try and pass on some of these risks to banks, export credit agencies and multilaterals.

Having dealt at length on the concept of non-recourse financing, it is also necessary to recognise that transactions that are strictly non-recourse are rare – more typically, such transactions take the form of limited recourse to the promoter/sponsor rather than nil recourse. Also, the lack of recourse as far as lenders are concerned in a *Project Finance* transaction does not generally extend to all possible outcomes. Generally, there would be certain situations where the lenders do have recourse, albeit not recourse to the other assets owned by the promoter/sponsor of the project. For example, in case of termination of a *PPP* project by the "public" party (i.e. the Government entity), the lenders may be entitled to receive a portion of the termination payment payable by the terminating party for recovery of that portion of the loan remaining unpaid at the time of termination. Similarly, in case of insured *force majeure* events that lead to a situation where the project assets cannot generate further cash flows, the lenders may well have the first priority

[6] By and large, SEBs in India have been split up and converted into a set of successor companies as part of power sector reforms – in drawing upon this example, the author is referring to the pre-reform scenario.

over the insurance proceeds. In general, the project promoters/sponsors may still be bound by contractual obligations and also provide certain guarantees in a *Project Finance* transaction even if the lenders do not have recourse to the balance sheets of the promoter/sponsor.

SPVs in the context of the provisions of the Companies Act in India: Under the Indian legal system, an SPV can be either a private company restricted to a maximum of fifty shareholders (the term used in the Companies Act is “member”) or a public company in case of a broader shareholder base. Of course there is nothing to prevent a SPV that is incorporated initially as private company from going public at some point in the ***Project Time-Line***. Getting listed on a stock exchange through an Initial Public Offering (IPO) is also possible, subject to legal requirements for a prospective listed company being met. By and large, a majority of the operational SPVs in the Indian *PPP/Project Finance* Context are private companies, primarily because of the relative ease of incorporation and operation (mainly in terms of reporting requirements and corporate governance aspects) vis-à-vis public companies.

It should also be clearly understood that any SPV that has a successful IPO would also be regulated by the capital market regulator, the Securities and Exchanges Board of India (SEBI) and be subject to other legislation related to capital markets as well as the contractual provisions of the Listing Agreement with the stock exchange, besides the provisions of the Companies Act that are specific to public companies. Also, it should be appreciated that the essential character of a company from the *Project Finance* perspective is in any case the limitation of the shareholders’ liability to the amount of equity[7] (hence, “risk capital”) infused into the SPV for financing the project, which remains unchanged across the categories discussed above, i.e. private companies and public companies. The restrictions on a private company are on the number of shareholders and public deposits – hence, there are no issues involved in such a private company raising non-recourse debt. The only restriction is that equity capital has to be raised from 50 or less members and no deposits can

[7]Under the Companies Act in India, it is also possible to incorporate companies limited by guarantee rather than the more usual case of a company limited by its share (equity) capital. In companies limited by guarantee, the members undertake to pay up to a certain amount (the guaranteed amount) in case of liquidation of the company. The guarantee is invoked only in case of liquidation of the company and not as long as the company is a going concern. Companies limited by guarantee may or may not have share (equity) capital. As such, the Companies Act even provides for other categories of companies such as Section 25 companies and unlimited companies but these are of limited relevance in the *PPP/Project Finance Context*.

be accepted from members of the public, a term defined to exclude Directors and their relatives (also defined). The amount of equity capital is in any case determined by two factors – the cost of implementing and operating the project and the extent to which that cost can be funded by debt. However, this has no impact on the choice between a private company and public company in case of an SPV as there is no provision in the Companies Act that links share capital to this aspect – i.e. there is no specific amount of share capital above which a company can only be a public company[8]. It should also be understood clearly that it is generally not necessary for a bidder to be a company – thus, sole proprietorship firms and partnership firms may be bidders subject to other conditions such as minimum net worth being met – the bidder only has to commit to incorporate an SPV in case of selection, which is in effect no different in case of a bidding company.

As mentioned earlier, *Project Finance* transactions are not restricted to infrastructure projects only. The basic idea of the SPV being incorporated to insulate the project's promoters from possible failure of the project can be applied to practically any area of activity including manufacturing and services. Nor for that matter are *Project Finance* transactions always structured with no recourse to the project's promoters/sponsors – more usually, the lender to the project has limited recourse to the project's promoter/sponsor and in case of certain events to the Government or insurance providers. In technical terms, *Project Finance* transactions generally involve limited recourse rather than no recourse.

2.2 *PPP* PROJECTS

2.2.1 Rationale for *PPP* Projects

As mentioned earlier, *Project Finance* transactions and non-recourse financing need not be associated only with *PPP* infrastructure projects. Conversely, not every *PPP* project necessarily involves *Project Finance*, "PPP" being commonly used as an umbrella term. However, the focus of this book is

[8]Provisions existed in the Companies Act earlier that governed "deemed public companies" – however, even then, a private company would become a "deemed public company" only on the basis of turn-over (revenues) and when either more than 25% of the paid up share capital of the private company was held by one or more body corporate or when the private company itself held more than 25% of the shareholding of a public limited company. In any case, these provisions are no longer applicable due to amendments in the Companies Act. Thus, there is effectively no legal provision in the Indian legal system that would require an SPV to be incorporated only as a public company.

indeed on such *PPP* infrastructure projects involving *Project Finance*, given that such projects account for the vast majority of *Project Finance* transactions and non-recourse financing in the Indian context and the vital role of the *Financial Model* in such projects. It thus makes sense to spend some time on the essential features of *PPP* infrastructure projects to better define our context for *Financial Model*s, especially for the reader not familiar with such a context.

We have already made a start by providing a basic and fairly general definition of a project in the ***PPP/Project Finance Context*** in Chapter 1 (Section 1.2) as a project involving two essential features, the second of which can now be recognised as defining the fundamental feature of non-recourse financing and therefore restricting our focus on the relevant *PPP* projects rather than using "*PPP*" as an umbrella term. The two features mentioned are:

- A contractual relationship between Government and a private sector implementing/operating entity in the form of a concession agreement, authorisation agreement or similar ***PPP Project Contract*** that outlines the rights and obligations of both parties and serves as the primary method for allocation, sharing and mitigation of project related risks between the two parties. The ***PPP Project Contract*** is based on a spirit of partnership and co-operation whereby both parties contribute identified resources and take on specific obligations and risks in order to achieve common and shared objectives rather than being based on conventional buyer-seller or principal-agent types of relationship between the parties to the contract, which are typically "arm's length" relations characterised by conflicting objectives that are managed contractually. Moreover, the ***PPP Project Contract*** must provide for a significant transfer to the private entity of the risks related to the creation and/or operation of the project assets and the returns earned by the private entity should be linked to the outcomes generated by the operation of the project assets.
- A project specific entity (the Special Purpose Vehicle or SPV) responsible for implementation of the project and its operation over a given period of time in line with the ***PPP Project Contract*** as defined above, with recourse to the promoters/sponsors (equity investors) of the SPV limited by and large to the equity invested in the SPV.

In taking a closer look at this context for the *Financial Model*s of the type that is the subject of this book, it should be noted even at the cost of repetition that the definition above is fairly general and covers a wide range of possible *PPP Project* ***Structure***s across various infrastructure sectors.

Thus, any attempt to create a "typical" picture of the *PPP* infrastructure project is not without its own risk. To mitigate this risk to an extent, it is necessary to first look at the underlying rationale for any *PPP* infrastructure project and the broader context of such projects, before turning to the typical ***PPP Project Structure***s and life cycles of such projects. Unfortunately, the increasing popularity of the ***PPP*** concept across infrastructure sectors in India is not without drawbacks in the form of many people espousing the cause of ***PPP,*** based on the belief that it is the "fashionable" thing to do. As a result, many in both Government and private sector have taken to *PPP* as an initiative necessary to establish their "progressive" credentials, with very little attention being paid to why ***PPP*** makes sense (or does not make sense) in a given situation.

In the late nineties, when the author with slightly less than four years of post-MBA work experience started working in the areas of infrastructure development and financing in a ***PPP*** framework, it was more or less taken for granted that it was the only way to go. Accustomed as we were to poor quality infrastructure as citizens of an over-populated, developing nation where the Government and public sector had a finger in almost every pie that could be termed "infrastructure" (besides many other pies), it appeared self-evident that the only way to address the immense shortage of high quality infrastructure in India was to involve the more dynamic private sector in the provision of infrastructure services. The prevailing mood was more or less summed up by the then fairly recent Rakesh Mohan Committee report[9] that presented estimates of investment required in various infrastructure sectors along with fairly incisive analysis on the many shortcomings of the Government's role in these sectors. "The Government cannot afford the required investment in infrastructure" was the common refrain – it appeared clear that *PPP* was the only way out because the private sector had to make up the inability of the Government to invest the required amounts in infrastructure after meeting the expenses relating to its large borrowings and work-force. This "resource additionality" argument prevailed over all other logic. Today, with over ten years of experience with *PPP* projects across various sectors and tiers of Government covering success stories as well as miserable failures, that simplistic rationale is perhaps more questioned but still remains powerful. However, to appreciate properly the ***PPP/Project Finance Context*** for *Financial Models* it is necessary to understand a few critical points.

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[9]The India Infrastructure Report: Policy Imperatives for Growth and Welfare, Government of India, 1996.

In India as elsewhere, the Government with its sovereign monopoly over money supply can borrow at the lowest rates. Thus, replacing Government funding of an infrastructure project with private funding immediately creates a cost disadvantage – the higher cost of capital for the private investor that will push up the project cost. Further, since *PPP* involves contractual arrangements beside efforts required to develop and bid out the project, the transaction costs of a *PPP* project may be higher compared to the alternative of creating the project assets using public funding. Of course, it cannot be claimed that public funded infrastructure projects do not involve transaction costs – it is just that these tend to remain hidden in many public funded projects as risks are not fully identified and are therefore implicitly borne by the public sector entity implementing the project or in some cases by the consumers of the output generated by the projects. In contrast, the need to clearly identify and address all project parameters that influence the risks borne by the private investors up-front in case of a *PPP* project tends to increase both the need for involving specialised and expensive skills and the visibility of the costs incurred on such inputs.

Clearly, the disadvantage of higher cost of capital and (possibly) transaction costs in a *PPP* project has to be exceeded by other benefits that private investment and management can provide. The sources of these benefits are not difficult to trace – by and large, the benefits are directly linked to inefficiencies arising from the Government/public sector implementation and management of projects (asset creation) as well as subsequent operation of these assets to provide infrastructure services. For example, with funds being allotted to projects through a budgetary process, the quantum of funds made available for any given project will invariably be influenced by political considerations. As a result, way too many projects are likely to be taken up because most politicians see the benefit in laying foundation stones but are not certain whether they would be around in a democracy to benefit from the completed project, especially an infrastructure project that involves gestation periods typically exceeding the election cycles. The inevitable consequence is the spreading thin of both human and financial resources, leading to time and cost overruns. Further, a bureaucracy subject to the inevitable red tape associated with the responsibility of allocating public funds to projects is likely to be more concerned about processes that will meet audit requirements than outcomes. With the cost of wrong or delayed decision making never measured while procedural discrepancies are frowned upon, it is more than likely that timely project implementation will suffer in the quest for procedural perfection that will meet audit and vigilance requirements later.

Thus, the system of Government funding and management of infrastructure projects has some inherent deficiencies that can defeat the most committed and honest public servant. A question that the author has faced frequently while conducting training programs on *PPP* for Government employees is on the relative strengths of human resources in the public sector vis-à-vis the private sector. In other words, "is it that the private sector employs better people?" is a common query. The answer generally offered by the author is invariably that there is no inherent difference in the quality of human resources – it is just that one system focuses more on accountability for adherence to process than achievement of outcomes and has a very weak linkage between performance and reward (or alternatively, lack of performance and punishment). By and large, this is appreciated by the audience as being the primary driver of efficiency that they can easily identify with based on their own experience. Clearly, the greater accountability of a private sector management for efficient and profitable operations, with pressures from customers, shareholders, lenders, the capital market and employees providing the required incentives and disincentives, lies at the heart of the benefits possible from ***PPP***. Of course, it cannot be claimed by any stretch of imagination that all public servants are just victims of the system and corruption or inefficiency does not exist — the hallowed catchphrase of "social good" can easily be distorted to promote personal agendas and often is, with the result that the benefits of public investment may never accrue to the target beneficiaries.

At the same time it should not be expected, especially in the absence of competition due to the natural monopoly characteristic of many infrastructure projects, that the mere fact of private management of a *PPP* project will ensure benefits. In fact, a privately managed monopoly with returns ensured through "rate of return" tariff regulation may well be as inefficient as its public sector counterpart in the absence of competition that ensures adequate incentives for the private management to control costs and for the shareholders to monitor management performance with any diligence given that the return on investment is assured. The bottom-line is that the benefits from a *PPP* project will not accrue if the incentives and disincentives linked to performance that characterises private sector management are not replicated in the *PPP* project.

The key point here is that a well designed ***PPP*** infrastructure project that has been thought through so as to retain the drivers of performance for the private sector management may well deliver benefits that far outweigh the disadvantages posed by the higher cost of capital and transaction costs. Such possible benefits may arise from a number of sources, such as:

- Quicker implementation of the project as funding is not dependent on a budgetary process subject to multiple and competing demands for finite funds and also as the private developer has every incentive to ensure quick construction in order to start generating revenues from the operational project assets.
- Optimum technology being adopted to minimise life cycle costs, not the easiest of tasks within a Government system driven by the "lowest cost is the best option" mentality where the cost of asset creation tends to dominate decision making as opposed to the combined cost of asset creation and operation over a fairly long period of time.
- Lower operating costs and better service to users as the private sector management's incentives are more aligned to performance as compared to the more time-bound regime of career advancement and rigid pay scales within Government. The lack of an entrenched and over-populated employee base may also help to keep operating costs within control.
- Quicker reaction to changes in the market and management of commercial risks as compared to a Government system not designed for such a role.

To conclude, whatever may be the sources of benefit from adopting the *PPP* framework for implementing a project, such benefits should be clearly identified before commencing the procurement process for selection of a private sector implementing/operating entity. The PPP Project Structure and contract should then be designed to ensure that there exist adequate incentives for the selected bidder to deliver these benefits. While a quantitative assessment of the benefits accruing from adopting the PPP route vis-à-vis the lower capital cost of Government funding of the project is often difficult in the Indian context, in the absence of data on past performance of the public sector in different infrastructure sectors, at least a qualitative assessment of such benefits should be undertaken. Unfortunately, even such a qualitative assessment is often omitted in the blind acceptance of PPP as necessary given the "resource additionality" argument in a country with obvious gaps in high quality infrastructure.

2.2.2 Key Features of *PPP*

Some key features of the definition of *PPP* presented earlier in this chapter (as well as Chapter 1) should be noted in order to understand why some projects are amenable to *PPP* and others are not, as well as the question of whether a particular project should be considered *PPP* or not. Of course, it is true that the definition of *PPP* presented here is by no means a standard definition, for the simple reason that no such definition exists. Various definitions of *PPP* abound and even seasoned *PPP* "experts" do not always see eye to eye on whether a project constitutes *PPP* or not. However, there is a broader agreement on some key features of *PPP* that are reflected in the definition used here. Firstly, the basic feature of a *PPP* transaction that distinguishes it from the traditional procurement of goods and services by the Government or public sector is that it involves co-operation or partnership among the parties to the ***PPP Project Contract***. Such co-operation or partnership is clearly possible only when there is agreement about the desired outcomes of the project – unless there is such a common goal to align the interests of the parties, there is no scope for co-operation. Of course, it is also true that the desired outcomes or the common goal has to be specified in unambiguous terms and be clearly measurable. For example, it is not enough to say that the goal of a *PPP* project is "provision of efficient water supply to the citizens of town A" because efficiency is subjective and a goal such as this can be neither effectively incorporated into the ***PPP Project Contract*** nor measured and monitored over the ***Project Time-Line***. Rather, to be effective as a common goal that aligns the interests of the parties to a ***PPP Project Contract,*** a more specific formulation is required. For example, the vague goal of "efficient water supply to the citizens of town A" may be rescued by specifying concrete parameters of such efficiency, as follows:

"The goal of the proposed *PPP* project is to improve the quality of water supply in town A, involving the following targets:

- 90% of all households should have piped water connections with accurate meters to measure consumption within two years from the start of the project
- Water supply should be available for at least 16 hours every day within one year from the start of the project
- Per capita water availability should be at least 120 litres per day within three years from the start of the project
- A computerised billing system that generates regular bills based on actual consumption for all customers every two months
- System losses in the form of unaccounted for water, covering both technical (leakages) and commercial (unauthorised use not billed), have to be reduced by 50% over the base level determined by a system audit carried out at the start of the project, with this target being achieved within two years from the start of the project
- Total consumption of power for water treatment and pumping has to be reduced by 20% over the base level determined by a system

audit carried out at the start of the project, with this target being achieved within two years from the start of the project"

Thus, *PPP* can be effective only where the desired outcomes can be defined in clear and measurable terms as part of the ***PPP Project Contract*** and form a basis for measurement of achievement that is agreed to by both parties.

It should be noted that the goals specified above for the water supply system of town A do not mention the inputs required, such as the number, technical specifications and capacities of water treatment plants or water storage tanks. This is a drastic change from traditional procurement, where the municipal body of town A would have specified in great detail the design, capacity and specifications of various components of the water supply system before awarding a construction contract. On part of the Government or public sector contracting entity, ***PPP*** thus requires a shift from specification of input to definition of the desired output. This by itself can lead to gains, as the greater effort required to define the need generally leads to a better project design that takes into consideration the life cycle cost of the infrastructure assets, covering both the cost of asset creation and operation. This is in contrast to the focus on input in traditional procurement, which tends to be associated with similar focus on the cost of creating the asset than the efficiency of that asset, also taking into account the cost of operation over a life time of operation, a period that will typically be at least fifteen years and often much longer for infrastructure assets with operating costs thus accounting for a substantial portion of the life cycle costs.

While the shift from input specification to output definition calls for a change in the mindset of decision makers within the Government or public sector contracting entity, it also provides the scope for innovative solutions by the private sector creating major benefits. With the private sector being no longer constrained by pre-defined inputs, it can look at innovative solutions in the form of technology, work practices and phasing of investment that lead to the efficient and least-cost delivery of the specified outputs. The key point emerging from this discussion is that *PPP* is possible only if a common goal in the form of clear and measurable outputs can be defined. In situations where this is not possible, for example in case of IT based services where rapid technological change may lead to frequent changes in the target output, *PPP* is not suitable.

Of course, just the definition of a common goal is not sufficient for successful ***PPP*** transactions. Another key feature that is reflected in the definition is that the return earned by the private sector party should be linked to the achievement of the common goal or target outcomes, which is generally possible through operation of the assets created. Without such a linkage to act as incentive for efficiency, it is unlikely that a *PPP* transaction will yield benefits. It follows that the private party in a *PPP* transaction should necessarily have a major role to play in the operation of the assets. Without such a role and the freedom required to perform that role effectively, the private party will have no control over the achievement of the target outcomes and will certainly not accept returns linked to such achievement, a key feature of the definition of *PPP*. Thus, a project where the Government or public sector entity intends to involve the private sector only in asset creation and manage the operation of these assets itself for whatever reason (such as a "design and build" or EPC contract) cannot be considered as a *PPP* transaction in the proper sense. Nor can any project where the private party is provided an assured rate of return without regard to the operation of assets be considered *PPP* in the proper sense. However, that does not necessarily mean that a project involving the payment by the Government or public sector contracting entity of fixed amounts to the private entity for the services produced using the assets created over a period of time (generally referred to as "annuity based projects") should not be considered as a *PPP* project. As long as the private party is involved in the operation of the assets, the returns earned by that party still remain linked to outcomes as any savings in the cost of operations will translate into higher returns for the private party despite revenues being fixed. Conversely, a project with similar payment structure but not involving the private party in operation of the assets is simply a form of deferred payment by the Government or public sector client to the contractor and not a *PPP* project.

A related point that emerges with reference to the definition of ***PPP*** is whether the private party has to be necessarily involved in the creation of the asset in a ***PPP*** transaction, including the funding of such asset creation. The relevant part of our definition effectively says "the ***PPP Project Contract*** must provide for a significant transfer to the private entity of the risks related to the creation and/or operation of the project assets and the returns earned by the private entity should be linked to the outcomes generated by the operation of the project assets", implying by use of the "and/or" that the private party does not necessarily have to bear risks related to the construction of assets or in other words be involved in such construction. Rather, it is the linkage of the private entity's returns to the operation of the assets that emerges from our definition as a necessary condition for a project to be classified as ***PPP***. Thus, a project where pre-existing assets (possibly public funded) are handed over to a private party for operation and maintenance (such as a management contract) should clearly be considered as *PPP* as long as the private party's returns are linked to such operations and serve as incentive for efficient operations. As mentioned earlier, this is possible even under a regime of periodic fixed payments from the Government or public sector contracting entity since the private party with its control over operating costs still earns a higher return by keeping operating costs low and conversely loses out if it cannot manage the operating costs efficiently.

Though the involvement of the private sector entity in asset creation is not a necessary condition for ***PPP***, it should be noted that several of the potential benefits from ***PPP*** relate to the efficiency arising from the private sector's management and funding of asset creation. The extent of benefit from ***PPP*** is thus reduced where the private party does not have any role to play in asset creation. Moreover, the incentives for the private party are strengthened when that party has contributed to the funding of asset creation and must subsequently earn an adequate return on such investment through its operation of the asset. Also, the quality of the asset created is likely to be better when the private party that will operate the asset is also involved in the design and construction of the asset. In a *PPP* project where the private party has to take over existing assets for operation and maintenance, that party will clearly not be willing to take on any risk arising out of the quality of the assets insofar as such quality affects efficiency of operations. The scope for transfer of risks to the private party is thus limited in such *PPP* projects. In any case, since our focus is on ***Financial Models***, we will restrict our attention and coverage mainly to ***PPP*** projects that involve private funding of asset creation given that ***Financial Model***s are typically relevant only in case of such projects where the private party funds (at least in part) the creation of assets and must subsequently generate returns through the operation of the assets.

2.2.3 Role of Legislative/Executive Jurisdiction in *PPP*

To better appreciate *PPP* infrastructure projects in the Indian context, it is also necessary to keep in mind the fact that the legislative jurisdiction (with executive powers largely aligned to such legislative jurisdiction in our system) for various infrastructure sectors in India's federal structure is divided among three levels of Government – Central or Union Government, State Governments and Local Governments. The division of legislative jurisdiction and executive powers between the State and Local Governments is not as rigid or uniform in the Indian context as compared to that between the Union Government and State Governments. Though the Indian Constitution promoted the Gandhian ideal of local self government as an objective from the outset, the Constitution did not directly define the third tier of Government and its role to start with. It is only after the 73rd and 74th Constitutional Amendments in 1992 that this aspect has changed to an extent. As a result of these amendments, two new parts were added to the Constitution - Part IX covering the rural local Government (Panchayats) with Articles 243 to 243O and Part IXA covering urban local bodies (Municipalities) with Articles 243P to 243ZG, providing Constitutional recognition to the third tier of Government. Articles 243G and 243W also provided for the addition of the Eleventh Schedule and Twelfth Schedule to the Constitution, listing matters to be placed under the jurisdiction of Panchayats and Municipalities respectively by the State Governments.

Given that the situation across states varied significantly prior to the 73rd and 74th Constitutional Amendments in terms of the legislative framework and institutional structure for various infrastructure sectors and the non-mandatory nature of Articles 243G and 243W, the actual jurisdiction and powers of Local Governments continue to vary across states, with limited tax and non-tax revenues of Local Governments and the consequent dependence on State Governments for financing being a common feature. The situation is quite different with regard to the division of legislative jurisdiction between the Union Government and State Governments, with the Seventh Schedule of the Constitution clearly laying down three lists covering matters where the Union Government has exclusive jurisdiction (List-I or Union List), matters where the State Governments have exclusive jurisdiction (List-II) and matters where both share jurisdiction, with the Union Government prevailing in case of a conflict (List-III or Concurrent List).

The above discussion leads to the following conclusions regarding the ***PPP/Project Finance Context*** in India:

- Depending on the infrastructure sector in question, the relevant Government entity empowered to enter into a ***PPP Project Contract*** may be from any of the three tiers of the Government.
- Further, with the differences across states in terms of the effective delegation of powers to Local Government, the relevant Government entity for *PPP* projects in sectors like urban water supply or municipal solid waste may vary from state to state. Also, even though a sector may be the exclusive preserve of the State or Local Governments, there may still be certain aspects of any project in such a sector that are subject to Central Government legislation, good examples being environmental aspects, land acquisition and tax on income.
- In sectors like power where both the Union and State Governments share the jurisdiction, the relevant Government entity may be

from either tier of the Government, though in terms of the overall regulatory or legislative framework, there should not be any conflict with Central Government legislation like the Electricity Act, 2003. In other sectors like ports and highways where the Union and State Governments share jurisdiction, the distinction is clear with major ports and national highways being the exclusive domain of the Central Government whereas minor ports and all highways other than national highways are in the domain of the relevant State Government.

Given the division of jurisdiction in the Indian Constitution, one implication is that there cannot be an umbrella legislation covering *PPP* at the national level that applies to all *PPP* projects. At the state level, some states like Gujarat, Punjab and Andhra Pradesh have come up with specific legislation for infrastructure development that cover some aspects of *PPP* including statutory bodies responsible for the development of such *PPP* infrastructure projects whereas other states have only announced policies that are not legally binding. There may also be policies governing specific aspects of *PPP* projects, for example, a policy for determining the amount of tolls to be levied on a privately developed and maintained highway.

By and large, with *PPP* becoming more prevalent across sectors over the last decade or so, the necessary legislative changes required to enable private participation in development and operation of infrastructure projects are now largely in place in India. It is interesting to note that even for a sector like Railways where not too many *PPP* projects have happened so far in India, there are nevertheless systems of revenue allocation between Zonal Railways in place. A private party taking up a railway *PPP* project can thus always be accommodated into the system as far as accounting and revenue allocation is concerned. In a sense, this highlights the fact that Railways in India were operated by private players in the early years of network development. It should thus be kept in mind that many infrastructure sectors were not always the exclusive preserve of the Government in pre-Independence India – power, railways and telecommunication being good examples of sectors with private sector participation during that period. Given that much of the pre-Independence legislation got carried forward, legislative barriers to private sector participation did not necessarily exist in some sectors. Still, there have been issues that needed to be addressed. For example, the Act governing tolls dating back to the late nineteenth century that was adopted by most states even after Independence provided for the collection of tolls by a private party on behalf of the Government but not appropriation of these tolls by the private party – the amount collected was to be promptly deposited in the nearest Treasury branch. Obviously, this needed to be amended if the State was to take up a highway project with private sector participation where the private party would recover the investment by collecting tolls from users.

Another general aspect that required legislative responses had to do with the fact that prior to the entry of the private sector into many infrastructure sectors, these sectors were the exclusive preserve of the Government with the roles of policy setting, regulation and operation, all being played by the Government, typically a combination of a Ministry and a statutory entity, department or public sector corporate entity under the administrative control of the Ministry in question. Such a set-up would never be viewed as a level playing field by the private sector entrants competing against the incumbent public players. Thus, autonomous regulators such as TRAI and TAMP had to be created by legislation to ensure private sector participation.

2.2.4 Regulation of Private Provision – The Concept of Natural Monopoly

The natural monopoly characteristic of many infrastructure services mean that direct competition cannot be introduced and has to be replaced by regulation of tariffs and service characteristics to protect the interests of consumers. As mentioned briefly in Chapter 1, a natural monopoly can be said to exist if the lowest cost or most efficient delivery is achieved with a single supplier. Of course, a more formal “microeconomics” definition is possible in terms of the nature of the average cost and marginal cost as functions of output (this is covered in the Text Box 2.1 “Going beyond the Obvious”) – however, it is sufficient for our purpose to understand that a natural monopoly is likely where there are high fixed costs and constant marginal costs (i.e. the cost of producing an additional unit of production at the margin) or where there are nil or low fixed costs and declining marginal costs over a range of output that is large, relative to the total size of the market. In such situations, the average cost per unit of output keeps declining over a range that is greater than the total output that the market can absorb – as a consequence, the efficiency is maximised with one supplier because this leads to the lowest average cost per unit of output than is the case if two or more suppliers cater to the market.

A slightly different perspective is provided by the view that the first supplier (incumbent) has such an overwhelming cost advantage that the high initial investment required to participate in the market and compete against the incumbent acts as an entry barrier and keeps out potential competitors.

The classical examples of natural monopoly are provided by network based infrastructure services such as distribution of power, water or gas. Creating parallel infrastructure for the distribution of power, gas or water in the same area where an incumbent already operates, will be inefficient from the society's point of view. At the same time, the lack of competition means that the consumers in a natural monopoly situation have no bargaining power vis-à-vis the supplier. Without any regulation by the state, the sole supplier would be in a position to extract high prices and super-normal returns, without necessarily providing the commensurate level of services. It is in these situations that the regulation of tariff, service quality and access by the consumers or supply by the public sector becomes necessary to protect the consumers – elsewhere the same role can be played by competition among multiple suppliers.

There has been significant debate on whether a natural monopoly situation can arise in real life, with some holding the position that this can at best be a short-term possibility. Rather than getting into the rather esoteric debate over whether a non-transient natural monopoly is possible in real life, a more realistic view is to adopt the "content versus carriage" distinction (or "unbundling") that can be applied to most infrastructure sectors. With this perspective, the "content" segments are amenable to competition, being the actual output consumed such as power, water, gas, flights, voice/data calls, cargo transported by road or sea, etc. In contrast, the "carriage" segments, comprising power transmission and distribution networks, water supply pipe-lines, gas pipe-lines, airports, fibre optic links, highways, ports, etc. display natural monopoly characteristics that do not allow for competition. However, multiple suppliers can compete in the "content" segment only if such suppliers have free and equal access to the "carriage" components for delivery of the content to consumers. Thus, some regulation of "carriage" segments becomes necessary even to ensure that competition can replace the need for regulation in the "content" segments. Ultimately, regulation should be viewed as essential only where competition is not possible as a tool for ensuring optimum outcomes. However, wherever tariff setting is regulated, we need to be conscious about the fact in developing and using *Financial Model*s. As we shall discuss in Chapter 4, where tariff set using a "cost plus" approach is incorporated into the *Financial Model*, this may have a significant impact on the interpretation and use of ***Output*** from the *Financial Model*.

Text Box 2.1

A Formal Definition of Natural Monopoly

Going Beyond the Obvious 1: A Formal Definition of Natural Monopoly

To appreciate a more formal definition of natural monopoly, it is necessary to first establish the relationship between the average and the marginal, mathematically. This relationship applies in various settings, whether one is looking at cost, revenues, output, etc. For our context, we can focus on cost where the total cost (TC) of producing an output of q units is given by the function TC=c (q), where c (q) is the function linking the dependant variable TC to the independent variable output. In this case, the average cost per unit of output produced is given by: AC=c (q)/q, or AC=c $(q)*q^{-1}$

The marginal cost or the extra cost for the production of an additional unit of output is given by: MC=dc (q)/dq, or MC=c' (q), where dc (q)/dq or (alternative notation) c' (q) represents the first derivative of the function c (q) with respect to q. If TC was to be plotted against q, MC represents the slope of the TC curve. Now, if we have the average cost AC decreasing, the slope of the AC curve has to be negative, or:

$$dAC/dq < 0, \text{ or } d(c\,(q)*q^{-1})/dq < 0$$

Using the product rule of differentiation, this can be written as:

$$-c\,(q)*q^{-2} + q^{-1}*dc\,(q)/dq < 0, \text{ or } q^{-1}*(dc\,(q)/dq-c\,(q)*q^{-1}) < 0 \ \dots\ (1)$$

Since the term q^{-1} has to be positive (>0) for any positive value of output q, we must have for average cost AC to be declining with increasing q:

$$dc\,(q)/dq-c\,(q)*q^{-1} < 0, \text{ or } dc\,(q)/dq<c\,(q)*q^{-1}, \text{ or } MC<AC$$

Thus, the average cost per unit can be declining only if marginal cost MC is less than the average cost AC. This makes sense intuitively as well because an average can increase only if the marginal cost of an additional unit of output is less that that average. If one has average marks of 60% after two tests where the marks obtained were 50% and 70% respectively, the average marks after including the marks of a third test will increase to a value more than 60% only if one obtains more than 60% on the third test (marginal marks). Similarly, the average marks can decline below 60% only if one obtains marginal marks (i.e. marks on the third test) of less than 60%.

Another conclusion that can be drawn from (1) is that the average cost will stop decreasing only at a point where marginal cost MC is equal to the average cost AC – since the slope of the AC curve (or first derivative of the AC function with respect to q) has to be zero at this point, we must have $dc(q)/dq-c(q)*q^{-1} = 0$ or $dc(q)/dq = c(q)*q^{-1}$, or MC = AC. Thus, the average cost AC declines till the value of output q where the curves for AC and MC intersect.

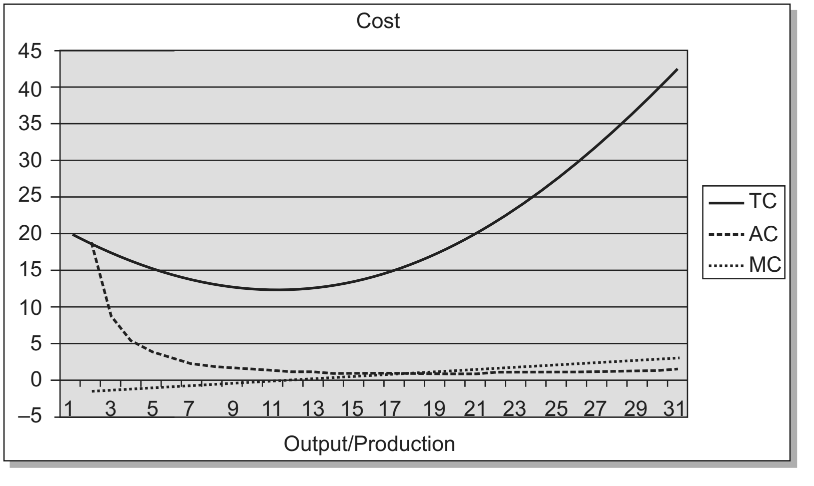
(*Contd.*)

In a typical scenario, the curves for total cost, average cost and marginal cost would be as shown in *Illustration 2.1*. This has been derived using a cost function of the type a+b*q+c*q^2, i.e. a quadratic equation with b < 0 and c > 0. As production/output increases from zero, the marginal cost (yellow curve) is less than the average cost (pink curve) and average cost keeps declining to its minimum value when output reaches 16 units (where the MC curve intersects the AC curve from below). Beyond the output level of 16 units, the marginal cost is greater than average cost and the average cost per unit of output increases with any increase in production beyond 16 units.

Now, if the curves in the illustration hold for a market where the maximum demand is ten (10) units, i.e. the range over which AC declines (i.e. MC<AC), one would have a natural monopoly situation. A second supplier facing a similar cost function as the incumbent could enter this market and lead to a situation that both suppliers have outputs of 5 units each, as a result of which the average cost per unit of output would be higher (i.e. the solution would be less efficient) as compared to the scenario where a single supplier produces and sells 10 units. More importantly, any potential competitor looking at this market would figure out that the incumbent supplier has a lower average cost such that he would be able to wean customers away only by selling at a loss. The entry of any competitor is thus unlikely and the natural monopoly is likely to be perpetuated.

ILLUSTRATION 2.1

Typical Total Cost (TC), Average Cost (AC) and Marginal Cost (MC) Curves



With the private sector entering into infrastructure services, often as competitors to the incumbent public sector service providers, the need for an autonomous regulator was also felt in sector after sector in India, leading to legislation for the setting up of regulators such as the Central Electricity Regulatory Commission (CERC), Telecommunication Regulatory Authority of India (TRAI), Petroleum and Natural Gas Regulatory Board (PNGRB) and Airports Economic Regulatory Authority (AERA). Though it may be questioned whether these regulators are truly autonomous, being often dependant on budgetary allocations for functioning and often staffed by retired bureaucrats, the fact remains that the setting up of such regulators represent steps in the right direction, though lacking in uniformity and consistency across sectors. It is of course a moot point whether the somewhat haphazard evolution of the regulatory framework driven separately for each infrastructure sector by the needs and constraints perceived at different points of time without any co-ordination or agreement about a common, long-term perspective on the appropriate regulatory philosophy is the best way to have addressed the need. Possibly not, with further developments only to be expected as a consequence, as has also been the trend in other countries with longer experience of *PPP* in infrastructure than India.

Overall, the developments on the regulatory front for *PPP* projects across various infrastructure sectors in India should also be viewed in a broader framework provided by the concept of "separation of powers" that drives the Constitution of India. Just as the federal structure with the division of legislative and executive powers across different tiers of Government is a fundamental feature of the Constitution, so is the separation of constitutional powers and functions across three arms of Government, i.e. legislature, executive and judiciary – these three arms are in fact covered by specific chapters both at the Union Government level (Part V – The Union) and the State Government level (Part VI) in the Constitution. The principle is based on the idea that the three arms will counter-balance each other to ensure that powers are used for common good rather than vested interests, with adequate accountability of the arms. Thus, the executive is politically accountable to the legislature, which comprises elected representatives accountable to the electorate. The executive is also legally accountable to the electorate as executive decisions and actions can be challenged in the courts of law. The judiciary is ultimately accountable for upholding the Constitution and the law of the land, which can be changed only by the legislature, besides the fact that the decisions of lower courts can be challenged at a higher level, culminating in the Supreme Court.

Given this perspective, the erstwhile system of co-locating executive functions and quasi-judicial functions related to regulation (including licensing) within a line ministry was definitely out of line with the principle of separation of powers. Now, with regulatory functions being vested in a regulator, ensuring the accountability of the regulator through supervision by the legislature, transparent processes for decision making including public hearings as well as adequate disclosure/discussion of proposed rules and subjecting the decisions of the regulator to judicial review through appeals, while still retaining adequate independence for the regulator, have emerged as the challenges to be addressed while going forward.

2.2.5 When and Why Legislative/Executive Jurisdiction and Regulation Matter?

The reason for devoting some time conceptually to the legislative framework for ***PPP*** infrastructure projects stems from our definition of a *PPP* project as involving a contractual relationship between Government and a private sector implementing/operating entity. It is an established principle of law that no contract is valid if it contravenes the law of the land – in other words, the ***PPP Project Contract*** must be supported (or at least, not invalidated) by the existing legislative framework for the sector, which is itself determined by the division of legislative powers across the three tiers of Government in the Indian context. Though the required legislative amendments or enactments to support ***PPP*** projects are now in place for most infrastructure sectors, this should not be taken for granted while analysing a project. Rather, it makes sense to run through some key questions before getting into the details of the ***PPP Project Contract*** and the ***Financial Model*** for the project. Some relevant questions are as follows:

- Which is the relevant tier of Government for this project/sector? What are the exceptions to this allocation of legislative/executive responsibility to this tier of Government, if any?
- What are the relevant Acts governing the sector? How do these Acts provide for private participation in the sector? Has the Act(s) been specifically amended to provide for *PPP* or is it that the Act(s) does not specifically rule out private sector participation in the sector?
- How is the Government entity entering into the ***PPP Project Contract*** empowered to do so? Is it a statutory entity set up under an Act? In which case, what are the relevant provisions of that Act? Is this authority/power of the Government entity subject to approvals, whether internal to the entity (Board or elected body, for example) or external (a Government Ministry/Department, Cabinet or regulator, for example)?
- How is pricing determined? Is there a regulator responsible for setting tariff? What aspects other than tariff are regulated? Is pricing

governed by an Act or policy or is it to be governed by the provisions of the ***PPP Project Contract***?

Some readers may question at this point whether this level of understanding or breadth of perspective is necessary for someone responsible for developing a Financial Model. In response, such readers should consider the fact that any *PPP* infrastructure project is generally complex and requires a multi-disciplinary team for development and implementation. Any person who is responsible for creating the abstract representation of the project cannot do so in a vacuum or with a limited perspective and still do justice to that task. A more holistic approach is definitely required in this ***PPP/Project Finance Context*** as compared to financial modelling in a less complex situation. Of course, a more mechanical approach may be possible for a *Financial Model* that pertains to a project in a sector with well established precedents, but anyone aspiring to be an effective financial modeller across a wide range of sectors and ***PPP Project Structure***s would still do well to cultivate a holistic approach that enables an understanding of alternative perspectives of the same project. In the author's opinion, a person who views the development of a *Financial Model* as an isolated exercise requiring specialised (and possibly, superior) skills is more likely to end up creating a "black box" *Financial Model* that other users cannot appreciate or use effectively and correctly.

Having looked at the concept of *PPP* and its context in some detail, we can now turn to the typical life cycle of a *PPP* project and the various ***PPP Project Structure***s that are possible.

2.3 PPP PROJECTS: KEY CONCEPTS

2.3.1 *PPP* Project Life Cycle

In terms of the life cycle of a ***PPP*** project, various definitions of the key phases are possible, depending on the extent of detailing of these phases. The terms used are also not necessarily standard. Recognising that there are other equally valid life cycle descriptions, a useful and fairly general representation is shown in ***Illustration 2.2*** below. Most typically, a *PPP* project originates within the Government and the initial project preparation or development is carried on by a Government ministry, department or statutory entity. The Government entity may during this phase involve a transaction advisor or appoint consultants to carry out a feasibility study or even prepare a detailed project report (DPR) – the key difference in scope being that the transaction advisor will typically be involved in managing the competitive bidding process (i.e. procurement phase).

ILLUSTRATION 2.2

Typical PPP Project Life Cycle

KEY PHASES	KEY ACTIVITIES	KEY OUTPUT/ OUTCOME
PREPARATION	• Initiation and Stakeholder Consultations • Appointment of Transaction Advisor (TA)* • Determination of Required Output/Specifications • Assessment of Feasibility • Analysis/Choice of Project and Bidding Structures	Project Report/Detailed Project Report (DPR)*
PROCUREMENT	• Initiation and Stakeholder Consultations • Appointment of Transaction Advisor (TA)* • Determination of Required Output/Specifications • Assessment of Feasibility • Analysis/Choice of Project and Bidding Structures; Approval of Selected Option*	• SPV incorporated • Executed *PPP* Project Contract
IMPLEMENTATION	• Financial Closure • Project Related Approvals • Land Acquisition/Transfer & Shifting of Utilities* • Appointment of Contractor(s) • Preparation/Approval of Design • Monitoring of Construction • Testing & Commissioning of Project Assets	• Detailed "Ready to Construct" Engineering Design* • Financing Agreements • Agreements with Contractors • Approvals for Project • Operational Project
DELIVERY	• Operation & Maintenance • Monitoring of Output Quality • Tariff Revision* • Re-negotiation* • Transfer of Assets to Government*	• Services for Users • Revenues for SPV

Note: Activities/Outputs marked with * may not be relevant for all *PPP* projects

The extent of detailing of the project at the preparation phase varies considerably – for high value projects involving technical complexity where the capital investment may vary considerably depending on technical parameters and where aspects like traffic drive the project's feasibility to a great extent, the Government initiator of the *PPP* project or the transaction advisor appointed by the Government may well undertake fairly detailed studies to define the project, estimate the likely capital cost and establish the project's feasibility as a *PPP* project under different scenarios.

In a ***PPP*** project, it is really the level of expected output that has to be well defined – for example, it may be desired that a road project should provide three lanes for traffic in each direction, a service lane in each direction, a certain number of flyovers/bridges and road furniture (signs, markings, safety features, crash barriers, etc.) as per established standards. Besides, the quality of the road that has to be maintained over the ***Project Time-Line*** may be defined in terms of established measures like International Roughness Index (IRI), with a maximum permissible level of IRI being specified. Generally, there are fairly well established technical standards for most infrastructure sectors by reference to which the tedium of defining output quality for a *PPP* project can be much reduced. The use of such standards should generally be for setting the floor – a bidder who has an incentive to opt for higher or better specifications should have the flexibility to do so.

Given this situation, it is generally not necessary for the Government entity developing the *PPP* project to define parameters of the project other than the required output – for example, keeping to the example of a road project, it is not necessary for the Government entity developing the *PPP* project with the intention of bidding it out to specify the pavement design. Given the expected traffic levels and the need to ensure a defined minimum quality of service for users of the road, it is likely that the private bidder selected will, in his own interest, design the pavement so as to minimise costs over the project life cycle[10].

[10]Pavement design is a critical aspect of any road project – it has a direct impact on the costs of construction as well as maintenance. An inadequate pavement in relation to the level of traffic on the road will mean quicker deterioration of the road surface and higher maintenance costs. On the other hand, over-engineering the pavement for a level of traffic much higher than that actually carried on the road will lead to a higher cost of construction for the road that will not be entirely compensated by the savings in maintenance costs incurred. Pavement design thus involves trade-offs so as to minimise the life cycle cost of the road given the current level of traffic and expected growth in traffic – this may involve the use of fairly sophisticated optimisation tools such as the Highway Development and Maintenance (HDM) model developed by the World Bank.

Indeed, it is preferable for the Government entity bidding out a *PPP* project not to over-step its mandate by specifying detailed design or the construction technology to be used for the project because doing so may remove or reduce any scope for innovation by the private sector player in terms of design or choice of construction technology to reduce costs, a key target benefit for adopting the *PPP* route in the first place. This restraint should definitely extend to aspects that are market driven and better left to the best commercial judgement of the selected party – for example, in a real estate project where the selected private party is expected to bear the demand risk for a portion of the property developed (the balance portion may be the return to the Government for providing the land), it would not make sense for the Government entity bidding out the project to lay down in detail the floor areas of units to be constructed or the specifications of flooring. Such aspects should be left to the private party who will have every incentive to ensure that he provides what the market wants rather than the Government entity trying to interpret what is desirable from the market's point of view.

At the same time, it should also be borne in mind that many infrastructure services are in effect local natural monopolies and the specification of output for a *PPP* project will typically need to address public service obligations in the absence of the competition that might otherwise ensure that such obligations are met. Thus, care has to be taken to ensure that obligations of the private party in terms of equal treatment of all consumers, coverage of all categories of consumers including those that require high costs for servicing without commensurate revenues, etc. are also clearly laid down during the project preparation phase along with aspects like quality of output. Of course, in sectors where the legislative and institutional frameworks for regulation are well established, this may not be necessary. In a sense, the level of detailing should ensure that the expectations from the selected private sector party are unambiguous and not open to different interpretations by different prospective bidders – thus, the need to ensure a "level playing field" among bidders must also be considered.

Overall, the level of detailing of the *PPP* project at the project preparation phase should be driven by the amount of information required by the prospective bidders for preparing bids. However, this should not lead to unrealistic expectations about the extent of effort and expense that prospective bidders may be willing to go to at the procurement phase, i.e. expecting every bidder to individually undertake the required technical studies for arriving at a reasonably accurate estimate of the capital investment is unlikely to yield results, besides being an inefficient duplication of efforts. Some investment in the *PPP* project preparation phase is essential, and the need to restrict detailing cannot become an excuse for short-cuts in project preparation. In many *PPP* projects, significant survey and estimation work would be required even to get a reasonable estimate of the likely project cost - a highway, port or large power transmission project would, for example, not be amenable to bidding as a *PPP* project unless some detailing of the project's technical parameters has been carried out in order to define the expected output. Broadly, the Government entity developing the project should try and provide adequate information for preparation of bids, being careful not to define detailed design or other aspects that are better left to the selected bidder. While the findings of any feasibility study or survey carried out at the preparation phase can be incorporated in the bidding documents during the procurement phase, this may not be feasible if the amount of data gathered during the preparation phase is voluminous – in such instances, a common practice is to provide all bidders access to a "data room", which is essentially a collection of all documents related to the project.

Any required control over the project's features to ensure that social benefits related to environment, safety, access, impact on traffic, aesthetics, etc. are not bypassed by the selected bidder in attempting to maximise returns can always be ensured by specifying the standards that have to be adhered to and/or by incorporating provisions in the ***PPP Project Contract*** that require approval of the detailed design by the Government entity after the design has been prepared by the selected bidder. However, given that the prior experience of many Government employees is dominated by the award of contracts for the construction of publicly funded projects and the consequent exposure to the typical contractor who tries to cut corners and costs at every opportunity, excessive detailing of the project in terms of design, construction technology/methods and technical specifications during the project preparation phase is fairly common in case of *PPP* projects in India. There is no simple decision rule regarding the extent of detailing at the project preparation stage that can be applied to all possible sectors and projects – the reader should treat the preceding discussion as providing principles for guidance rather than as binding rules.

A related aspect is the cost incurred (or investment made) in project preparation. Typically, this cost/investment can be recovered from the selected bidder if the *PPP* project is successful. At a more general level, the Government making this investment is well rewarded by the benefits of the successful *PPP* projects, even taking into account the fact that a few *PPP* project concepts will surely be dropped at the preparation stage. Various steps to ensure and facilitate such investment such as project development funds, partnerships based on a contract between Government and entities focussed on *PPP* project preparation, setting up of dedicated entities for project preparation, etc. have been tried in India and elsewhere. Entities dedicated to *PPP* project preparation are often joint ventures (JV's) between

Government and a technical consulting firm or project preparation arm of a financial institution. At times, such JVs are for a specific sector like urban infrastructure or even a specific region. It is difficult to take a call on the effectiveness of such arrangements. While it is no doubt useful to ensure the participation of experienced professionals from various areas such as engineering, law, finance, environment, capital markets, etc. in project preparation, it is also difficult to ensure that quality does not suffer with competition for providing services related to *PPP* project preparation getting limited due to exclusive partnerships or JV's[11]. The possibility of conflicts of interest should also be kept in mind while going in for any dedicated arrangement for *PPP* project preparation. Overall, no arrangement selected for *PPP* project preparation can be effective without active *PPP* project "champions" within the Government and it is to that extent difficult to isolate the effect of alternative arrangements. An arrangement that works effectively in a given state, sector or period of time may be ineffective elsewhere and ultimately the willingness and ability to try out new approaches to *PPP* project preparation should not be curbed.

Apart from design and other technical aspects of the project required to define the desired output of the *PPP* project, the feasibility of the project will typically be examined at the project preparation phase. This may involve the preparation of the first *Financial Model* of the project. However, this is by no means a necessity – where it is fairly evident that the proposed *PPP* project would be feasible for a private sector developer, for example in a situation where the Government initiator is putting up a piece of well-located land for development of a largely commercial real estate project, a *Financial Model* may not be considered necessary. In case of smaller sized *PPP* projects, not involving any high degree of technical complexity, a fairly basic estimation of the capital cost and revenue potential may be all that is required. The understanding in such situations is that since the project will be bid out, the competition among bidders will result in a favourable outcome for the Government entity initiating the project, thus obviating the need for a *Financial Model* to estimate the likely financial returns from the project and estimating a "fair" share of this for the Government (the so-called "reserve price"). Of course, this approach can be effective only if the required output is well defined and the effort required on the part of the bidders to make an estimate of the required investment and the potential revenue and operating expense streams over the ***Project Time-Line*** is reasonable.

[11]JVs, being corporate entities that can theoretically exist in perpetuity, would tend to limit competition over longer periods of time though this is countered to an extent by the argument that a JV can ensure continued availability of *PPP* project preparation experience.

2.3.2 PPP Project Structure and Bidding Structure(s)

The other key aspects of the *PPP* project that get defined at the project preparation phase are the ***PPP Project Structure*** and the bidding structure. The ***PPP Project Structure*** will typically cover:

- The contractual relation between the Government awarding entity and the selected private party, including the tenure of the contract. The broad contractual structures commonly used are described later in this section though it should be recognised that within a given broad structure there may exist many variations needed to cater to specific requirements of a sector or project – so much so that every ***PPP Project Contract*** can in a sense be considered unique.
- Identification of the rights and responsibilities of both parties with regard to creation of the assets, ownership of assets, regulatory approvals, pricing, operation and maintenance of the assets, service delivery, payments, etc., in effect defining the allocation of project related risks between the parties. This would include the penalties for non-compliance, which may extend to the termination of the ***PPP Project Contract*** in case non-compliance is not addressed within a specified period ("cure period" is the term often used to describe this time period).

To summarise, the ***PPP Project Structure*** may be defined as covering the allocation of the risks and returns associated with the ***PPP*** project to various stakeholders, primarily the Government, the private developer represented by the SPV implementing and operating the project, the lenders to the project and the consumers of the project's outputs, with such allocation of risks and returns being reflected primarily in the ***PPP Project Contract*** executed between the Government and the private developer.

The choice of the ***PPP Project Structure*** would largely be driven by the benefits targeted from the ***PPP*** project, the extent of competition (or conversely, the element of natural monopoly) in the delivery of the project's output services, the legal and regulatory framework for the relevant infrastructure sector and the objectives of the initiator of the project. By and large, the project structure will be reflected in the ***PPP Project Contract***, a draft of which is typically issued as part of the bidding documents or Request for Proposal (RFP). The allocation of risks and returns related to the *PPP* project would also cover or extend to the other stakeholders such as the lenders to the project and consumers of the project's output, even though such stakeholders are not direct parties to the ***PPP Project Contract***. However, successful implementation of the *PPP* project is impossible without the project being supported by lenders and consumers – to that extent, it is always necessary to ensure that the ***PPP Project Contract*** (or more broadly, the ***PPP Project Structure***) is "bankable" from the point of view of lenders and also acceptable to consumers. For instance, a ***PPP Project Structure*** that involves a level of tariff not acceptable to enough consumers of the project's output is bound to fail and such aspects have to be considered while making a choice about the ***PPP Project Structure.*** Lastly, it may be noted that there are some generic or standard *PPP Project* ***Structure***s, discussed in the next section (Section 2.4). However, the actual provisions of the ***PPP Project Contract*** can vary considerably even within a given *PPP Project* ***Structure***.

2.3.3 The Role of Bidding Structure

Apart from the choice of the PPP Project ***Structure,*** the other key output of the project preparation phase is the ***bidding structure.*** Given that many *PPP* infrastructure projects involve natural monopolies for the provision of services, competitive bidding is an important element required to introduce competition indirectly – the bidding structure is thus vital and can make all the difference between a successful *PPP* project and a failure. Typically, the bidding structure covers:

- Required qualification for bidding – typically, this is defined in terms of technical capabilities as reflected by past experience and/or financial strength required to undertake the project, often specified in terms of minimum levels of revenues and/or net worth of prospective bidders. This involves a balancing of the conflicting needs to ensure that the selected bidder has the capability to implement the project on the one hand and to ensure competition through adequate participation on the other.
- Provisions regarding bidding by consortia – for example, covering aspects such as whether prospective bidders may jointly submit a bid, the maximum number of entities allowed in a consortium, the form of agreement between the consortium members to be submitted as part of the bid, identification and responsibilities of a lead member of the consortium, the liabilities of the members of a bidding consortium (typically, joint and several liability), change of a consortium member, the basis for determining the qualification of a consortium, etc.
- The stages in the bidding process – for example, whether the process would involve pre-qualification of prospective bidders in the first stage, followed by the submission of bids in the second stage only by those bidders found to be qualified. In contrast, a single stage

approach may be adopted, based on bifurcation of the bid into a technical component that establishes the qualification of the bidder and a financial component. Here, the technical components of bids received may be first examined and the financial component of the bid then examined only for the biddies the technical components of whose bids are found to conform to requirements.

- The method of evaluation – whether this would be a combination of technical and financial scores or solely on the basis of financial bids of the qualified bidders. In case of the latter, the financial bid parameter on the basis of which a bidder would be selected would have to be specified. The financial bid parameter could be one of several possible financial parameters – up-front payment offered by the bidder to the awarding entity, the price of services to be offered, the revenue share offered to the awarding entity, the tenure of the *PPP* project over which the private party would operate the project and collect revenues before handing back the assets to the Government, the lowest amount of financial support in the form of a grant from the Government, etc. Obviously, the identification of a financial bid parameter requires other related parameters to be frozen – for example, it is not possible to identify the up-front payment offered by the bidders as the financial bid parameter while the tenure of the *PPP* project is also kept variable and open. In general, it is advisable to keep the method of evaluation as objective and transparent as possible to avoid allegations of bias or mala-fide intentions. In a sense, it may be said that the choice of the financial bid parameter is driven by the ***PPP Project Structure*** with the financial bid of the selected bidder providing the last missing bit required to make the ***PPP Project Structure*** effective and to reflect it in the ***PPP Project Contract***.
- Other miscellaneous aspects such as the formats for bidding, the amount and form of bid security specified to discourage frivolous bids, dead-lines for submission of bids, etc.

Following the selection of a bidder, the Government entity awarding the *PPP* project will typically issue a Letter of Award (LoA) communicating to the selected bidder its intention to enter into the ***PPP Project Contract*** with that bidder and specifying the conditions to be met by the bidder and the time-frame for such actions. Typically, such actions include the formalisation of the consortium through a shareholders' agreement, the incorporation of the SPV for implementing/operating the project, the submission of the specified performance security (bank guarantee or other form of security that can be invoked in case of non-performance) and the payment by the selected bidder or SPV of any sum of money specified in the RFP or based on the winning bid. The procurement phase can be considered complete, once the ***PPP Project Contract*** has been executed between the Government entity awarding the *PPP* project and the private party (SPV, selected bidder or both). Of course, such a ***PPP Project Contract*** may also list "conditions precedent" that have to be fulfilled before the contract can be considered effective and binding on the parties to the contract. If the selected bidder refuses or fails to enter into the ***PPP Project Contract***, the Government entity awarding the project may invoke the bid security submitted by the bidder and enter into negotiation with the bidder ranked second in the evaluation of bids. Once the ***PPP Project Contract*** has been executed, the Government entity will typically return the bid securities submitted by the other bidders.

On execution of the ***PPP Project Contract***, the provisions of the contract will typically drive the activities in the development phase. A key activity or milestone of this phase is financial closure, whereby the SPV receives binding commitments for funding of the project cost from lenders, following which the SPV enters into financing agreements with these lenders. A maximum time period is typically allowed in the ***PPP Project Contract*** for the achievement of financial closure. Typically, lenders may seek some amendments to the ***PPP Project Contract*** at this point, which may be accepted provided that such acceptance does not mean a significant and material departure from the draft *PPP Project Contract* issued as part of the RFP – any such change may be open to legal challenge by the other bidders leading to a delay in implementation. The other key activities during the development phase may include:

- the handing over of the project site to the SPV
- the commissioning, preparation and approval of detailed engineering design
- putting into place the mechanism for monitoring of construction such as the appointment of an independent engineer
- the SPV applying for and obtaining any regulatory approvals necessary for implementation and operation of the project
- the SPV appointing contractors for construction of the project assets

At the end of the development phase, the constructed project assets may have to be inspected and declared satisfactory by the independent engineer or any other party acting on behalf of the Government entity, following which the project assets may be made available for use – a milestone typically called the "commercial operations date" (COD), which marks the commencement of the last phase of the *PPP* project's life-cycle, i.e. "delivery and closure". The "delivery and closure" phase will continue till the expiry of the ***PPP Project Contract***, with key activities being driven largely by the provisions of the ***PPP Project Contract***, as is the case in the preceding "development" phase.

2.4 COMMON *PPP PROJECT STRUCTURES*

Turning to the typical ***PPP Project Structure*s**, now that the life-cycle of a typical *PPP* project has been discussed, it may be noted that there exists a continuum of such contractual structure options for involving the private sector in the provision of infrastructure services. There are several key features that in effect define the contractual structure of *PPP* project, such as:

- Ownership of the assets – does ownership of pre-existing or newly created assets remain with the public sector/Government, with the private party given operational control only? Alternatively, does the private party own the assets?
- Responsibility for additional investment, including financing of such investments – does the entire responsibility for meeting new investments rest on any one of the two parties to the ***PPP Project Contract*** or shared by both? How is the quantum of investment decided?
- The nature of the Government's contribution to the project – is this in the form of pre-existing assets, a concession/license to provide the defined infrastructure services or a mix of both?
- Tenure of the ***PPP Project Contract*** – is the arrangement for the short term (2-5 years), medium term (10-15 years), long term (>15 years) or perpetuity? Is there any provision for re-bidding?
- Scope of the private party's role – does this cover only a specific task (e.g. billing and collection or maintenance of specific assets), an entire segment of infrastructure service delivery (e.g. distribution of power or power generation) or end-to-end responsibility (e.g. covering sourcing/transportation/treatment of bulk water, distribution, billing and collection for a specified area)?
- Exposure to commercial risks, in particular whether the private party is directly exposed to the demand for the relevant infrastructure services or is insulated from the retail market by selling to a single buyer (generally a publicly owned entity) under a "take or pay" agreement or being assured of fixed payments irrespective of the level of usage/demand (i.e. an "annuity" based model).

A specific contractual model for the delivery of services paid for by the Government rather than directly by the consumers of the project's output is the Private Finance Initiative (PFI) popularised in the United Kingdom. In a typical PFI transaction, the private sector promoters/sponsors set up a Special Purpose Company (SPC) to undertake the development of a new or refurbished facility, which may be a road, school or hospital with the specifications set by the relevant public body. The private sector bidder selected through a competitive bidding process sets up the SPC to finance the project and then operate it over a typical period of 25-30 years usually through facility management sub-contractors. For construction, the SPC typically appoints a design and build contractor and also raises non-recourse loans (debt funding up to 90% of the project cost is common) to supplement the equity invested by the promoters/sponsors in the SPC. Over the term of the project, the SPC owns the project assets and receives from the public sector client, regular performance-linked payments that may vary with the levels of usage, availability and quality of services – such payments cover the SPC's cost of operations, debt service obligations and also provide the promoters/sponsors with a return on the equity invested. At the end of the project concession period, the ownership and management of the assets revert to the public sector client and the SPC has no further role to pay. PFI transactions are also referred to as design, build (or refurbish), finance and operate (DBFO) model.

In a sense, the potential combinations of these key features of the ***PPP Project Contract*** are far greater than the standard contractual structures one comes across in *PPP* related literature. The context provided by the legislative and regulatory framework for the relevant infrastructure sector, precedents of *PPP* projects, the targeted benefits, the willingness and ability of the consumers to pay for quality service, etc., has to be considered while examining any *PPP **project***'s contractual structure rather than viewing the same in isolation as an example of any standard contractual structure defined in literature. Nevertheless, the standard contractual structures do provide a useful frame of reference, especially when arranged according to any key feature. A common arrangement is on the basis of the scope of the private party's role, as shown in ***Illustration 2.3*** below. However, this representation is by no means comprehensive and there are several variants of these standard contractual structures that may be adopted for a *PPP* project. For example, the Government may wish to retain a share of possible up-sides from the project by entering into a joint venture with the private party – an arrangement that is quite common where the Government contributes land for real estate development. Similarly, there are variants for the concession structure where

ILLUSTRATION 2.3

Standard Contractual Structures for PPP Projects

Service Contract	Management Contract	Lease	BOT (Concession)	BOO	Privatisation
Private sector entity made responsible for specific activities related to service delivery against fixed fees paid by a Government entity that retains overall responsibility for service delivery; relatively simple route to tapping private sector efficiency, though hardly different from the routine supply of goods and services by private sector vendors.	Similar to service contract except that payments to the private sector party are linked to performance; allows for better alignment of incentives with performance, the fundamental driver of private sector efficiency.	Involves the lease of existing public owned assets to a private party for operation by that party for a fixed period; the private party is required to pay lease rentals and may also be responsible for making investments to enhance the quality of service delivery.	Award of a concession to the selected private bidder that authorizes the private party to invest in assets and operate/maintain the same over a concession period to recover the investment and earn returns from user charges; the private party has complete responsibility for operations, bears commercial risk and is expected to meet specified output standards, with some flexibility in choosing appropriate means for achieving these standards; ownership of assets may continue to remain with Government or vest in the private party; the assets are transferred back to the Government at the end of the concession period, generally without any payment being made by the Government.	Essentially a perpetual concession awarded to the selected private bidder, authorizing the private party to invest in assets and operate/maintain the same in lieu of user charges collected and appropriated by the party, without any obligation to transfer the assets back to the Government.	Sale of majority shareholding in a public sector corporate entity to the private sector, often with the operations being subject to license; requires political will and cannot be used where the public sector service provider is a statutory entity without first transforming that entity into a company.

BOT = Build-Operate-Transfer

BOO = Build-Own-Operate

the private party receives fixed periodic payments from the Government in return for its investment in creating assets, with such payments not being linked to the level of usage of the relevant assets. Even within each standard contractual structure shown, variations in the contractual provisions from one contract to another are very much possible.

2.5 COMMON FEATURES/PARTS OF *PPP PROJECT CONTRACTS*

From the discussion till this point, it should be clear that:

- There is no such thing as a "typical" ***PPP*** transaction or contract
- The ***PPP Project Contract*** plays a central role in any transaction project in the ***PPP/Project Finance Context***.
- The ***PPP Project Contract*** has to be viewed in the overall legislative and institutional frame-work of the infrastructure sector in question and sometimes even in terms of Constitutional law, though this may not be necessary once clear precedent transactions exist. However, even in such cases the possible involvement of the judiciary or quasi-judiciary regulatory entities by stakeholders in a specific transaction and the potentially evolutionary nature of the ***PPP Project Contract***s must be borne in mind

Having said that, it is also true that most ***PPP Project Contract***s have some features/parts in common, irrespective of the quality of drafting and sector-specific features that may and indeed, do vary. Any commentary on such common features must be accompanied by a caveat that such features cannot be blindly taken for granted as inevitable and many variations are possible that must be viewed without prejudice caused by this listing of "common" features. With that done, some common features of *PPP Project Contract*s that we can usefully observe are as follows:

2.5.1 Preliminary

The context for the contract is typically provided at the outset without any specific article/clause number, covering:

- Parties to the ***PPP Project Contract,*** in many cases is a Government/ public sector entity[12] awarding the contract and a project SPV;

[12]Unless it is executed through corporate or statutory entity that can serve as a legal persona that can sue or be sued as such, the executive arm of the Government (for example, a Ministry or department) will typically enter into contracts on behalf of the constitutional head of the executive such as the President in case of the Union Government and Governor in case of State Governments.

- The basis for selecting the project's promoter/sponsor, which in most cases is through a competitive bidding process;
- References to any legislation or executive action that provides the relevant legal foundation for the ***PPP*** project;
- Brief description of the quid pro quo underlying the ***PPP Project Contract*** – simply put, this is the fundamental obligations and rights of the parties to the contract, which is fully addressed with the required degree of detail only in the body of the contract[13].

Apart from the above, the preliminary section may also list certain actions that are required to be completed by one or both parties before the contract can be considered legally enforceable (a general term used for this is "Effective Date") – such actions are called conditions precedent to the contract. Some contracts also define actions required to be taken after the effective date but this aspect is better covered under the responsibilities of the parties to the ***PPP Project Contract*** (discussion below) unless there is compelling reason to define conditions subsequent up-front.

2.5.2 Definitions and Interpretations

A significant proportion of this section of the contract may be "boiler plate" in nature. However, it is necessary to identify the key definitions for the purpose of the *PPP* project in question covering:

- The ***PPP*** project milestones, including the date when the ***PPP Project Contract*** becomes effective, the date when commercial operations commence, the effective end date under different situations, etc.
- Definitions related to the output of the *PPP* project.
- Legislation and/or executive decisions referred to – in effect, what is the primary Act driving the *PPP* project (often defined as "the Act" in the ***PPP Project Contract***), as distinguished from other legislation related to corporate entities (The Companies Act in case of India) or environment related aspects. Some definitions of the primary Act ("the Act") may be applicable to the ***PPP Project Contract*** itself and this point may be incorporated in the definition of "the Act".
- Entities other than the parties to the ***PPP Project Contract*** that require to be defined (other than the generic "third party") – for example, a regulator.

[13]It should be noted that as a general principle, a "contract without consideration", i.e. where there is no quid pro quo is not legally valid. Even if the consideration is a token amount or not quantified (for example, "transmission services"), it is thus necessary to establish a quid pro quo in the preliminary section of the contract.

2.5.3 Common Warranties and Indemnities

All parties to the ***PPP Project Contract*** in effect aver that they are legally entitled to execute the ***PPP Project Contract*** and have completed all the required processes with regard to the execution of the ***PPP Project Contract***, including due diligence. In case of any subsequent discovery of any shortcoming in this regard on part of one party to the ***PPP Project Contract***, it indemnifies the other party (ies) against any negative consequence, including liabilities to any "Third Party" (in general, anyone not party to the ***PPP Project Contract*** but affected by the *PPP* project in question). This may appear to create unlimited contingent liabilities but that is not generally the case given that liabilities would be subject to the established law of the land. In addition to common warranties and indemnities, there may be clauses covering specific warranties and indemnities of one or more parties to the ***PPP Project Contract***.

2.5.4 Specific Rights and Responsibilities of Parties

The clauses/sections covering these aspects in effect define the nature of the "partnership" in the *PPP* project, in brief, "who brings what to the table and takes what away". For the private party, this is in effect the definition of the output that the party is expected to deliver while the public/Government side may also be required to carry out specific actions (for example, handing over of land, notifications related to the *PPP* project, co-ordinating and facilitating required approvals or shifting of utilities, etc.). Aspects that are related to this aspect of the ***PPP Project Contract*** are the penalties and safeguards (for example, performance security in the form of bank guarantees) for and against non-performance of specific responsibilities. A comprehensive and balanced drafting of the clauses related to specific responsibilities, penalties and safeguards is a key success factor for *PPP* projects, which is possible only by ensuring adequate discussion while finalising the ***PPP Project Contract*** during *PPP* project development. Of course, these aspects tend to get standardised with more *PPP* projects being taken up in a specific sector/segment. The rights of the parties may be viewed as adjunct to the responsibilities defined by the ***PPP Project Contract***. Though there may be specific clauses/sections devoted to specific rights of the parties to the ***PPP Project Contract***, it is important to appreciate that the rights of the parties to the ***PPP Project Contract*** effectively spill over to other clauses/sections such as those dealing with penalties, safeguards including performance guarantees and termination of the ***PPP Project Contract*** in various (defined) situations, etc. It is also important to appreciate that the rights and responsibilities are not static but linked to the stage of the ***PPP*** project. Nor do such rights and responsibilities exist independently – indeed, some rights may become effective only after certain responsibilities have been fulfilled. As such, an alternative and generally effective approach to covering the rights and responsibilities of the parties to the ***PPP Project Contract*** is to incorporate clauses/sections linked to the stage of the PPP project and define the rights and responsibilities accordingly. For example, clauses/sections related to "development", "construction", "commissioning" and "operation and maintenance" may be used.

2.5.5 Penalties, Incentives and Safeguards

As mentioned, the clauses in this regard are closely linked to the definition of the *PPP* project provided by the specific responsibilities identified for the parties. In effect, various outcomes are defined for non-performance of one or more parties though typically the bias is towards covering non-performance of the private party to the ***PPP Project Contract***. Thus, while some leeway for non-performance (meeting project construction time schedules, for example) may be provided, especially for non-performance due to force majeure, non-performance beyond a point would typically create financial disincentives for the private party, first in the form of penalties, then moving on to invocation or use of performance security and finally through a defined process to termination, by the party adversely affected due to the non-performance of the other party (generally, the term "default" is used for such non-performance). The right to terminate the ***PPP Project Contract*** under defined circumstances, i.e., the occurrence of default and persistence of default despite notification by the party adversely affected and the lapse of a "cure period" provided to the defaulting party to address the default after such notification, can be viewed as the ultimate safeguard for parties to the ***PPP Project Contract***. As an adjunct to penalties and safeguards, ***PPP Project Contract***s may also provide for incentives in case of actual performance exceeding a specified target level, for example, "98% availability of the Transmission Assets created by the Developer". The processes for monitoring and measuring of such performance then become by extension, aspects to be addressed by the ***PPP Project Contract***. The choice and use of penalties and incentives is critical for ensuring that targeted benefits from the *PPP* project are achieved in reality.

2.5.6 Dispute Resolution

Closely linked to penalties and safeguards but also important because it is not practically possible to cover every possible scenario in a contract, there is typically a defined process for dispute resolution, often involving arbitration. As a last resort, any dispute that remains unresolved may be referred to the courts of law.

2.5.7 Force Majeure and Insurance

It is only realistic to accept that there may be events beyond the control of the parties to the ***PPP Project Contract*** – such "force majeure" events are typically defined. The acceptance of one party of the non-performance of responsibilities by the other party may be the first possible response to force majeure events occurring, but the time limits in this connection are typically defined. Also, some force majeure events may be insurable risks, in which case obligations with regard to the quantum of insurance cover, responsibilities for payment of premia and the beneficiaries named in the insurance policies need to be defined, often as a clause/section independent of that covering force majeure.

2.5.8 Lenders' Rights

Though the lenders are typically not firmed up at the time of execution of the ***PPP Project Contract*** and lenders are not directly party to the ***PPP Project Contract***, it is important to recognise lenders as important stakeholders in the *PPP* project – a project that cannot raise debt funding and has to be funded entirely by equity is unlikely to succeed. As discussed earlier, the relevant rights of the lenders may not be linked to the physical assets being created as part of the *PPP* project – rather, it is the rights to cash flows generated by the *PPP* project, to step in and ensure the commercial operations of the *PPP* project by identifying a substitute entity in place of a private party that is unable to deliver and therefore has the ***PPP Project Contract*** terminated and the rights to insurance proceeds that typically form the lenders' rights. Lenders' rights may be covered under a clause/section of the ***PPP Project Contract*** dealing with the assignation of the rights and responsibilities of the private party to the ***PPP Project Contract*** and/or creation of security interests (the term "charges" is also commonly used).

2.5.9 Change in Law

Though any change in law that affects one or more parties to the ***PPP Project Contract*** can be considered as a force majeure event of sorts, this aspect is typically dealt with through a distinct clause/section of the ***PPP Project Contract***.

2.6 IMPLICATIONS FOR THE FINANCIAL MODEL

Having now looked at the concept of *Project Finance* as well as the rationale, typical life-cycle and common contractual structures for *PPP* projects, we can observe some key implications for *Financial Model*s in the ***PPP/Project Finance Context***, the subject to which this book is devoted. It should be clear from the earlier discussion that every *PPP* project does not necessarily require investments to be made by the private party. Indeed, a service contract may not even require a SPV to be set up. While such ***PPP*** projects not requiring investment by the private party may well require some financial analysis, the focus of this book is on those ***PPP*** projects requiring investments in assets funded on a *Project Finance* basis.

Some of these implications have already been touched upon earlier and will also be re-visited and further developed in subsequent chapters but it still makes sense to provide a comprehensive listing of such implications at this point, which is provided below.

2.6.1 Evolution of the Financial Model

It is clear from the earlier discussion that a typical *PPP* project evolves over a life-cycle. As such, any *Financial Model* of the project should not be viewed as static, but rather in the context of the project's position in its life-cycle, which in turn will drive the primary objective of the *Financial Model*, as well as the level of detailing possible (and indeed, necessary). During the project preparation phase, the primary focus of the *Financial Model* will typically be to establish the financial feasibility of the *PPP* project or given the lack of feasibility on a "stand alone" basis, to identify the kind of ***PPP Project Structure*** required to make the project feasible for private investment, particularly in terms of capital grants or any other form of funding on soft terms that can be made available by the Government. A *Financial Model* prepared during the project preparation phase may not have access to detailed studies covering the required capital investment and/or demand for the project's output. Those developing and using the *Financial Model* have to be aware of such limitations and should use the preliminary *Financial Model* judiciously to identify the key drivers of the project's feasibility that may need to be examined in more detail as well as suitable benchmarks that can be used in the absence of detailed information/estimates regarding the project parameters.

During the procurement phase, the primary objective of the *Financial Model* is likely to become the determination of the financial bid parameter from a prospective bidder's point of view. The information on project parameters available during this phase is likely to be much more detailed – in particular, the draft ***PPP Project Contract*** has to be viewed as a critical source of inputs for the ***Financial Model***. At the same time, given that a common set of information related to the project is available to all prospective bidders representing the competition, a team working on the *Financial Model* from a bidder's perspective must consciously seek additional sources of information that may lead to a winning bid. Some possible parameters for exploration in this regard are as follows:

- Based on past experience, can the actual time-line for construction be shorter than the maximum one allowed by the ***PPP Project Contract***? What is the trade-off in terms of incremental costs for such "crunching" of the construction schedule? Can this be a significant source of competitive advantage?
- Is there any competitive advantage that can be squeezed out of better financing terms than that underlying the *Financial Model* prepared to establish feasibility during the project preparation phase?
- Is any saving possible with regard to the capital cost and O&M costs, for example through the adoption of technology? If so, does the draft ***PPP Project Contract*** provide flexibility for adoption of such technology?

Obviously, a bidder with prior experience of similar projects or willing to go to the effort and expense required to obtain the benefit of such experience from an advisor will be better placed to fine-tune the *Financial Model* in order to arrive at a more competitive bid with a higher probability of winning. After the award of the project, it is possible that the *Financial Model* on which the winning bid is based is made part of the ***PPP Project Contract,*** though this is by no means necessary.

Once the project moves into the implementation phase, the primary objective of the *Financial Model* is likely to shift to enabling financial closure. During this phase, it can be expected that the lenders will critically analyse the underlying assumptions and focus on the debt service capacity of the project under different scenarios reflecting downturns in demand/prices as well as other *Project Variable*s, like construction period and capital cost estimates that affect the project's financial performance significantly. Depending on which side of the negotiating table one is sitting on, the person with primary responsibility for the development or appraisal of the *Financial Model* will have to try and anticipate queries and defend assumptions (if on the borrower's side) or try to identify potential weaknesses or unrealistic assumptions (if on the lender's side).

Post-commissioning, the role of the *Financial Model* in the delivery phase is likely to be limited. However, the *Financial Model* may be re-visited in the context of tariff setting or adjustments of a similar nature. For example, if the usage of the project (i.e. demand for the output services) turns out to be lower than projected earlier, it is possible that the SPV will seek an increase in tariffs, extension of the tenure of the *PPP Project Contract* or additional support from the Government in order to restore the level of returns to that projected/expected earlier. In such cases, the *Financial Model* may well become the frame of reference for any such decision by the Government. Where there is an autonomous regulator responsible for tariff setting, the exercise will in all probability be driven by the methodology adopted by the regulator, which typically tends to be based on fair returns on the accounting value of assets rather than a purely cash flow driven *Financial Model* – however, to the extent that the ***Output*** of the *Financial Model* includes projected statements of account, the *Financial Model* may still serve as reference for any tariff revision exercise. It has been argued that any such action on the part of the Government to address lower than expected returns in a *PPP* project actually amounts to sharing the commercial risks with the private party or passing the risk on to consumers. While no doubt valid to an extent, the argument has to be viewed in terms of the possible cost of failure of one *PPP* project in terms of bidding interest for other *PPP* projects and some leeway needs to be provided in an environment where *PPP* projects are yet to be well established. Mistakes in projecting demand are bound to occur where the experience is limited and taking a rigid stance on re-visiting the ***PPP Project Contract*** and/or project parameters may not be practical.

2.6.2 Use of the *Financial Model* for Deciding the *PPP Project Structure*

A key issue that deserves some consideration is the role of the *Financial Model* in project preparation. As mentioned, it is not necessarily true that the project preparation phase of every *PPP* project will involve the development of a *Financial Model*. In instances where the feasibility of a simple project can be established without a detailed projection of financials and where there is not much scope for a wide range of capital investment estimates, it may be possible to leave the return to the Government to be determined by the competitive bidding process. In contrast, there may well be projects that are not feasible for private sector investment on a stand-alone basis. In case of such projects, the *Financial Model* may have to play a key role in deciding the ***PPP Project Structure***. A common route adopted for this is the provision of capital grants by the Government, also commonly known as viability gap funding. For such projects, it is necessary to develop a *Financial Model* to get an idea about the level of such capital grants required to make the project feasible for private investment. The exact project and bidding structure may vary – one possibility is to bid the project out on the basis of the minimum amount of capital grant support sought by bidders. Alternatively, the amount of capital grant to be provided by the Government for funding the project assets may be fixed up-front and bidders required to submit bids regarding the level of tolls/tariffs/user charges or the length of the concession period for which the private operator proposes to operate the project assets and collect/appropriate the user charges before handing back the assets to the Government at no cost (or at most, for a nominal consideration payable by the Government).

However, beyond determining the level of capital grants required to make a *PPP* project feasible for development by a private party[14] the role of the *Financial Model* in determining the ***PPP Project Structure*** should not be over-emphasised. The reason for this is simple – any project has an intrinsic value determined by the cash flows associated with the project, along with the associated risks that may affect the quantum and timing of these cash flows. The ***PPP Project Structure*** determines the allocation of the project's cash inflows (returns) and risks among the parties to the ***PPP Project Contract*** (i.e. the Government and private developer) as well as other key stakeholders such as the lenders to the project and the consumers of the project's outputs. Thus, it may be said that the choice of the ***PPP Project Structure*** is made with the potential returns (cash flows) and risks as given – the ***PPP Project Structure*** simply reflects an allocation of the returns and risks among the stakeholders, thus affecting the sharing of the project's value but not affecting the intrinsic value of the project itself. By assuming the responsibility for some cash flows (for example, meeting a part of the cash outflows on investment without staking a claim to a commensurate share of cash inflows, by way of capital grants) or reducing some of the project related risks (taking the responsibility for land acquisition, for example), the Government can and often does increase the share of the project's value that accrues to the private party implementing the *PPP* project so as to make it financially feasible for the private party. However, such structuring should be based on an objective assessment of the social benefits accruing from the

[14]It is not necessary that the grants from Government should be restricted to funding of the capital investment. Grants to cover deficits in the level of revenue required to meet the operating expenses, especially during the initial years, may also be considered.

proposed *PPP* project, keeping in mind the fact that the intrinsic value of the project in financial terms cannot be changed.

Ultimately, the project structuring exercise or choice of the ***PPP Project Structure*** is a zero sum game where the allocation of a certain cash flow or risk to one party must be accompanied by a commensurate decline in the cash flows accruing to or the risks borne by the other party. The risks should be allocated to the party best positioned to manage that risk (in other words, manage the risk at a lower cost) and the return from the ***PPP*** project for any party should be proportional to the risk borne by that party – there should be no proverbial "free lunch" available in a ***PPP*** project, as in any other sphere of economic activity. Trying to de-risk the project for the private party to a great extent, while still allowing high returns to be earned or conversely trying to pile on all or most of the project-related risks on to the private party without providing for a commensurate up-side in terms of returns from the project are both unlikely to succeed either by eliminating a large part of the possible benefits from the ***PPP*** project or simply on account of rejection by potential bidders. Even after examining risk, return and the risk-return trade-off in Chapter 3, we may well conclude that it is not always easy to quantify risk. This does not necessarily negate the value of the *Financial Model*, but should definitely call for caution in viewing the *Financial Model* as a tool for deciding on ***PPP Project Structure***.

2.6.3 Key Issues for Financial Models

Quantitative assessment of the economic return from the *PPP* project as opposed to the financial return typically measured by the *Financial Model* is possible, using established concepts such as Social Cost Benefit Analysis (SCBA) and Economic Internal Rate of Return (EIRR). A broader approach is also possible for capturing the benefits of the *PPP* project through tools such as the Public Sector Comparator (PSC) and Value for Money (VFM). However, these typically require a significant amount of historic data to be useful and/or often require heroic assumptions in the absence of such data, which is generally the case in the Indian context. In any case, such tools should be viewed as complementing the *Financial Model* – the bottom-line is that using the *Financial Model* as a tool for deciding on ***PPP Project Structure*** has limitations. To retain focus, this book does not get into the concepts of SCBA, EIRR, PSC or VFM mentioned above. Rather, we shall largely be concerned about the *Financial Model* of a *PPP* project with a given *PPP Project* ***Structure***, remaining aware of the following facts:

- There are non-financial returns that cannot be captured by the financial investor and are thus not reflected in the returns generated by the ***Financial Model***. A separate exercise to estimate such economic returns or benefits may be necessary.
- Using a ***Financial Model*** to estimate the extent of Government support for a ***PPP*** project with a given ***PPP Project Structure*** is possible and represents a valid use of the ***Financial Model***.
- The risk-return trade-off will apply to the risks/returns of the parties to the ***PPP Project Contract*** but it is not always possible to quantify the trade-off. Moreover, the Government entity may well be considering non-financial returns accruing to the economy as a whole. Lastly, there are parties other than those entering into the ***PPP Project Contract*** such as lenders and customers that have to be considered in arriving at the ***PPP Project Structure*** – the ***Financial Model*** needs to reflect this and not build on unrealistic assumptions about what price would be acceptable to customers and lenders given a ***PPP Project Structure***.
- Variation in gearing and capital cost: In contrast to the constant company level gearing often assumed for corporate finance, the ***PPP/Project Finance Context*** implies that the capital structure of the SPV (hence the project since the project serves as the *raison d'être* for the SPV) will change over time. This feature has to be kept in mind while calculating and using the financial metrics for the project. We will come back to this point following the discussion of such financial metrics in Chapter 3 and the introduction of the *Financial Model* in Chapter 4. At this point, the reader would do well to just note this key feature of the PPP/Project Finance Context.
- Tax Shields: Another critical implication for the *Financial Model* in the ***PPP/Project Finance Context*** is the valuation of the tax shields provided by depreciation, following capital investment. In most projects, the higher level of depreciation allowed under tax laws in many countries coupled with the ramp-up of output and the high levels of interest payments in the initial years after commissioning means that the project does not generate any taxable profits. In a corporate finance context, these tax losses can be immediately utilised for setting off against the profits generated by other projects/businesses of the corporate entity. In the ***PPP/Project Finance Context***, the SPV by definition has no other projects/businesses to

absorb such tax losses of the initial years of operation. The SPV's ability to actually reduce tax outgo depends on the period over which such tax losses can be carried forward under the tax laws and whether the SPV generates sufficient taxable profits within that time limit. This observation applies equally to other concessions on income tax such as those currently provided under Section 80IA of the Income Tax Act in India, whereby private sector investment in most infrastructure sectors get a tax holiday over a block of ten financial years in the first fifteen or twenty years of commercial operation. As with the previous implication, we will return to this point in Chapter 6 when we discuss taxation of income in the ***Financial Model*** of a project in the ***PPP/Project Finance Context.***

CHAPTER 3

Finance Theory – Basic Concepts

INTRODUCTION

This chapter provides a quick and reasonably thorough foundation of finance theory for those readers with limited exposure to formal training programs or courses in finance with one section also devoted to the key accounting concepts required for the effective development and preparation of Financial Models. Readers who have the benefit of formal training in finance and accounts may simply glance through the contents to ensure that they are familiar with these concepts before proceeding to Chapter 4.

Key Topics Covered in this Chapter

- Time Value of Money
- Present Value, Net Present Value
- Discounting and Appropriate Discount Rate/Opportunity Cost
- Internal Rate of Return (IRR) and its interpretations
- NPV versus IRR
- Basic Concepts of Risk
- Key Accounting Concepts

3.1 TIME VALUE OF MONEY

The concept of time value of money is the basic foundation for all of the theory of finance and in practical terms, all financial calculations. Stated simply, this concept states that a Rupee earned (or spent) today is worth more than a Rupee earned or spent tomorrow (or at any future date). Alternatively, reflecting the saying "a bird in hand is worth two in the bush", it can be stated that any rational individual will attach a higher value to (or prefer) a Rupee available now as compared to a Rupee available in the future. The further in the future a Rupee is available, the less it is valued (or preferred) compared to a Rupee in hand today.

Typically, the reason for the time value of money is explained in terms of the return[1] earned on cash invested today – if one was to get a Rupee today, one can invest the Rupee and have it increase to somewhat more than a Rupee at any point in the future because of the interest (or return) earned on the investment, the increased value depending on the rate of interest earned and how far in the future that point lies. Thus, one would always choose to receive a Rupee today compared to the same Rupee at any point in the future.

Of course, it is possible to argue that it is not certain that a Rupee invested today would increase to somewhat more than a Rupee in the future since investments can lead to losses. While accepting the fact that investments can be loss-making, the fact remains that there are investments that are virtually free of risk and still yield a positive return on the investment. If one were to ignore risky investments that might lead to losses, there would still be a set of risk-free investment options like Government bonds, Government operated and guaranteed investment products or fixed deposits in a strong bank that are available to everybody and are virtually risk-free. Thus, the explanation of time value of money based on interest may be said to hold.

However, it is important to appreciate that when risk comes into the picture, even a rational individual may prefer to receive a smaller amount today with a degree of certainty rather than a much larger but much more uncertain sum in the future. This is the second basic foundation of financial theory – i.e. a safe Rupee is always worth more than a risky Rupee. The most important point to remember from this seemingly simple concept is that when comparing sets of cash flows occurring at different points of time, it is essential to be conscious about the fact that risks associated with such

[1]Many texts use the term interest though "return" is a more general and appropriate term.

cash flows should be comparable. It is not correct, for example to treat a bank fixed deposit maturing in one year from now, at par with the pay-off expected from selling shares of ABC Limited one year from now. While the first is virtually certain, we really have no way of knowing with any degree of certainty what the shares of ABC Limited will sell for, one year down the line. As such, even the price of ABC Limited shares next week is practically impossible to predict with certainty – else, we would be surrounded by millionaires who made their fortunes trading in the shares of ABC Limited (or XYZ Inc).

In general, the more in the future a cash flow occurs, the more difficult it is to predict. In comparing two sets of cash flows and the returns implied by these sets, it is necessary to keep in mind that unless both sets have about the same degree of certainty (or uncertainty or risk) it is futile to take decisions on the basis of the computed returns. Having introduced the idea of risk and the fact that it is important, it is best to ignore it for the time being in order to first develop a better understanding of time value of money before tackling the concept of risk. At the most, it may be worthwhile at this stage to amend the initial statement on time value of money to read as follows:

Ceteris paribus (other things being equal), a Rupee received, earned or spent today is worth more than a Rupee received, earned or spent at any point of time in the future.

With this statement of time value of money incorporating the "ceteris paribus" condition much favoured in Economics, it is difficult to fall into the trap of comparing sets of cash flows that are essentially not comparable on account of differences in the associated risks, i.e. where the "other" things are not equal.

Text Box 3.1

Time Value of Money and Interest Explained in terms of Trade in Purchasing Power across Time Periods

Going Beyond the Obvious 1: Time Value and Interest as the Outcome of Trade in Purchasing Power Across Time Periods

The explanation of time value of money in terms of interest cited above, though used extensively in literature, is somewhat superficial in the sense that the implied cause and effect is by no means clearly addressed. The explanation suggests that the time value of money is caused by interest, i.e. since one can earn interest on a sum of money received today and end up with a bigger sum in the future, one would

(*Contd.*)

always prefer to receive a given some of money today rather than the same sum of money any time in the future.

A perceptive reader may well question what causes (or gives rise to) interest. It is possible to superficially tackle this question by saying that interest exists because of the concept of time value of money. That is, since every rational person prefers a sum of money today as compared to the same amount any time in the future, the only way to make people forego a present payment is by returning a larger amount in the future or in other words, by paying interest.

To avoid getting caught in a classic "chicken-and-egg" closed loop, it is necessary to understand a little better what gives rise to the phenomenon of interest. Lending, borrowing and interest, all arise because people differ in their preferences between current and future consumption (or more broadly, spending) and a given person's preferences are rarely, if ever, matched by his/her income streams. Thus, some people prefer to spend more than their earning at present, while others want to set aside some of today's earning for spending at a later date. Borrowing and lending is just a mechanism that allows both sets of people to spend as per their preferences rather than being constrained by current income.

Without lending, those earning more than they wish to spend could still set aside some money. In fact, storing of value across time is one of the uses of money in any form, be it metal coins, paper currency or even cowrie shells as long as the same is recognised by society as having purchasing power and widely accepted. However, those wishing to spend more than they currently earn would not be able to do so unless they had saved up and set aside money in the past. This in turn would mean that even those with great business ideas but no savings would never be able to bring their ideas to the market.

It is well established that the trade in purchasing power across time through borrowing and lending prevent such inefficient outcomes and makes both sets of people better off. In fact, jumping the gun to some extent, it may be said that the concept of Net Present Value (NPV) and the rule of accepting an investment opportunity with a positive NPV is applicable regardless of spending preferences and income streams. Readers who wish to delve into this are advised to refer to a standard text book such as the book listed at Serial Number 1 under References.

Having understood the concept of borrowing and lending, one can dispense with the "chicken-and-egg" problem that results if one tries to establish cause and effect between time value of money and interest and/or vice versa. With the foundation of trade in purchasing power, it is easy to see that the phenomenon of paying and receiving interest is primarily the way that the gain from this trade is divided between those with a surplus of current income over spending (i.e. the lenders) and those whose preference for current spending exceeds current income (i.e. borrowers). Of course, interest also represents the incentive required to induce the lenders to put up with the risks of default in repayment by the borrowers and the

(*Contd.*)

erosion in real value caused by inflation. As with most things in life, both default and inflation have uncertainties attached – however, it is possible to look at the interest rate adjusted for expected (as distinguished from known) inflation. The relation between the real interest rate R_r and the nominal interest rate R_n, given an expected rate of inflation i is given by:

$$(1 + R_r)*(1 + i) = 1 + R_n$$

Or, given a known nominal rate of interest and the expected inflation, one can work out the real rate of interest from:

$$R_r = (1 + R_n)/(1 + i) - 1 \text{ OR, } R_r + i*R_r = R_n - i$$

Given that the values of i and R_r are typically small (less than 0.1 or 10%), the term iR_r being even smaller can be ignored in an approximation and the real interest rate then estimated simply as the difference between the nominal interest rate and inflation rate, i.e. $R_r = R_n - i$ (Approximation)

Using the approximation with nominal interest rate of 8% (0.08) and inflation rate of 5%, one would thus get a real interest rate of 3% (8% - 5%), while the full calculation yields 2.857%, a difference of 0.143%.

3.2 APPLICATION OF TIME VALUE OF MONEY – DISCOUNTING, PRESENT VALUE AND NET PRESENT VALUE

3.2.1 Applying the Time Value of Money Concept

Having established the concept of time value of money, one can start applying the concept. What we have established with the time value of money concept is that, given certainty or at least the same degree of uncertainty, a Rupee today has more value than a Rupee at any future point of time. The natural progression is to then pose the question "how much more is the present Rupee valued compared to the future Rupee?" To answer this question it is essential to bring both the present Rupee and the future Rupee on to the same platform to avoid "apples-to-oranges" comparisons. One possibility is to convert the present Rupee into a future Rupee. This is something everybody is familiar with from school arithmetic on interest calculation. Sticking to compound interest which is more wide-spread and practical and assuming complete certainty, we know that a principal amount P will grow with an interest rate of r per period compounded over n periods into an amount A that is given by:

$$A = P*(1 + r)^n$$

To use terms more commonly used in literature on finance, the formula can be re-written as:

$$FV = PV^{*}(1 + r)^{n}$$

In the re-written form, FV represents the future value and PV the present value.

Even with just the basic concept outlined, one can start applying the time value of money concept to questions like the following - Given that Mr. A can earn 6% per annum, what should he opt for – ₹ 100 today or ₹ 105 after one year? If Mr. A were to opt for ₹ 100 today, he could immediately invest it and have ₹ 106 after one year. Thus making the like-to-like comparison in terms of Rupees one year from now, it is obvious that the first option is better by ₹ 1 in terms of Rupees one year away.

Is it then all right to address questions such as the one faced by Mr. A by using the familiar compound interest formula? What happens if we complicate the problem faced by Mr. A by posing the question as follows - Given that Mr. A can earn 6% per annum, what should he opt for – ₹ 100 today or ₹ 50 after one year and ₹ 60 at the end of two years? In applying the time value of money concept, we now face the dilemma of what to use as the standard Rupee for comparison – the Rupee today, the Rupee one year from now or the Rupee two years from now? One can still use only the compound interest formula to arrive at an answer based on the Rupee two years from now as the standard. In the first option, Mr. A will have ₹ 112.36 after two years [from $100(1.06)^2$]. In the second option, the ₹ 50 received after one year will grow to ₹ 53 at the end of two years, which sum added to the ₹ 60 received then will leave Mr. A with ₹ 113 at the end of two years. He would thus be better off not taking the ₹ 100 today, since by accepting the payments staggered over two years, he would be better off by 64 paise (₹ 113 – ₹ 112.36) after two years.

The point of the simple illustration above is that though possible, it can be cumbersome to use the Rupee of a future date as a standard for making comparisons incorporating the time value of money concept. Imagine the illustration expanding to a comparison of ₹ 100 received today with various sums of money received at the end of each of the next ten years. It would still be possible to use the compound interest formula to arrive at a decision but it would be cumbersome to convert everything into Rupees after ten years as the standard for comparison. More importantly, calculating how much better a given option is compared to another in terms of Rupees of a future date does not communicate much. As consumers, we are aware of what a Rupee today will buy, but measuring something in terms of Rupees 'x' years in the future conveys very little.

Given this, it is preferable to do the required "apple-to-apple" (or, "orange-to-orange") comparison in terms of current (today's) Rupees. That way, the quantification of how much better or worse a given option is compared to another due to the time value of money becomes more meaningful, stated as it is in current Rupees.

3.2.2 Discounting to Convert Future Cash Flows into Equivalent Present Value

As it happens, the conversion of future values into present day values involves only a simple manipulation of the familiar compound interest formula, whereby:

$$PV = FV/\ (1+r)^n$$

Using this discounting formula (discounting being just the reverse of compounding), the second fictitious problem faced by Mr. A above can be answered differently. In the first option Mr. A has ₹ 100 today. In the second option, the two pay-offs received by Mr. A at the end of years 1 and 2 are worth in terms of their present values ₹ 50/(1.06) and $60/(1.06)^2$ respectively, i.e., ₹ 100.57. In terms of current Rupees Mr. A is better off to the extent of 57 paise. Compare this amount to the difference of 64 paise arrived at earlier by using Rupees two years later as the standard for comparison – it should come as no surprise that the present value of 64 paise two years later given a rate of 6% is 57 paise, i.e., $64/(1.06)^2$.

Having established discounting as a tool for dealing with the time value for money, it can be extended to a more general form involving receipt of various amounts C_1, C_2, C_3… C_n[2] at the end of every year for the next 'n' years. The present value of the payment C_1 is $C_1/(1+r)$, that of C_2 is $C_2/(1+r)^2$ and so on. Noting that each of these present values express amounts in terms of current Rupees and can therefore be added without any problem, a more general form of the present value formula can be stated as follows:

$$PV = C_1/\ (1+r) + C_2/\ (1+r)^2 + \ldots + C_n/(1+r)^n$$

[2]It should be noted that these cash flows represent the net cash flows. Though not evident in the example involving Mr. A, in case of a business entity there would be further cash outflows (or expenses) incurred in the future years 1 to n over and above the investment C_0 in order to generate cash inflows (revenues). What we are referring to as C_x for year x is generally the cash inflow after netting off all cash outflows (expenses) incurred – many finance texts use the abbreviation NCF (net cash flow) or FCF (free cash flow) to emphasise this aspect. Once a convention regarding cash flows is adopted, we can say that C_x may be both positive (inflow) or negative (outflow).

In the above generalised form, C_n represents the cash flow at the end of the n^{th} year and r is the discount rate.

3.2.3 Net Present Value

Having covered the concepts of present value and discounting as applied to a set of cash flows, we can move on using the same for looking at more realistic examples of investment decisions and also develop the concept of Net Present Value (NPV). In our earlier examples involving Mr. A, we looked at receiving alternate sets of cash flows as options facing Mr. A and used discounting as the tool to arrive at a choice between the two options. Such cash flows in one direction only are rarely encountered in real life as observed by the economist John Maynard Keynes who is credited with the saying "there is no such thing as a free lunch". In general, we either invest money first and derive benefits in the form of cash inflows/receipts later or receive cash first (or something purchased with cash as in case of a car loan) only against an obligation to make payments to the lender later. All investment decisions involve initial cash outflows followed by inflows that the investment generates. Given this, it is best to establish a convention to differentiate between cash in-flows and out-flows:

From the view-point of the investor, all cash outflows are denoted as negative numbers while cash inflows are positive numbers.

While this convention is fairly simple, some people face problems when confronted with a number of components associated with a project that need to be summarised into cash flow aggregates for analysis. Most typically, the confusion arises in the treatment of debt repayment and payment of interest in projects where it becomes unclear which of these components are to be included or excluded and what signs to be used while discounting to calculate the rate of return. In such cases, it is essential to be clear about whose point of view we are analysing and decide accordingly. If one is taking the view point of the person(s) putting equity into the project, what "go out" from the equity investors and "go in(to)" the project is the equity investment in the project and what "go out" of the project and "go (in)to" the equity investor is any cash surplus generated after paying operating expenses, interest, taxes and loan instalments – the plus sign should be associated with the cash flows that, from the equity investors' point of view are "in" and negative sign to the "out" from the same viewpoint. The return on equity should thus be calculated accordingly.

When looking at a project as a whole what "go out" from the investors and "go in(to)" the project is the total investment (whatever the source of funding –

equity or debt) and the cash surplus after meeting operating expenses and taxes then "go out" from the project and "go (in)to" the investors, either as interest and repayment to lenders and the balance to equity investors. Since one is calculating the return generated by the project from the investors' points of view, the signs to be attached can be decided accordingly – the investments in the project considered negative and the cash flows accruing to the investors positive.

In this context, it may be noted that in a simple borrower-lender transaction, the cash flows for each party have opposite signs (are mirror image of sorts) and this does not affect the rate of return calculation which is the same for both, despite the differences in signs – only, the rate calculated is the return for the lender that he should try to maximise while it is a cost for the borrower that he should try and minimise. This point is illustrated using an example later once the concept of IRR is introduced.

To get back to NPV, this concept is an extension of present value. While we have so far described how a set of cash inflows can be discounted back to present values, we have been ignoring the fact that getting such a set of future cash inflows typically requires a cash outflow at the beginning. NPV simply sums up the present value of such future inflows and looks at the question – Is the present value of the (expected) cash inflows more than the cash outflow to be incurred today? Given that the cash outflow is occurring at time zero or at present, the formula for NPV is as follows:

$$NPV = C_0 + C_1/(1+r) + C_2/(1+r)^2 + \ldots + C_n/(1+r)^n$$

Note that in using the above formula, C_0 is generally a negative number representing the investment under consideration. Some texts present the NPV formula with a negative sign attached to C_0 but that is not really necessary as long as one keeps in mind that the values C_0, C_1,...C_n have to follow the convention discussed above, i.e. inflows are positive and outflows negative.

Using the NPV formula to arrive at investment decisions requires a very simple rule, which says:

Invest in projects with positive NPVs (i.e. NPV>0) and reject projects with negative NPVs (i.e., NPV<0).

The NPV investment rule should be fairly appealing even intuitively once the meaning of NPV is examined a little. What the terms $C_1/(1+r) + C_2/(1+r)^2 + \ldots + C_n/(1+r)^n$ add up to is the present value of all the pay-offs (inflows) from the investment option being considered, say investment option A. In arriving at this present value, we use a discount rate r, which should correctly be considered as the rate of return that can be earned on an alternative investment option of the same risk profile. The usual term for this is the opportunity cost. By going in for the investment option under consideration, one loses the opportunity of investing in the best alternative investment option (say, option B) that would earn a return of r. Since we are using a discount rate r that represents the rate of return generated by option B, the terms $C_1/(1+r) + C_2/(1+r)2 + \ldots.+C_n/(1+r)n$ essentially tell us what amount one would have to invest in option B in order to get the same pay-offs as option A. Once we add C_0 (negative) to this value to arrive at the NPV, a positive value of NPV tells us that C_0 is less than the investment required in option B in order to get the same set of pay-offs. Option A is thus preferable to the best alternative option B and should be taken up. A negative NPV, on the other hand, tells us that we can get the same set of pay-offs as option A with an investment less than C_0 in option B - taking up option A thus does not make sense.

An alternative, and equally valid, interpretation of the discount rate r can be in terms of the cost at which the investment option A can be funded. In that case, the terms $C_1/(1+r) + C_2/(1+r)^2 + \ldots + C_n/(1+r)^n$ add up to the amount of capital that can be supported by the expected pay-offs from option A. If the absolute value of C_0 is less than the amount of capital carrying a cost of r that can be supported by the pay-offs from option A (i.e. NPV is positive), it makes sense to go in for option A since the required investment C_0 is less that the amount of capital that can be supported by the inflows produced by C_0. If the absolute value of C_0 is greater than the amount of capital with cost r that can be serviced by the cash inflows produced by C_0, it means that the investment option A does not generate adequate cash inflows to service the capital and should not be taken up.

With either of the above interpretations of the discount rate, NPV represents the value of the investment option under consideration – it tells us how much more the investment option is worth as compared to the best alternative investment option or how much additional value the investment option generates over and above the cost at which it can be funded. NPV thus represents:

- The additional amount that would have to be invested in the best alternative investment option available in order to generate the same pay-offs as the investment option under consideration; OR
- The amount generated by the investment option over and above the amount required to repay the principal and meet the interest payments on the funds used to make the investment.

Text Box 3.2

Discount Rate and the Term Structure of Rates

Going Beyond the Obvious 2: The Discount Rate and the Term Structure of Rates

Though we have so far developed the concept of time value of money using interest rates and absolutely certain cash flows for convenience, it should be recognised that a more general term discount rate should really be used when applying discounting. The multiplication factor $1/(1+r)^n$ is generally called the discount factor for a cash flow C_n occurring at the end of the n^{th} year from today. It should be noted that in line with the statement of time value of money, the discount factor is less than 1 for any positive discount rate greater than zero, as it must be for the present value for C_n to be less than C_n for the time value of money concept to hold good.

More generally, one can talk in terms of the rate of return rather than interest rate since the concept of time value and discounting apply even if the cash flows in question do not represent a loan where cash flows are fairly certain. As mentioned earlier, real life cash flows are rarely completely certain and in using the time value of money, one has to consider the risks involved. At this point, it is enough to re-emphasise that applying the same discount rate to cash flows differing widely in terms of the risks involved is incorrect and may result in wrong (and costly) decisions. In general, the more risky a set of cash flows is, the higher the discount rate that should be used. Also, once we recognise that the concept of time value of money is not restricted to just debt transactions and absolutely certain cash flows, it is more appropriate to use the terms expected rate of return and expected cash-flow, with the addition of the word "expected" highlighting the uncertainty associated with financial projections.

Most textbooks present a more generalised form of the discounting formula, which allows for different discount rates to be applied to cash flows occurring at different points of time, as follows:

$$PV= C_1/(1+r_1) + C_2/(1+r_2)^2 + \dots +C_n/(1+r_n)^n$$

This general form recognises the fact that rates may vary for different time periods – something which is fairly apparent in case of interest rates such as those offered by banks on fixed deposits. Typically, fixed deposits of longer duration earn higher rates of interest.

That interest rates for different maturities differ is observed in most economies and is known as the term structure of interest rates. One explanation of the term structure is based on the greater uncertainty involved in locking into a transaction for a longer period where the uncertainty is higher compared to a shorter period of time, requiring higher rates to compensate for the higher risks – this being an extension of the general observation made earlier about higher discount rates for more uncertain cash-flows. While the more generalised form of the discounting formula is no doubt theoretically and conceptually correct, it has limited practical value in our context of Financial Models for infrastructure projects where such finesse is generally not possible and broad assumptions are often required on many counts. Thus, the concept has been introduced in a text box rather than coming as part of the main text.

In some ways, the two interpretations of the discount rate are not very different – if the investor does not have an alternative investment option, he still has an opportunity cost in the sense that he has a given cost of funds. Assuming that the investment option does not differ significantly in terms of its risk profile from past investments made by the investor, the cost of funds at which these past investments have been funded represents the opportunity cost for the investor as any cash generated by the investment option under consideration can be used to repay funds raised for the past projects. The fact that this results in a saving equivalent to the cost of funds is in no way significantly different from having an alternative investment option that would generate a return equal to the cost of funds. In fact, the equivalence of the two interpretations is often summarised by using the term opportunity cost of capital when discussing investment decisions.

3.2.4 Applying NPV

To round off the explanation of NPV, we can look at applying NPV to a hypothetical investment option. Say you have just inherited ₹ 500,000 from a distant uncle. You have no immediate need to spend the money and plan to put the windfall into a fixed deposit for 5 years, which will yield a return of 8% per annum. Before you can put the money into a fixed deposit, however, you bump into an old friend from school who you have not met for many years. Your friend has jumped on to the business process outsourcing (BPO) bandwagon and is successfully running a BPO operation employing almost 500 people. He tells you that he has bagged a large contract from an American bank that requires significant expansion of his company's operations in order to deliver over the next five years. While he has enough saving set aside to fund most of this expansion, he is falling short by ₹ 500,000 that he requests you to loan him. While he will not be in a position to make any repayments in the next two years due to the expenses associated with the expansion and the gradual build-up of revenues, he promises to make payments of ₹ 150,000, ₹ 275,000 and ₹ 325,000 at the ends of the 3rd, 4th and 5th year respectively in order to repay your loan with returns. You have always admired this friend for his focus on results and integrity and have absolutely no doubt that he will make the repayments as promised. However, your friend also tells you to not be affected by your long friendship with him but to treat the proposed loan as a detached business decision that is justified financially. What should you do?

Obviously, this investment option is amenable to the application of your newly acquired knowledge of NPV. The only issue that bothers you is what discount rate you should use. While it is true that you have no doubts about your friend's ability and willingness to repay the loan and really have no other investment option other than the fixed deposit, you feel that it would not be quite right to use 8% as the discount rate, given that a loan to expand your friend's BPO operations should surely count as being more risky that a fixed deposit in a bank. You decide, therefore to work out the NPV using discount rates of 8%, 10% and 12%. The results extracted from your spreadsheet would look like ***Illustration 3.1***. Having worked out the NPV, you are satisfied that even with a discount rate of 10%, which is 2% more than your opportunity cost; the investment option offered by your friend has a positive NPV though small at about 0.5% of the investment.

ILLUSTRATION 3.1

Calculation of NPV at Different Discount Rates

	A	B	C	D	E	F	G
1	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
2	Cash Flows – C	–500,000	0	0	150,000	275,000	325,000
3							
4	Discount Factors @ 8%	1.00000	0.92593	0.85734	0.79383	0.73503	0.68058
5	Present Values	–500,000	0	0	119,075	202,133	221,190
6	NPV1 = SUM(B5:G5)	42,398					
7							
8	Discount Factors @ 10%	1.00000	0.90909	0.82645	0.75131	0.68301	0.62092
9	Present Values	–500,000	0	0	112,697	187,829	201,799
10	NPV2 = SUM(B9:G9)	2,325					
11							
12	Discount Factors @ 12%	1.00000	0.89286	0.79719	0.71178	0.63552	0.56743
13	Present Values	–500000	0	0	106,767	174,767	184,414
14	NPV3 = SUM(B13:G13)	-34,052					

Looking at the calculations, the points that could strike you are as follows:

- Irrespective of the discount rate, the discount factors keep reducing the further into the future one goes. This means that the further in the future a cash inflow occurs, the lesser is its present value and contribution towards the NPV. Typically, the contribution of cash flows beyond 15 or 20 years to the PV or NPV is fairly insignificant. This is of particular importance since infrastructure projects can be fairly long term investments. However, it is unlikely that a private developer could be induced to take up a project with a 30-year concession period where the inflows to him from the project would accrue only after the first 15 years once the loans have been paid off and usage of the project increased over time. We would have to look for ways to structure the project to produce some cash in the initial years in order to make it viable for a private investor. Another implication of this observation is relevant to real estate projects where the projects are often structured with long-term lease or authorisation periods such as 90 years. In such projects, even if we build into the ***PPP Project Structure*** some form of payment for the investor at the end of the period, this would typically have very little impact of the project's ability to attract investors – we would be better off trying to improve cash inflows or reduce outflows in the initial years through appropriate structuring.

- The higher the discount rate, the lower is the discount factor for any given point of time. For any given investment option, the NPV typically decreases with increasing discount rates. In the example discussed above, you can see that the NPV reduces as we increase the discount rate and changes from positive to negative as the discount rate is increased from 10% to 12%. However, though it is rare in real life situations, it is possible to have hypothetical cash flow sets for which the NPV is not a smoothly declining function of discount rate. This possibility is discussed subsequently, after introducing the concept of IRR.

Before going on the concept on Internal Rate of Return, it is pertinent to note that the PV and NPV concepts also work as a theory of value. Given a set of expected future cash inflows, one can always apply discounting with an appropriate discount rate to arrive at the value at present of the expected cash inflows. The PV is the value of the future cash inflows whereas when we use NPV and bring into the picture what we are expected to pay now to acquire the future inflows, we are essentially considering the additional or net value that is derived from the opportunity. At least theoretically, this can be applied regardless of the nature of the asset producing the cash inflows, which may be a physical asset like plant & machinery or a financial instrument like a bond or equity share.

The only part of using PV and NPV as a theory of value, i.e., for valuation that poses difficulty is deciding on the appropriate discount rate to be used if making reasonably good projections of the future cash flows is possible. However, with a clear understanding of the discount rate as representing either the opportunity cost or the cost of capital, the choice of discount rate can generally be tackled. Preparing reasonable projections of future cash inflows often requires a good understanding of the basics of the business or project in question and some amount of judgement. To the extent that such cash flow projections always involve uncertainty, it is necessary to use sensitivity analysis to come up with a range of values under different assumptions rather than a single value. In this manner, one can check the impact on the value of those assumptions that have a greater degree of uncertainty involved – it may well happen that certain assumptions with a high degree of uncertainty may not have a significant impact on the value. The only way to arrive at such conclusions is by carrying out sensitivity analysis using different possible values of the assumed parameters that are uncertain.

3.3 INTERNAL RATE OF RETURN (IRR)

We can now move on to the concept of Internal Rate of Return (IRR), also known as the discounted-cash-flow (DCF) rate of return. It may be argued that IRR does not really deserve the tag of basic concept as it is an extension or application of the time value. Others may with some justification argue that NPV is actually the sounder of these two main applications of the time value of money. However, it is the author's call that IRR because of its apparent simplicity and wide-spread use combined with the underlying complications in proper understanding and use, deserves a separate section.

3.3.1 Rate of Return in the Single Period Case

To start with, consider a simple one-period investment option that requires an investment of C_0 and generates at the end of the period a cash payoff (inflow) of C_1. As per the convention for attaching signs to cash flows discussed earlier, C_0 is negative and C_1 positive. However, in calculating the return generated by an investment option, we are really concerned only about the absolute value of the investment, when we say that the rate of return is given by:

(Payoff – Investment)/Investment or (Payoff/Investment)-1

Sticking to our convention, whereby C_0 is a negative number, we would have to express the above relation symbolically by saying that:

$$\text{Rate of return, } r = (C_1/\text{-}C_0) - 1$$

If we look at the formula for NPV and equate it to zero, what we get is this:

$$\mathbf{NPV = C_0 + C_1/(1+discount\ rate) = 0}$$

$$\mathbf{Or,\ discount\ rate = (C_1/\text{-}C_0) - 1}$$

Thus, in a simple one period case, it is clear that the discount rate at which NPV is equal to zero is equivalent to the rate or return offered by the investment option. Unfortunately, it is not as easy to establish the same relationship between the discount rate which equates NPV to zero and the rate of return for an investment option that extends beyond one period. However, this is possible as outlined in the text box "Going Beyond the Obvious (4)", though most readers may skip this.

3.3.2 IRR Defined

IRR is defined as the discount rate which equates NPV to zero for any given investment option. In other words, IRR is the solution of the following equation:

$$C_0+C_1/(1+IRR) + C_2/(1+IRR)^2 + \ldots.+C_n/(1+IRR)^n = 0$$

If we were to replace 1/(1+IRR) by x, those with some exposure to algebra should recognise that finding out the IRR involves solving a polynomial equation of the general form:

$$a_0 + a_1x + a_2x^2 +\ldots+ a_nx^n = 0$$

There is an alternative way of looking at the IRR equation's equivalence to a polynomial equation of the nth degree where n is the last year in which cash flows occur. The IRR equation, as mentioned earlier, is given by:

$$C_0+C_1/ (1+IRR) + C_2/ (1+IRR)^2 + \ldots. +C_n/ (1+IRR)^n = 0$$

If both sides of the above equation are multiplied by $(1+IRR)^n$, we would get:

$$C_0(1+IRR)^n +C_1(1+IRR)^{n-1} + C_2(1+IRR)^{n-2} + \ldots.+C_n = 0$$

This is the same as a polynomial equation of the form:

$$a_0 + a_1x + a_2x^2 +\ldots+ a_nx^n = 0$$

with a_0 replacing C_n, a_1 replacing C_{n-1} and so on till a_n replacing C_0 and x being equal to (1+IRR). Solving the polynomial equation for x is equivalent to finding the IRR with any unique solution for x yielding a corresponding one for the IRR.

Of course, it is not necessary to go about trying to solve such polynomial equations because Excel spreadsheets have a simple in-built formula to calculate IRR for a set of cash flows, which is all that one will need to use in real life situations. The mathematically inclined may be tempted to question how Excel goes about solving the equivalent of a polynomial equation since it is known that there exists no general algebraic method for solving polynomial equations of the fifth and higher degrees[3]. The answer would have to be that Excel can only do what the mathematician armed with pen and paper would do – that is, try and factorise the polynomial to simplify it and proceed with iterations till reduction to a lower degree polynomial capable of solution by a standard method is reached. Only Excel with the processing power at its disposal can use iteration or "trial and error" by evaluating the polynomial for a range of values at a much faster rate to throw up the IRR. However, it is also possible that the trial and error does not yield a value that is feasible for IRR and in that case even Excel will give up with an error message. To understand how this is possible, just keep in mind that the polynomial equation may have roots (or solutions) that are real numbers, irrational numbers or complex numbers — the last two categories of solutions along with those real solutions that are negative cannot be meaningfully treated as IRR. However, the concept of IRR outlined above, unlike NPV, is by no means intuitively clear and appealing. To understand why the discount rate that equates NPV to zero is significant, delving a little more into the concept of IRR is worthwhile.

[3]School level algebra generally covers the solving of the first two degrees of polynomials, i.e. linear equations and quadratic equations. Higher algebra courses outline methods for solving cubic (3^{rd} degree) and quartic (4^{th} degree) equations. For fifth and higher degrees, no general method for solving is known though solutions are possible if a rational root of the equation exists – in such instances where r is a rational root, dividing the polynomial equation of the nth degree by the factor (x-r) reduces the polynomial equation to one of (n-1)th degree and further iterations along the same lines can lead to a solution comprising all n roots.

Text Box 3.3

Establishing the Equivalence between IRR and the Discount Rate at which NPV = 0

Going Beyond the Obvious 3: Establishing Generally the Equivalence between IRR and Discount Rate at Which NPV = 0

Consider a general set of cash flows over n periods, represented by an investment at time zero represented by C_0 (which is negative) and inflows C_1, C_2... C_n. Now, if the rate of return on this set of cash flows is r, essentially the return earned in any period x should be r on the opening balance of that period, which is simply the initial investment C_0 and the accumulated return for all periods till x-1 less the cumulative cash inflows till period x-1. That is, the return for any period has to be earned on the balance amount out of the total initial principal/investment and the accumulated returns till period x-1 that has not been recovered through the cash inflows received till date.

Thus, in period 1 the initial investment of C_0 (remembering that it is negative) will earn a return of r so that at the end of the period the total amount to be recovered is given by:

$$-C_0*(1+r)$$

Against the above, we receive C_1 at the end of period 1, so that the balance amount left over is:

$$-C_0*(1+r) - C_1$$

In period 2, the rate of return r has to be earned on the balance amount shown above. So at the end of period 2, the balance amount after considering the cash inflow C_2, is:

$$(-C_0*(1+r) - C_1)*(1+r) - C_2$$
$$\text{OR, } -C_0*(1+r)^2 - C_1*(1+r) - C_2$$

In period 3, the expression above earns a return of r and after deducting C_3 from the above expression multiplied by (1+r) the balance amount at the end of period 3 (i.e. opening balance for period 4) is given by:

$$(- C_0*(1+r)^2 - C_1*(1+r) - C_2)*(1+r) - C_3$$
$$\text{OR, } -C_0*(1+r)^3 - C_1*(1+r)^2 - C_2*(1+r) - C_3$$

Extending the above logic, what we have left over at the end of period n is given by:

$$-C_0*(1+r)^n - C_1*(1+r)^{n-1} - \dots - C_{n-1}*(1+r) - C_n$$

Now, if r is indeed the rate of return earned on the given set of cash flows, the balance amount left over to be recovered at the end of period n has to be equal to zero, since all of the initial investment C_0 and the return earned on the opening balances for each period till period n would have been recovered once the last inflow C_n is received. Thus, if r be the return earned on a set of cash flows, we have:

(*Contd.*)

$$-C_0*(1+r)^n - C_1*(1+r)^{n-1} - \ldots - C_{n-1}*(1+r) - C_n = 0$$

Multiplying both sides by - $(1+r)^{-n}$, we get:

$$C_0 + C_1/(1+r) + \ldots + C_{n-1}/(1+r)^{n-1} + C_n/(1+r)^n = 0$$

The above expression is nothing but the formula defining IRR as the discount rate which equates NPV to zero, thus establishing the equivalence of IRR and discount rate at which NPV is equal to zero.

3.3.3 Interpretation of IRR

To go back to our earlier example of your lending ₹ 500,000/- to an old friend for his BPO business, we have already seen that the NPV turns from positive to negative as the discount rate increase from 10% to 12%. The IRR obviously lies somewhere in between. Using the IRR formula in Excel, we find that the IRR is 10.12%. Now, if this IRR were to be applied as the interest rate paid by your friend, a calculation of the opening balance, interest accrued on the opening balance of any given year during the year, the repayment received and the closing balance carried forward would be as follows:

ILLUSTRATION 3.2

First Interpretation of IRR

	A	B	C	D	E	F	G
1	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
2	Cash Flows – C	-500,000	0	0	150,000	275,000	325,000
3							
4	IRR =IRR(B2:G2, 0.05)	10.12%					
5							
6	Opening Balance	Row a	500,000	550,611	606,346	517,721	295,127
7	Interest @ 10.12%	Row b = 0.1012 * Row a	50,611	55,734	61,376	52,405	29,873
8	Repayment - end of year	Row c	0	0	150,000	275,000	325,000
9	Closing Balance	Row a + Row b – Row c	550,611	606,346	517,721	295,127	0

Obviously, the IRR is that rate, which when applied to the opening balance of every period after accounting for repayments of the original investment and interest accrued on the opening balances in every preceding period that has already been received in the form of cash inflows up to that period, ensures that the balance investment reduces to zero at the end of the last period in which cash inflows accrue from the investment in question. This is the first interpretation or meaning of IRR. The reader is welcome to ensure using a spreadsheet that this is indeed true for different hypothetical investment and payoff sets. Having done that, it is fairly easy to accept that the discount rate that equates the NPV of a set of cash-flows associated with an investment option is nothing but the relevant rate of return for that investment option.

It is also possible to apply the concept to something most people are familiar with – i.e., a loan repaid in equal monthly instalments (EMIs). Say Ms B has decided to go in for cosmetic surgery on her slightly crooked nose and unwilling to wait till she saves up the required amount of ₹ 250,000/- to pay Doctor Lookgood, she decides to take a personal loan. Ms B's bank after appraising her case informs Ms B that she can get a two-year loan at a flat rate of 12% per annum, which she can repay in 24 EMIs. She will also have to pay a processing fee of 1% of the loan amount up-front, to be deducted at the time of disbursement. What a flat rate of 12% means is that Ms B's EMI will be (250000*(1+0.12*2))/24, i.e. ₹ 12,917. Note that though Ms B actually receives ₹ 247,500 after deduction of the 1% processing fee, the EMI is calculated on ₹ 250,000 – just one of many ways that a lender can squeeze out a higher return from a loan. However, in calculating the IRR (monthly) for Ms B, we have considered the actual cash inflow she received, i.e. ₹ 247,500. Every EMI can be split into two components – one being interest on the opening balance of the month at the IRR (monthly) and the residual amount going towards repayment of the outstanding principal amount as the other component. The following table (copied from an Excel spreadsheet) shows the split of each EMI and the resultant closing balance carried forward to the next period as opening balance. It is clear that even with an EMI based transaction, the IRR is the appropriate rate to use for splitting each EMI into interest and principal repayment components, so as to reduce the principal outstanding to zero at the end of the last period. This is an extension of the interpretation of EMI cited earlier. It may be noted that such splitting of EMIs using IRR is not a theoretical exercise but very much a requirement for financing companies to split certain receipts (lease rentals for example) into income and principal repayment streams so as to recognise income in the P&L and reduce outstanding loans in the balance sheet.

ILLUSTRATION 3.3

IRR Applied to Equal Monthly Instalments

	A	B	C	D	E	F	G	H
1	**Period**	**Cash Flows**	**IRR**	**Opening Balance**	**EMI**	**Interest**	**Principal Repaid**	**Closing Balance**
2	0	247,500	1.89%	Col A	Col B	C=0.0189* Col A	Col D=Col B- Col C	Col A- Col D
3	1	–12,917		247,500	12,917	4,667	8,250	239,250
4	2	–12,917		239,250	12,917	4,511	8,405	230,845
5	3	–12,917		230,845	12,917	4,353	8,564	222,281
6	4	–12,917		222,281	12,917	4,191	8,725	213,556
7	5	–12,917		213,556	12,917	4,027	8,890	204,666
8	6	–12,917		204,666	12,917	3,859	9,057	195,609
9	7	–12,917		195,609	12,917	3,688	9,228	186,380
10	8	–12,917		186,380	12,917	3,514	9,402	176,978
11	9	–12,917		176,978	12,917	3,337	9,580	167,399
12	10	–12,917		167,399	12,917	3,157	9,760	157,639
13	11	–12,917		157,639	12,917	2,972	9,944	147,694
14	12	–12,917		147,694	12,917	2,785	10,132	137,563
15	13	–12,917		137,563	12,917	2,594	10,323	127,240
16	14	–12,917		127,240	12,917	2,399	10,517	116,722
17	15	–12,917		116,722	12,917	2,201	10,716	106,007
18	16	–12,917		106,007	12,917	1,999	10,918	95,089
19	17	–12,917		95,089	12,917	1,793	11,124	83,965
20	18	–12,917		83,965	12,917	1,583	11,333	72,632
21	19	–12,917		72,632	12,917	1,370	11,547	61,085
22	20	–12,917		61,085	12,917	1,152	11,765	49,320
23	21	–12,917		49,320	12,917	930	11,987	37,333
24	22	–12,917		37,333	12,917	704	12,213	25,121
25	23	–12,917		25,121	12,917	474	12,443	12,678
26	24	–12,917		12,678	12,917	239	12,678	0
27								
28				**Annual IRR**	**25.13%**			

So far, we have established IRR as an appropriate measure of returns when applied correctly to multiple period cash flows. A second interpretation of IRR is possible in terms of single period pay-offs. Consider for example a 5 year bank fixed deposit where one invests say ₹ 1,000 and gets a pay-off of ₹ 1,469.33 after 5 years. This is easily recognised as an application of the compound interest formula discussed earlier:

$$A=P^*(1+r)^n$$

With A = 1,469.33, P = 1000 and n = 5, we can solve for r to get 0.08 or 8% as the rate of interest/return. It is interesting that the IRR calculated on such single pay-off cash flow sets (i.e. one outflow and one inflow, separated by a given period) gives us the same result, i.e., r=8%, which is the compounded annual growth rate (CAGR) at which the initial investment grows. We can examine whether this analogy between IRR and CAGR holds in the more general case with interim cash inflows before the last one.

To examine this, we go back to the earlier example of your lending ₹ 500,000. The first set of cash flows (Set A) have an IRR of 10.12% as already calculated. Now, we look at a second set of cash flows (Set B), which has the same initial investment but a single pay-off (inflow) at the end of the 5th year given by the initial investment of ₹ 500,000 growing at 10.12% per annum. This pay-off is ₹ 809,740 as shown below. The IRR of Set B is also 10.12%.

Now, if the two sets A and B have the same initial investment, time-frame and IRR, we should at the end of the time-frame (5 years in this case) be equally well off. In other words, we should have the same amount of cash at the end of the 5th year - ₹ 809,740. Is this the case for Set A? It is, if we consider that the interim cash flows are re-invested to earn a rate of return equivalent to the IRR. This is shown in the illustration where the interim cash inflows of set A are re-invested at 10.12% and the future values of these at the end of Year 5 are calculated. These future values add up to exactly the same amount available at the end of Year 5 in case of set B, i.e., ₹ 809,740.

Thus, there are two ways to understand the meaning of IRR as a measure of the rate of return. Firstly, IRR can be understood as that rate associated with an investment (i.e., cash outflow) yielding returns over a number of periods, which when applied to the opening balance of the initial investment remaining in every period after accounting for the interest/return accrued and recovery of the initial investment in the form of cash inflows in all preceding periods ensures that the balance amount of the investment remaining at the end of the last period falls to zero. Secondly, IRR can be thought of as a

ILLUSTRATION 3.4

Second Interpretation of IRR

	A	B	C	D	E	F	G
20	Year	0	1	2	3	4	5
21	Cash Flows Set A	-500,000	0	0	150,000	275,000	325,000
22	IRR of Set A = IRR(B21:G21,0.05)	10.12%					
23							
24	Cash Flow Set B	–500,000	0	0	0	0	809,740
25	IRR of Set B = IRR(B24:G24,0.05)	10.12%					
26							
27	Cash Flows Set A	–500,000	0	0	150,000	275,000	325,000
28	Future Value of cash inflows at end of Year 5 @ 10.12%		0	0	181,904	302,836	325,000
29	Total Future Value at end of Year 5=SUM(C28:G28)	809,740					

rate of return associated with an investment (cash outflow) generating cash inflows over a number of periods (say, n periods) that yields at the end of the last (nth) period the same amount of cash as a single pay-off obtained in the last period by applying the same rate to the same initial investment and compounding over the 'n' periods. Of these, the second interpretation above is not very apparent, and many textbooks state that IRR implicitly assumes the re-investment of interim cash flows at IRR, though few actually explain what form this implicit assumption takes. That by itself is a little surprising given that a simple manipulation of the formula defining IRR establishes the interpretation, as follows:

IRR is defined by the rate r for which:

$$C_0 + C_1/ (1+r) +\ldots + C_{n-1}/ (1+r)^{n-1} + C_n/ (1+r)^n = 0$$

$$\text{OR, } C_1/ (1+r) +\ldots + C_{n-1}/ (1+r)^{n-1} + C_n/ (1+r)^n = - C_0$$

Multiplying both sides by $(1+r)^n$ we get:

$$C_1*(1+r)^{n-1}+C_2*(1+r)^{n-2}+\ldots+C_n = -C_0*(1+r)^n$$

The expression, if simply interpreted, tells us that IRR is the rate of return using which the future value of the initial investment at the end of the time period (i.e., after 'n' periods) is identical to the sum of the future values of the interim cash inflows in periods 1, 2,.., n at the end of the nth period.

Having accepted IRR as a measure of profitability for a project or investment option, it is simple to state the decision rule for investment options as follows – Investment options or projects that have an internal rate of return (IRR) exceeding the opportunity cost of capital should be accepted and those that have an IRR less that the opportunity cost of capital should be rejected.

Text Box 3.4

Compounding Intervals and Working with IRRs for Different Time Periods

Going Beyond the Obvious 4: Compounding Intervals and Working with IRRs for Different Time Periods

The example involving Ms B's EMIs introduces the concept of monthly IRR, i.e. the IRR expressed on a per month basis rather than a per annum basis. This is of course no different conceptually from the compound interest formula. Though we generally treat the compound interest formula as applying to time and rates of return expressed in terms of years (per year for rate of return), it holds good for any time period like month, week, etc. In general, if the annual interest rate is R, the compound interest formula when we compound interest n times during the year is given by:

$$A=P*(1+R/n)^n$$

Using slightly different notation, if r is the interest rate per period and R the interest rate for n such periods, we have:

$$(1+R) = (1+r)^n$$

$$\text{OR, } R = (1+r)^n-1$$

$$\text{OR, } r = (1+R)^{1/n}-1$$

Using the above, we can easily convert from the interest rate (or IRR) per period to the equivalent interest rate or IRR for n periods, and vice versa. In the example of Ms B's personal loan, with the cash flows occurring at monthly intervals, the calculated IRR is 1.89%. The equivalent annual rate R is given by $(1+0.0189)^{12}-1$, i.e. 0.2513 or 25.13%. We see that the effective cost of the loan as measured by the annual IRR is much higher than the flat rate of interest that the bank quoted and used to arrive at the EMIs payable by Ms. B. Typically, for loans repaid in EMIs the actual effective cost is roughly twice the flat rate of interest.

It is interesting to note that the idea of compounding interest for short periods took hold in the context of regulatory limits on annual interest rates imposed in some countries in the past. In order to attract deposits/investments without breaking the law, financial institutions started compounding the interest more frequently. By

(*Contd.*)

compounding a given interest rate n times a year the effective rate of interest paid increases. For example, with an annual interest rate of 15%, the effective annual rate when compounded:

Twice a year is given by $(1+0.15/2)^2-1$, i.e. 15.5625%

12 times a year or every month is given by $(1+0.15/12)^{12}-1$, i.e., 16.0755%

52 times a year or every week is given by $(1+0.15/52)^{52}-1$, i.e., 16.1583%

365 times a year or every day is given by $(1+0.15/365)^{365}-1$, i.e., 16.1798%

8760 times a year or every hour is given by $(1+0.15/8760)^{8760}-1$, i.e., 16.1833%

525600 times a year or every second is given by $(1+0.15/525600)^{525600}-1$, i.e., 16.1834%

Thus, there is a limit to the extent to which the effective annual rate of interest can be increased by compounding more frequently. Mathematically, this follows from the Basic Limit Theorem, i.e., the limit of $(1+1/n)^n$ as n approaches infinity is e (a constant equal to 2.71828).

The maximum effective annual interest rate when the annual rate is r is given by e^r-1. Thus, with r=15%, the maximum effective annual is $e^{0.15}-1$, i.e., 16.1834%

3.4 NPV VERSUS IRR

3.4.1 General Considerations

Having examined both NPV and IRR as concepts that can be applied to investment decisions, it is clear that both are based on the same fundamental concept of time value of money. As such, both NPV and IRR should lead us to the same decision when applied to an investment opportunity represented by an outflow (investment) at time zero followed by a set of expected inflows over subsequent time periods, representing the returns on the investment made. However, there may be certain situations where IRR cannot be measured easily or where its interpretation is not clear. Some of the key issues of this nature have been outlined in this Section.

In practice, IRR is used far more extensively as compared to NPV, given its intuitive appeal as a rate of return measure that can be easily compared with the cost of capital and communicated easily to stakeholders from functions other than finance. Even a lay person can appreciate that a project is attractive if it has an IRR of 30% when the cost of debt is 12% (say). This is not the case with NPV and if we state for the same project with 30% IRR that it has a NPV of ₹ 450,000/- without any mention of the IRR, most people will not be able to immediately reach a conclusion about whether the project should be undertaken or not. Moreover, a correct calculation of

NPV requires that the proper discount rate be known or at least a reasonably accurate assumption about the discount rate being possible. While an attempt has been made to explain the discount rate in terms of the opportunity cost of capital in the preceding Sections, the practical difficulties involved in making a reasonably accurate assessment of the opportunity cost in real life situations has been glossed over, as is the case with most textbooks on finance where the risk associated with a given investment opportunity or project is generally assumed to be known while covering DCF as a tool for investment decision. In other words, the investment decision is segregated from the financing decision in most cases. This can be applied to financial modelling as well, where the project IRR is calculated as an intrinsic measure of the return generated by the project whereas an assumption about financing is required to arrive at the equity IRR. This has been covered subsequently in Chapter 4.

One of the arguments against IRR is that it does not distinguish between a lending transaction and one involving borrowing. This is illustrated below in ***Illustration 3.5*** where the IRR calculated on the cash flows for both borrower and lender turns out to be identical even though the cash flows of the two parties are essentially mirror images (signs reversed). The supposed problem that IRR's inability to distinguish between lending and borrowing creates is that while lending, one would like to maximise the rate of interest earned (the IRR) and minimise the rate paid (the IRR) when borrowing since it is a cost. However, this is hardly a strong argument against IRR since one is presumably aware while calculating IRR whether one is looking at lending or borrowing, and hence whether to seek the maximum or minimum possible IRR.

ILLUSTRATION 3.5

Calculation of IRR for Borrower and Lender

	A	B	C	D	E	F
1		**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
2	Cash Flows (Borrower)	100	–30	–30	–30	–30
3	Cash Flows (Lender)	–100	30	30	30	30
4						
5	Formula in B5 = IRR(B2:G2,0.05)	15.24%				
6	Formula in B6 = IRR(B3:G3,0.05)	15.24%				

3.4.2 Non-Standard Cash Flows and Multiple IRRs

A more serious issue with IRR arises in case the investment opportunity or project is characterised by cash flows that are not of the standard type, i.e. involving cash outflows initially followed by cash inflows. In the standard type of cash flows, there are negative cash flows (i.e. outflows) in the initial period(s) followed by positive cash flows (inflows) in all subsequent periods. In other words, there is only one change of sign associated with the standard type of project or investment cash flows, from negative to positive. As mentioned earlier, IRR is essentially the solution (or root) of a polynomial equation of the general form:

$$a_0 + a_1{*}x + a_2{*}x^2 + \ldots + a_n{*}x^n = 0$$

The IRR is related to x by the relation IRR=1/x – 1. For polynomial equations, the "Descartes Rule of Signs" establishes that the polynomial equation has as many positive rational roots as there are changes in signs, or less than this number (of changes in signs) by a multiple of two. Thus, for a project/investment with non-standard cash flows that exhibit more than one change of signs, there will not necessarily be one unique IRR. For example, with three changes of signs, the number of possible positive roots (all potential IRR values) can be three or one (3-2) and with four changes of sign, the possible numbers of IRR values are 4, 2 and zero. In case of the standard cash flows, it is clear that there will be only one positive root corresponding to the single change of sign.

Though this type of non-standard cash flows with two or more changes in signs may be rare, it is by no means impossible in real life projects. For example, a road project where the toll revenues in a period when periodic maintenance is to be carried out are not adequate to cover the higher expense associated with periodic maintenance as compared to normal O&M expense may have more than one change of signs as additional fund infusion (investment) beyond the initial construction period becomes necessary to fund the periodic maintenance. Alternatively, a hazardous waste disposal project may require investment at the end of the design life when the facility is to be closed down and secured, again leading to multiple change of signs associated with the cash flows.

At the same time, such multiple IRR scenarios are not exactly common – the reader can be convinced of this by trying to create by trial and error a set of cash flows with three of more changes of signs that also have multiple IRRs. One way of trying to figure out if one is on the right track in such a scenario is to calculate the NPV of the set of cash flows for a range of discount rates and plot the same using Excel. In many cases it will be found that the resultant graph will be of the type shown in ***Illustration 3.7***. This graph is based on a hypothetical set of cash flows with five changes of signs as shown in ***Illustration 3.6*** below.

ILLUSTRATION 3.6

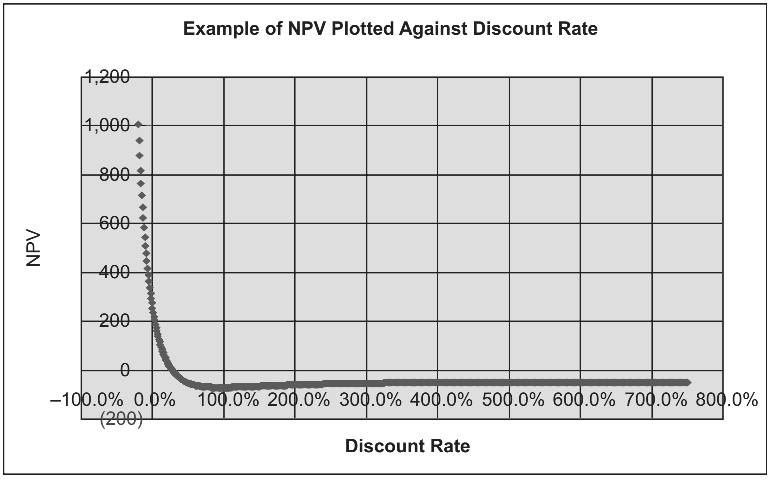
Hypothetical Set of Cash Flows

	A	B	C	D	E	F	G	H	I	J
1	Year	0	1	2	3	4	5	6	7	8
2	Cash Flows	–55	100	–420	60	440	100	150	–200	80
3	Formula in B3 is "= IRR(B2:J2,0.1)	27.5%								

The formula in the cell B3 is "=IRR (B2:J2, 0.1)", which indicates an IRR of 27.5% for this hypothetical set of cash flows. This set of cash flows has five changes of signs, and therefore one, three or five possible IRRs. In order to check whether there is only one IRR value, i.e. 27.5%, the NPV can be calculated for a wide range of discount rates and plotted as shown below.

ILLUSTRATION 3.7

NPV Plotted against Discount Rates (Check for Multiple IRRs)



It is clear that the graph of NPV cuts the X-axis once (indicating IRR of 27.5%) and becomes negative thereafter with the graph becoming almost parallel to the X-axis for larger discount rates implying that beyond a point increasing the discount rate has limited effect on the NPV. One can thus be reasonably sure that despite the five changes of signs, there is only one IRR[4]. The trick of plotting the NPV against the discount rate can also be used in any modelling situation where the cash flows are non standard in order to arrive at a reasonably good idea about the likelihood of more than one value of IRR occurring. In fact, a reader who indulges in creating graphs similar to ***Illustration 3.7*** for many hypothetical cash flow sets with one, two, three, four or five changes in signs will soon realise that graphs of NPV very similar to ***Illustration 3.7*** result in most of the cases.

However, the above is not meant to convey that multiple IRR situations are impossible in real life. This is quite possible with two changes of signs accompanied by two IRRs. As an example, consider the example shown below in ***Illustration 3.8***. Here the cash outflow in the last year (Year 4) leads to two changes in signs and two IRRs of 6.6% and 36.5%. This is in keeping with the Descartes' Rule of Signs which indicates that the number of positive real roots would have to be either two or zero. It may be noted that the result produced by the IRR formula in Excel in such instances depends on the guess value entered, as shown. In case of cash flows of the type shown in ***Illustration 3.8*** the graph of the NPV plotted against the discount rate (***Illustration 3.9***) has a point of inflexion and thus crosses the X-axis on which discount rates are plotted at two points, both corresponding to a zero value of NPV as shown. In such cases, it is obvious that IRR cannot be easily interpreted.

Examples with three changes in sign and three IRRs are also possible. The cash flow set (-100, 360, -431, 171.6), for example, has three IRRs 10%, 20% and 30%. However, these type of cash flow sets are in a sense rarer – unlike the cash flow sets of the type shown in ***Illustration 3.8***, which retain the property of two IRRs when all cash flows are changed in the same proportion as well as when all or any cash flow forming part of the cash flow set (-50, 40, 50, 65, -110) is changed by a small amount, the smallest change in any one element of the cash flow set (-100, 360, -431, 171.6) will lead to the property of three different IRRs disappearing though the property is retained when the cash flow elements are all changed in the same proportion.

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[4]The other roots of the polynomial equation that represents the hypothetical set of cash flows may be pairs of complex numbers of the form a+bi or irrational numbers, which have no meaning as the IRR.

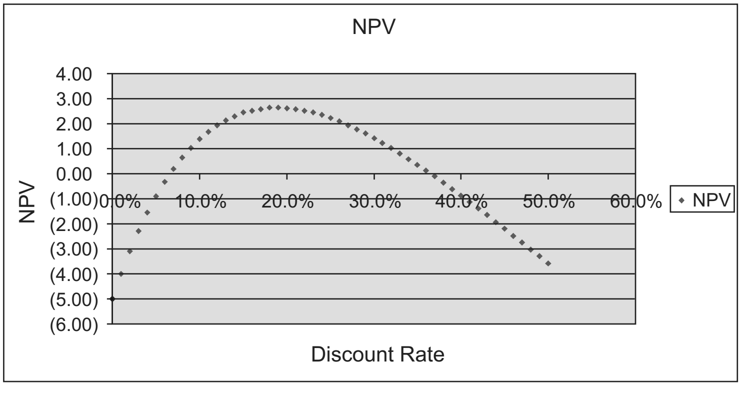
ILLUSTRATION 3.8

Multiple IRRs – An Example

	A	B	C	D	E	F
1	Year	0	1	2	3	4
2	Cash Flows	–50	40	50	65	–110
3	IRR (Guess Value set to 10%)	6.6%				
4	i.e. Formula in B3 is "=IRR(B2:F2,0.1)"					
5	IRR (Guess Value set to 35%)	36.5%				
6	i.e. Formula in B7 is "=IRR(B2:F2,0.35)"					

ILLUSTRATION 3.9

NPV as a Function of Discount Rates (Multiple IRRs)



3.4.3 Re-Investment Assumption in IRR

Another major issue associated with IRR arises from the second interpretation of IRR discussed earlier. As we have seen, the second interpretation of IRR establishes IRR as equivalent to the annual rate of return on the investment. That is, for an investment generating cash inflows over n periods from a cash outflow in period 0, if the interim cash inflows in periods 1 to n-1 are reinvested at IRR, the cash accumulated at the end of the nth period will be identical to the cash generated by a single pay-off in the nth period obtained by compounding the initial investment over 'n' periods at a rate equal to the IRR. In fact, much of IRR's intuitive appeal arises from this interpretation of equivalence to an annual rate of return and explains the widespread use of IRR as the primary tool for making investment decisions. However, if one examines critically the underlying assumption, one can only conclude that it is entirely possible that such investment opportunities do not exist and the IRR calculated in such cases will obviously over-state the investment's rate of return. Given that the IRR is project-specific and has no relation with the actual cost of capital, the re-investment of interim cash flows to earn a rate of return equal to IRR is rather questionable. It can also be reasonably assumed that projects yielding high IRRs are rare opportunities that do not occur frequently -thus, the more unique a project with high IRR is, the more is the likelihood that the interim cash inflows generated by the project cannot be re-invested to yield a rate of return equal to the (high) IRR. Also, for projects with IRR much above the opportunity cost of capital, the extent of overstatement will be much more compared to projects with an IRR slightly higher than the opportunity cost of capital.

In contrast to the implicit assumption of cash inflows being re-invested at IRR underlying the IRR concept, NPV as a measure effectively considers re-investment of cash inflows at the discount rate and expresses in present value terms how much more or less is generated by the investment option being analysed as compared to an equivalent investment earning a return equal to the discount rate. This should be clear from the earlier discussion on NPV but can be reinforced by considering the now familiar set of cash flows used in earlier illustrations.

ILLUSTRATION 3.10

Re-investment of Cash Inflows Applied to NPV

	A	B	C	D	E	F	G
1	Year	0	1	2	3	4	5
2	Cash Flows – Set A	–500,000	0	0	150,000	275,000	325,000
3	Value of all cash inflows at end of 5th year when re-invested at 8%, i.e. CFn*1.08^(5-n) for n = 1,2,3,4,5		0	0	174,960	297,000	325,000
4	Cumulative Value of all cash inflows with re-investment at end of Year 5 (say, C), i.e. "=SUM(C3:G3)"	796,960					
5	Present Value of C at 8%, i.e. investment required today to generate C at end of Year 5	542,398					
6	Investment Actually Required	500,000					
7	Difference between PV of C and Investment Actually Required, i.e. "=B5-B6"	42,398					
8	Which is nothing but the NPV at a discount rate of 8% using the formula "=B2+NPV(0.08,C2:G2)"	42,398					

Most people would agree that assuming that the interim cash inflows can be reinvested at a rate equal to that which can be earned in projects/ investments with a similar risk profile (i.e. the opportunity cost or discount rate used for calculating NPV) is a more rational assumption and to that extent the calculation of NPV is more rational. To address this shortcoming of IRR, one possibility is the calculation of a modified IRR (MIRR) that specifically incorporates an assumption about the rate of return earned on the interim cash inflows. Sticking to the example introduced in ***Illustration 3.1*** and also used in subsequent illustrations, we know that the simple IRR of the cash flows represented by Set A works out to 10.12%. Also, if the initial investment of ₹ 500,000 earns a return of 10.12% over five years and yields a single pay-off at the end of Year 5, we would receive ₹ 809,740, which is also the cumulative value at the end of Year 5 of the inflows in all years when re-invested to earn 10.12%. Now, if the inflows in all years are re-invested till the end of Year 5 not at 10.12% but at 9%, the cumulative value at the end of Year 5 declines to ₹ 802,965 from ₹ 809,740. We can work out that a single pay-off of ₹ 802,965 at the end of Year 5 represents a return of 9.94%. In effect, if the cash inflows get re-invested at 9% instead of 10.12%, the IRR falls from 10.12% to 9.94%. The MIRR function in Excel generates precisely this value, as shown below in ***Illustration 3.11***. In addition to the rate of return implied by the simple IRR, which can be entered as the IRR function, the syntax of the MIRR function requires another argument representing the rate at which the interim cash inflows are re-invested and generates the modified IRR as shown in the illustration.

ILLUSTRATION 3.11

Modified IRR

	A	B	C	D	E	F	G
1	**Year**	**0**	**1**	**2**	**3**	**4**	**5**
2	Cash Flows - Set A	–500,000	0	0	150,000	275,000	325,000
3	IRR calculated as =IRR(B2:G2, 0.05)	10.12%					
4	Value of investment at the end of 5 yrs if annual return is 10.12%, i.e. 500,000*1.1012^5	809,740					
5	Value of cash inflows received in Year:		**1**	**2**	**3**	**4**	**5**
6	at end of 5 years, re-invested at the IRR, i.e.	10.12%	0	0	181,904	302,836	325,000

(*Contd.*)

(**Illustration 3.11:** *Contd.*)

7	Sum of the values of cash inflows at the end of 5 years, i.e. =SUM(C6:G6)	809,740					
8	The rate of return represented by a single pay-off equal to B7 is the CAGR, i.e. (B7/-B2)^(1/5)-1	10.12%					
9	Value of cash inflows received in Year:		**1**	**2**	**3**	**4**	**5**
10	at end of 5 years, re-invested at	9.00%	0	0	178,215	299,750	325,000
11	Sum of values of cash inflows received at the end of 5 years, i.e. =SUM(C10:G10)	802,965					
12	The rate of return represented by a single pay-off equal to B19 is the CAGR, i.e. (B11/-B2)^(1/5)-1	9.94%					
13	Modified IRR, calculated using formula "=MIRR(B2:G2,0.1012,0.09)	9.94%					
14	Modified IRR, calculated using formula "=MIRR(B2:G2,IRR(B2:G2,0.05),B10)"	9.94%					

3.4.4 Considerations of Scale and Mutual Exclusivity of Projects

A last issue with regard to IRR in the "IRR versus NPV" debate is that IRR obviously does not represent the scale of the project and the associated cash flows. It is simply a percentage measure of return, unlike NPV which is expressed in monetary terms. As a corollary to this, NPV is additive – that is, one can meaningfully add the NPVs of two or more projects whereas such an operation with IRR is meaningless. When a choice has to be made between two alternative investment options or projects, only one of which can be taken up (i.e., the projects are mutually exclusive), going blindly for the option/project with the higher IRR does not necessarily make sense if the scale of investments required is different as it is possible that the option/project requiring higher investment has a lower IRR but a higher NPV. Since NPV expressed in monetary terms reflects the additional values or wealth created for the investors over and above the return expected by them for a given level of risk associated with an investment, the option/project with the higher NPV should be selected in keeping with the goal of maximising the shareholders' wealth.

A similar conflict between NPV and IRR can also arise for mutually exclusive projects that have the same scale of investment but wide differences in the distribution of the cash inflows. As examples of the potential conflicts between NPV and IRR in case of mutually exclusive projects, consider the projects shown in ***Illustration 3.12*** below.

ILLUSTRATION 3.12

Conflicts between NPV and IRR in Ranking Mutually Exclusive Projects

	A	B	C	D
1	1) With Same Scale of Investment			
2	Years:	0	1	2
3	Project A cash flows	–1,000	900	400
4	Project B cash flows	–1,000	400	1,000
5		NPV @	12.0%	
6	Project A	122.4	Formula in B6 is "=B3+NPV(C5,C3:D3)"	
7	Project B	154.3	Formula in B7 is "=B4+NPV(C5,C4:D4)"	
8	Choice using NPV	Project B		
9				
10		IRR		
11	Project A	22.62%	Formula in B11 is "=IRR(B3:D3,0.1)"	
12	Project B	21.98%	Formula in B12 is "=IRR(B4:D4,0.1)"	
13	Choice using IRR	Project A		
14				
15	2) With different scale of investments			
16	Years:	0	1	2
17	Project C cash flows	–250	250	250
18	Project D cash flows	–500	450	450
19		NPV @	12.0%	
20	Project C	172.5	Formula in B20 is "=B17+NPV(C19,C17:D17)"	
21	Project D	260.5	Formula in B21 is "=B18+NPV(C19,C18:D18)"	
22	Choice Using NPV	Project D		
23		IRR		
24	Project C	61.80%	Formula in B24 is "=IRR(B17:D17,0.1)"	
25	Project D	50.00%	Formula in B25 is "=IRR(B18:D18,0.1)"	
26	Choice Using IRR	Project C		

To conclude the discussion on NPV versus IRR, it can be said that:

- In most cases, IRR and NPV will lead to the same decision on whether or not to invest.
- IRR does have shortcomings that one should be fully aware of – in particular one should question the likelihood that interim cash inflows can be deployed to earn a rate of return equal to IRR, especially for projects with apparently high IRRs. If the deployment of interim cash flows to earn return equal to IRR seems unlikely, MIRR should be calculated.
- In choosing among mutually exclusive projects, IRR should not be used as the criterion. Rather, the project with higher NPV should be selected even if the IRR of the alternative project is higher. This reasoning is based on the fact that the standard objective for management is to maximise shareholder wealth. When choosing between two alternative projects, the NPV's of these projects in effect reflect the amount of value over and above what an equivalent amount of money invested at the opportunity cost of capital would earn. Being expressed in the same monetary units as wealth, NPV is a better proxy for shareholder wealth than a measure of return that has by itself no reference to the amount of investment on which this return is earned.

3.5 RISK, COST OF CAPITAL AND EXPECTED RETURN

3.5.1 Measurement of Risk

What risk essentially means in the context of projects or investment opportunities is that the future cash-flows are not absolutely certain but can take on different values, thereby resulting in different returns, each corresponding to a particular set of cash-flows. Therefore, it is appropriate to refer to the returns arising from future cash-flows as expected return.

Conceptually, it is useful to think of each of the possible returns as having a certain probability attached. Thus, we may think of 'n' possible returns r_1, r_2..., r_n with probabilities p_1, p_2 ..., p_n. Since one of the 'n' possible returns must occur, we must have $p_1+p_2 +p_n=1$, as is the case with probabilities for any set of mutually exclusive and cumulatively exhaustive (MECE in probability theory jargon) events. In this scenario, the expected return E(r) is given by:

$$E(r) = p_1{}^*r_1 + p_2{}^*r_2 + \ldots + p_n{}^*r_n \text{ OR, } E(r) = \sum_{i=1}^{n} p_i{}^*r_i \text{ where } \sum_{i=1}^{n} p_i = 1$$

However, the expected return by itself does not tell us anything about the risk associated with the project. Intuitively, the degree of risk attached to the project depends on the variability of cash flows (or returns). For example, a project A with five possible returns (with equal probability of each return being realised) of 14%, 15%, 16%, 18% and 22% is intuitively less risky than project B with possible returns of –10%, 0%, 10%, 20% and 65% (again, with equal probability of each possible return being realised) even though the expected return for both A and B is 17%. Our intuitive assessment of the risks associated with the projects is probably based on the observation that the returns possible with project B are more dispersed than those of project A, which has returns that are less dispersed. Thus, what we really need to measure risk is a measure of the dispersion of values. One possible measure is range, the difference between the maximum and minimum values, which we are likely to have used in our intuitive assessment of the risks of projects A and B since it is striking that the range of returns for project A is 8%, while it is 75% for project B. However, range as a measure of dispersion of values suffers from the drawback that it takes into account only the extreme values and not all the values – two sets of returns with the same range may in fact differ considerably in terms of the dispersion of intermediate values between the two extremes.

Statistics offers a standard measure for measuring the extent of variation (or, variability or dispersion) for a given set of values. This is done by first working out the mean value and then summing up the squares of the difference of each data value from the mean, with the difference being squared to prevent positive and negative values (i.e. values lying above and below the mean) from cancelling out. To standardise the measure and allow comparison of the variances of sets of values with unequal numbers of values, it is divided by the number of data values (say, n). This measure, known in Statistics as Variance, is thus a measure of the extent of variation around the mean value of a data set. Since variance calculated on a set of data will have a unit that is the square of the unit in which the data set members are expressed, it is customary to look at the square root of variance as a measure of variability that can be expressed in the same unit as the data in question. This is known as Standard Deviation and is the usual measure of risk.

For example, applying standard deviation to the projects A and B, we can check our instinctive assessment of project B as more risky of the two projects. The calculation of standard deviation of returns for project A is shown in ***Illustration 3.13***. Using similar working, the standard deviation of Project B can be calculated as 26% as opposed to 2.83% for Project A. The two projects with the same expected return vary in the standard deviation of the returns. Thus, that our intuitive assessment of Project B as being more risky is supported by standard deviation as a measure of risk. It may be noted that the detailed working shown in ***Illustration 3.13*** is unnecessary as Excel already has an in-built function for calculating standard deviation[5]. The working has been shown in the illustration only to explain the concept and calculation of standard deviation.

ILLUSTRATION 3.13

Calculation of Standard Deviation of Returns for Project A

	A	B	C	D	E
1	Project A		A=	B=	
2	Return	Probability	Return Less Expected Return	A^2	Comments:
3	14.00%	0.2	–3.00%	0.09%	
4	15.00%	0.2	–2.00%	0.04%	
5	16.00%	0.2	–1.00%	0.01%	
6	18.00%	0.2	1.00%	0.01%	
7	22.00%	0.2	5.00%	0.25%	
8					
9			Expected Return =	17.00%	Formula in D9 is =SUMPRODUCT(A3:A7,B3:B7)
10			Variance =	0.0008	Formula in D10 is =SUM(D3:D7)/5
11			Std. Deviation =	2.83%	Formula in D11 is =D10^0.5
12			Std. Deviation =	2.83%	Formula in D12 is =STDEVPA(A3:A7)

Though the above concept of risk as measured by variance or Standard Deviation of returns is theoretically sound and intuitively appealing, it does not provide much guidance in deciding the appropriate discount rate given the risks associated with a given set of cash flows associated with a project/ investment. After all, it is next to impossible to assign probabilities to a set of possible future returns and proceed from there. However, where we have reason to believe the returns are distributed in a manner that can be expressed

[5]A distinction is made between standard deviation as calculated for a sample of values from a given population vis-à-vis calculation for the entire given population.

mathematically, for example as a normal curve, the standard deviation can be linked to probability. Moreover, it is certainly possible to look at past returns and use the variance of these returns in order to use the concept of risk in practical modelling situations. For this, it is necessary to proceed a bit further with the concept of risk and encompass aspects like diversification and especially establish a linkage with the capital market. Diversification is important in the context of risk because investors can use diversification as a tool to reduce risk. Thus, when we look at the risk-return trade-off, or in other words try to translate the risk measured in terms of variance or standard deviation into a corresponding rate of return, finance theory makes a distinction between that portion of the risk or variance that can be reduced or eliminated by diversification (known as diversifiable risk or unique risk associated with a project or investment) and the balance portion of risk/variance that cannot be eliminated through diversification, i.e. the non-diversifiable risk or market risk. Moreover, theory tells us that it is only the non-diversifiable or market risk that is relevant when we consider the linkage of risk to return. In other words, it is only the non-diversifiable risk or market risk that is rewarded through higher returns and diversifiable risk is not relevant to the risk-return trade-off as an investor can address diversifiable risks by holding a portfolio of investments. Broadly, it can be said that diversifiable or unique risk arise from specific features of a particular company or industry whereas non-diversifiable or market risk arise from economy-wide factors that affect the performance of (or returns generated by investments in) all companies operating in the economy – of course, in an increasingly connected global economy some of these influences operate at a global scale and the country of origin or incorporation of a company or alternatively the performance of that company's stock in any market where its equity shares are traded (including the "home" market where the stock has maximum trading volumes), are probably less important than the markets where the company generates its revenues.

Capital markets are especially useful in the study of risk since these markets provide data on returns over fairly long periods for a range of financial instruments that can be used to expand on the basic concept of risk outlined above. The capital market is not something totally removed from projects or investment opportunities in the real world. After all, the financial assets traded on capital markets ultimately represent claims on the cash flows generated by various projects comprising real assets[6], which is not

[6]"Real assets" is a broader term than physical assets, and includes intangible assets like brand value, know-how, etc. that can have significant impacts on the cash flows generated.

too different for investing directly in a project and thus having a claim on the cash flows generated by the project. An investor evaluating a project (say, a cement plant) does not necessarily have to invest his money in physically setting up the cement plant – he can always take his money to the capital market and invest in shares of an existing cement company (or better still, a few cement companies). There is of course a difference between the two in that any investment in equity shares on the secondary market does not lead to the creation of new real assets, unlike investment in a new cement plant. However, the returns generated on the portfolio of equity shares of cement companies would still be driven by the real assets of the cement companies. Thus, it is not unreasonable to expect that when looking for an appropriate discount rate or rate of return to apply to the projected cash flows associated with the cement plant project in his DCF Financial Model, our would-be investor will look to the capital markets and check what kind of returns cement company shares have yielded historically.

The literature on risk as reflected in capital markets is voluminous and remains a key area of research in finance. It is therefore almost impossible to cover in detail all aspects in this book. However, a significant part of this work centres on the Capital Asset Pricing Model (CAPM), which is also useful for the purpose of explicitly reflecting risk in a DCF analysis of the type covered by this book. Readers should note that only the essential features of CAPM are outlined later in this Section, with the necessary caveat that the coverage is by no means comprehensive and interested readers are advised to refer to any standard textbook on finance theory or modern portfolio theory to flesh out the skeletal coverage provided here. Before starting on CAPM, the relation between risk and return as exhibited by capital market data is outlined and explained.

3.5.2 Trade-Off between Risk and Return

Empirically, it is well established that the return earned on an investment is directly proportional to the risk associated with that investment. For financial instruments, the risk is influenced by the tenure (i.e. time till maturity) of the instrument, its nature (i.e. debt, equity or hybrid), the proposed usage of the funds raised through the issue of the financial instrument and the issuer. Short-term instruments issued by the Government like Treasury Bills (T-Bills) offer almost certain returns to the investor as the probability of default by a Government is extremely remote given its power to create money. This is often spoken of as the ability to print bank-notes, though in reality the Government would generally operate through the country's central bank which may subscribe to Government debt and "create" purchasing power through an accounting entry crediting the Government's account at the central bank rather than running extra shifts at the mint. However, even for such "almost risk-free" instruments the investor cannot be certain about the purchasing power of the amount received on maturity as this is affected by the rate of inflation. Nevertheless, in a stable economy with moderate inflation, the rate of return offered by T-Bills represents a good benchmark for the risk-free rate in that economy.

As an investor shifts from T-Bills to long term Government debt like bonds, though the risk of default is still nil, the investor takes on additional risk as compared to the T-Bills since the price of such long term bonds would vary with changes in the interest rate prevailing in the economy. If the interest falls from that prevailing at the time of issue of the bond, its price would rise and open up the possibility of capital gains. Conversely, a rise in interest rates leads to capital loss as the price of the bond falls. The explanation for this is provided in the text box "Going beyond the Obvious (5)".

When the investor shifts from a bond issued by the Government to one issued by a corporate entity he assumes an additional risk, that of default by the issuer, in addition to the risks arising from fluctuations in the market price for the bond arising out of changes in interest rates and inflation affecting purchasing power of the proceeds from the bond. However, all corporate bonds are not equally risky. Apart from the tenure of the bond, the nature of the issuer and the instrument also affect risk. In developed markets, a fairly stable relationship is found between the risk rating of an instrument and its yield. At the one end, there are corporate bonds rated "AAA" (or similar) indicating highest degree of safety that may yield only a few basis points over a Government issued bond of the same tenure. At the other extreme, there are junk bonds rated "BB+" (or similar) and lower that have much higher yields compared to AAA corporate bonds and of course, Government bonds. In general, it can be said that investors are willing to take on more risks only in return for higher returns and the composition of any investor's portfolio of financial assets held reflects that investor's appetite for risk. A less risk-averse investor seeking higher returns may thus invest in junk bonds. In slightly different terms, it may be said that there exists a *risk premium* over the risk-free rate that increases with increasing risk. In case of debt instruments, this is often referred to as the *default spread*. This aspect becomes clear from the typical interest rates of corporate debt instruments with different ratings shown below in ***Illustration 3.14***, with the risk-free rate being 4%.

ILLUSTRATION 3.14

Example of Default Spreads by Credit Rating

Rating	Interest Rate	Default Spread
AAA	4.35%	0.35%
AA	4.50%	0.50%
A+	4.70%	0.70%
A	4.85%	0.85%
A-	5.00%	1.00%
BBB	5.50%	1.50%
BB	6.50%	2.50%
B-	10.00%	6.00%
CCC	12.00%	8.00%
C	16.00%	12.00%
D	24.00%	20.00%

The cost of debt may also be affected by the nature of the debt. In particular, debt is often categorised as senior debt and subordinated debt. What this essentially means is that a difference in priority for recovery in case of liquidation of the borrower gets introduced. Senior debt gets preference over subordinated debt when it comes to repayment. Subordinated debt is thus riskier from the lenders' viewpoint and typically carries a higher interest rate to reflect this. While it may seem strange that any lender would accept a lower position in the creditors' queue in the event of liquidation, one obvious attraction is the higher return. Even otherwise, subordinated debt is often used by equity investors as a signal to potential lenders that they support the entity in question. To appreciate this, one must consider the event where the entity has to be liquidated – the equity investors get lowest priority in recovery of their investment or dues and to that extent, the equity invested in the entity acts as a buffer against the possible loss in the value of assets owned by the entity when it is liquidated. Subordinated debt serves a similar purpose, particularly in the case of banks and financial institutions. Since the subordinated debt provides an additional buffer to the lenders of senior debt, the probability of these lenders recovering less than the amount due to them because of the liquidation of the entity and its assets gets reduced.

[7]Adapted from lecture notes of Prof. Aswath Damodaran at Stern University from www.stern.nyu.edu, with the figures shown pertaining to the US market in 2003.

3.5.3 Expected Return on Equity

Extending the risk-return relation across categories of financial instruments from debt to equity instruments, one may well wonder what kind of returns or yields equities offer. In comparison to debt instruments, the key distinguishing feature of equity is that there is no obligation or promise by the issuer that the principal invested will be repaid, nor any assurance regarding the rate of return on such invested principal.

As a corollary, equity differs from debt instruments (apart from the small class of perpetual bonds) in that there is no tenure or maturity period associated with equity. For all practical purposes, equity shares of a firm represent a claim on the residual cash flows of the firm for as long as the firm exists, which is theoretically for ever though in practical terms there have been several studies that have established that firms have a fairly high rate of failure and churn. Naturally, it is only to be expected that a rational investor will shift from debt to equity if and only if he/she is compensated for the additional risk created by these factors through higher returns. Is it then true that all equities carry the same degree of risk (and therefore offer the same return) since none of these represent any obligation to repay principal or provide an assured minimum rate of return on the principal? This is obviously not the case because the equity issuers' operations vary widely. At the one end, there are established companies in mature industries that are not expected to show much variation in operating results from year to year. Such companies may also not have too many avenues to invest retained earnings and are likely to pay out much of the earnings in the form of dividends to equity investors. For such "blue chips" both the upside and the downside are likely to be limited and equity investment in such companies obviously don't carry the same degree of risk as equity investments in companies that operate in nascent industries with limited track records, subject to fierce competition and disruptive technology. Equity investments in such companies are likely to provide higher return to investors to compensate for the additional risk as compared to equity investment in a "blue chip".

All of the above is fairly well established through empirical data[8]. Not only do Government T-Bills provide the lowest rate of return, it is also observed that within equity instruments, the return earned on equity shares of smaller companies is typically higher than the return on "blue chips". Of course, there is no reason to assume that blue chips will continue to remain in that

[8]See for example the results of the Ibbotson study cited in Brearley & Myers (Serial No. 1 under "References").

category for ever, since over long periods changes in technology and markets can be quite significant even in established industries while new industries mature. In terms of the risks associated with investment in specific equity shares, historical data on the actual returns earned enable us to calculate standard deviation for any given equity share or combinations of different equity shares (i.e., investment portfolio). Such returns may be looked at for various time-periods – we may use weekly, monthly, quarterly, semi-annual or annual returns generated by any given equity share or portfolio of equity shares. By and large, such analysis for different capital markets has established the following:

- The standard deviations of returns generated by different equity shares in a given market vary considerably.
- The standard deviation of returns generated by a portfolio of different equity shares (i.e., portfolio returns) tend to decrease as the number of equity shares included in the investment portfolio (total portfolio value remaining constant) is increased up to a point – increasing the number of equity shares included beyond 20-30 different shares does not yield significant further reduction in the standard deviation of portfolio returns.

In line with the above point, the standard deviation of returns for any given market as a whole can be considered as that generated by a reasonably well-diversified portfolio of investments in the equity shares of companies that are traded in the market. A stock market index represents such a portfolio. Alternatively, specific indices for various segments or industries can be used to calculate standard deviations. By and large, the standard deviation of returns generated by a market index (i.e., the market return) is lower than the standard deviation of returns of most stocks traded in the market – only a few stocks have standard deviations of return that are lower than that of the market return.

The standard deviation of returns vary across markets as well, with markets in a developing economy with greater growth and investment opportunities typically having higher standard deviations compared to developed economies with mature markets. Nevertheless, even among developed countries the range of standard deviations of historic market returns is fairly wide.

Text Box 3.5

Bond Prices and Yield to Maturity (YTM)

Going Beyond the Obvious 5: Bond Prices and Yield to Maturity (YTM)

A bond is a long term debt instrument with a fixed face value and coupon rate. A 10-year bond with a face value of ₹ 10,000/- and a coupon rate of 6.5% will thus pay to the bond-holder ₹ 650/- per year (or ₹ 162.50/- every quarter) in every year up to the tenth year from the issue and at the end of the tenth year the bond issuer will redeem the bond by paying ₹ 10,000/- to the holder. Bonds, being long term instruments, are typically traded in a secondary market in order to provide liquidity. Thus, the holder of the bond described above does not necessarily have to hold the bond till the end of the tenth year and may sell the bond after five years should he require cash to meet expenses. Banks and financial institutions are typically active in the secondary market and provide a market for these instruments.

The important question to be asked is what determines the price of the bond on the secondary market at any given point of time. Sticking to the above example, we need to find out how much our fictional bond holder will realise when he sells the 10-year 6.5% bond after 5 years. To answer this, we need to look at what the buyer of the bond is getting in return. The buyer gets ₹ 650/- in each of the next five years and ₹ 10,000/- at the end of the fifth year. His cash inflows are thus as follows for the next five years:

650, 650, 650, 650 and 10,650

Going back to our earlier discussion on the concept of PV and NPV as a theory of value, we can say that the price that the buyer will pay for the bond is equal to the PV of the above cash inflows. The difficult question is what the relevant discount rate should be? One may be tempted to use 6.5%, the coupon rate. However, this would not be correct. Remembering the explanation of the discount rate as an opportunity cost, the correct answer should be the rate that the buyer can currently obtain on a similar instrument. If we assume that the interest rates have gone up and a similar bond issued at date carries a coupon rate of 8%. Thus, the buyer can always earn 8% by investing in the current issue of the similar bond rather than buying the 5-year old bond on the secondary market. This is exactly what is meant by opportunity cost and is the appropriate discount rate. By investing in the secondary market, the buyer gives up an "opportunity" to earn 8% and this is thus the relevant discount rate. Applying the discount rate 8%, we get the PV of the future cash inflows on the bond as ₹ 9,401.09/- Thus, the realisation that our fictional bond holder gets is ₹ 9401.09/- which is at a discount to the face value of ₹ 10,000/-

If instead of rising to 8%, the interest rates had declined to 5%, we could apply a similar logic and find out the price of the 10-year 6.5% bond in the secondary market. The PV of the cash flows at 5% works out to ₹ 10,649.42/- which is at a

(*Contd.*)

premium to the face value of ₹ 10,000/- In either case, if we look at the complete set of cash flows from the buyer's point of view starting with the price paid for the bond in the secondary market, the IRR calculated on the set would by definition be equal to the prevailing interest rate or opportunity cost for the buyer. Thus, the IRR calculated on the set of cash-flows (10,649.42), 650.00, 650.00, 650.00, 650.00 and 10,650.00 is 5%. This is the effective rate of return yielded by a bond purchased on the secondary market and is known as the Yield to Maturity (YTM).

The important point about the above is that bond prices do not remain constant but fluctuate with changes in the prevailing interest rate. The relation between bond price and interest rate is an inverse one – i.e. when the interest rate rises, the bond price falls and when the interest rate falls, the bond price rises. Also, when the interest rate is above the coupon rate the bond trades at a discount to its face value and when the interest rate falls below the coupon rate the bond trades at a premium to its face value.

The relevance of the discussion above to financial modelling arises because these historical returns can provide benchmarks that can be used to compare the return generated by a new project, as reflected in the Financial Models prepared. For example, if the average rate of return on equity in a given industry (say, cement) is 16%, we may either check if the investment in a new cement plant yields at least 16% return for the equity investors (promoters) or use 16% as the relevant discount rate and check if NPV is greater than zero. However, such usage is valid only if the project is in the same industry or has the same risk profile as existing operations. It does not make sense for the management of a hypothetical cement major, for example, to apply 16% as the discount rate to the projected cash flows from a toll road project that the cement company's management is considering bidding for (the captive consumption of cement probably has something to do with this!). Rather, the cement company's management should look for listed toll road operators and use the return generated by such companies as the benchmark. As mentioned earlier, all of this may become somewhat irrelevant if there are no listed companies operating the type of infrastructure project that one is evaluating.

3.5.4 Outline of CAPM in Brief

With the above background on risk, one can move on to CAPM as a systematic approach for estimating the required rate of return or discount rate in a DCF Financial Model. Keeping in mind the earlier discussion on NPV as a valuation method, it is clear that if the expected cash flows associated with an asset are known (or can be estimated reasonably accurately), all one further requires for calculating the asset's value/price is the appropriate discount rate. This makes it clear where the "Asset Pricing Model" in CAPM comes from even though CAPM is directly useful for estimation of the appropriate discount rate (more correctly, the expected return on equity) rather than being directly applied to asset valuation.

Essentially, CAPM can be stated as the following relationship:

$$E\ (R_i) = R_f + \beta i\ {*}(E\ (R_m) - R_f)$$

Where,

- $E(R_i)$ is the expected rate of return for a particular security (say, security i)
- R_f is the risk-free rate of return[9]
- β_i is the beta co-efficient for the security i, a measure of the non-diversifiable risk
- $E(R_m)$ is the expected rate of return for the market as a whole

The derivation of the CAPM relationship, which is itself of a fairly simple linear nature, requires a large set of assumptions that would seem unrealistic to anybody but the dedicated economist, who is more used to the idea that such simplifying assumptions are necessary to make any progress at all and that the analysis based on such assumptions may yield results that have some value even in the real world where the assumptions do not hold. Since the focus of this book is on financial modelling in the ***PPP/Project Finance Context***, the derivation of CAPM has not been taken up here. Interested readers may refer to standard textbooks on finance theory and investment/ portfolio management for a more comprehensive coverage of CAPM including its derivation.

Essentially, what CAPM allows us to do is arrive at a logical expected rate of return on equity that we should be looking at for any project, including those covered by a Financial Model in the PPP/Project Finance Context that we are concerned with. Obviously, for such a project being implemented by an SPV that is in all likelihood not listed and certainly not listed at the stage when the Financial Model is vital, i.e., before the decision to go ahead with the project has been reached, there is no way of directly arriving at the equity Beta without any past data on returns offered by the SPV's equity share vis-a-vis the market for equity shares as a whole—this can be captured by any reasonably broad index of equity shares traded on the market[10]. However, the alternative generally adopted is looking at the equity Beta for listed companies with projects similar to the one being analysed /evaluated or

[9]It is perfectly valid to call this the risk-free rate of interest (rather than return), since the instrument typically considered as being risk-free is the T-Bill, for reasons discussed earlier.

listed companies (not necessarily SPVs) in the same sector/industry. The only issue, as touched upon earlier, is that in the absence of such listed companies, it is not feasible to use CAPM. As such, this is very much a relevant issue in the Indian PPP/Project Finance context as on date, though the situation may be expected to change over time.

3.5.5 The Bottom-line on Risk

To summarise our discussion on "Risk, Cost of Capital & Expected Return", perhaps the best concise summary would be a sentence generally attributed to John Maynard Keynes, i.e., "There is no such thing as a free lunch". To expand on this, the following may be considered:

PPP/Project Finance transactions are inherently complex and therefore often marked by a high level of project risk emanating from multiple factors, such as:

- The regulatory framework
- Precedents of PPP/Project Finance transactions in the economy
- Technology
- Nature of the market for the project's output – are customers willing to pay market driven costs? If not, how is this aspect being addressed?

Both the overall level of risk and the composition and contribution of the multiple factors listed (and any other that may be relevant) differ from project/transaction/sector to project/transaction/sector and from country to country. All PPP/Project Finance transactions are not equally risky.

The primary distribution of the project related risks takes place through the ***PPP Project Contract*** between the two primary parties to that contract – "Public" and "Private". Of course, there is nothing to prevent the private

[10]Depending on the nature of the security i, we would have to look at the overall market for that type/class of financial securities and not the capital market in general. As such, it is true that capital markets are becoming increasingly global in nature and the advances in IT and telecommunications mean quick transmission of information across the globe leads to some co-relation between national and sub-national markets situated across various time zones. It is due to this that we regularly see headlines in the financial press along the lines of "Decline in Dow Jones affect sentiments in the market" (in India or Europe or Hong Kong or Tokyo – you can pretty much choose any one). At the same time, it should be kept in mind that capital markets remain subject to regulation and restrictions in many economies, while national economies also differ in terms of structure and size. Thus, while it is true that the so-called "hot money" does move across national boundaries, often at speeds that catch Governments and regulators off-guard, the differences between markets are still wide enough for us to focus on Indian markets when looking at a PPP/Project Finance transaction in India and take a similar approach for other countries.

party from managing its risks where there is a ready and competitive market for further dividing and sharing the risks, i.e., a trade in risk is possible. In such cases, the private party to the ***PPP Project Contract*** can further trade the risk with others through insurance, forward contracts, options and futures. Of course, all risks cannot be traded. Also, there may be specific restrictions in the ***PPP Project Contract*** itself or there may not exist a market for risk trading products, i.e., risk sharing at a "reasonable" cost is not possible.

By definition, diversification as a risk management strategy is fairly limited at the level of the SPV. However, diversification at the level of a holding company investing in a portfolio of projects/SPVs is possible. Also, in a sense the basic features of Project Finance are driven by the need to isolate risks – i.e., the restriction of the project risk by the SPV route. In that sense, Project Finance is itself a tool for ensuring the funding of riskier projects.

However, that last sentence should not be interpreted as equivalent to "***Project Finance*** transactions have lower risks". This is of critical importance. Some may argue that in the ***PPP/Project Finance Context***, the Government, by providing a grant is ensuring lower risk. However, every reader who has understood the concept of weighted average lost of capital (WACC) and gives some thought to this claim should realise that it is specious and faulty logic at work. What the Government (Public) does by providing a grant (in effect, zero cost funding) is to bring down the investment required to be made by the private promoter/sponsor (as well as lenders to the project). It has absolutely no impact on the essential riskiness of the project in question, which is driven by multiple factors discussed above. In other words, by providing 30% of the capital cost of a project in the ***PPP/Project Finance Context***, the Government (Public) is unable to affect the answer to the question "what level of return the private party should expect from the (lower) equity investment?" That answer continues to be driven by the concept of opportunity cost – in other words, the fact that the private party has to invest a lower amount of equity does not affect the return he would get by investing in "an alternative investment of similar risk", which is what the private party looks at. The same holds true for lenders. Thus, an objective and best effort estimation of project risk remains essential in every project.

In contrast, where the Government (Public) underwrites some of the project risk through the ***PPP Project Contract*** or goes in for an annuity type of structure, project risk is directly impacted. Still, this does not negate the need for the private party to the ***PPP Project Contract*** or lenders to the SPV to take a view of the credit-worthiness of the Government (Public)[11] as well as the "residual" project risks in order to determine the expected return on equity (or interest to be charged to the SPV in case of lenders) keeping in mind the risk-return trade-off that is well established empirically, as discussed earlier in this Section.

3.6 KEY ACCOUNTING CONCEPTS

Having largely covered the key aspects of finance theory required for development of ***Financial Models***, it would not be out of place to also present an overview of some key concepts of double entry accounting that are required for ***Financial Models***. A key point on the application of finance theory to financial modelling and analysis that is elaborated in the next Section is that only cash flows are relevant. However, double entry accounting (as opposed to a cash based accounting used in some areas like the Finance Accounts of Government in India) is based on conventions and principles that require understanding in order to relate cash flows to Accounting Statements. This is obviously an aspect that the reader without formal training in finance and accounts may struggle with even in our defined PPP/Project Finance Context for the development and use of Financial Models. The words "and use" have been added deliberately here to emphasise that even those readers who are not directly involved in the development of Financial Models need to be able to conceptually appreciate the category of ***Output*** of the ***Financial Model*** represented by the projected accounting statements.

Accordingly, this Section has been included with the limited objective of providing such readers with the necessary conceptual clarity about accounting concepts. This will obviously not be a comprehensive coverage of accounting required to carry out book-keeping functions but should be adequate for the limited objective of this book. For those involved directly in the development of Financial Models, the coverage in this Section is certainly not adequate. For a start, such readers should ensure they are familiar with the accounting

[11] A good way to look at the credit-worthiness of the Government in its sovereign capacity (i.e. including in the framework the Government's control over monetary and fiscal policy) is to think of any Government as being the only AAA plus entity within the national boundaries and for debt denominated in local currency i.e. the one in the control of the Government in question. However, the actual extent of such control in an increasingly global world in the sense of "no restriction on movement of capital across national boundaries" is uncertain and certainly differs from nation/economy to nation/economy. Also, the multiple tiers of Government and the many instrumentalities used by the Government (for example, Ministry/Department, Statutory Entity, corporate entity, etc.) necessitate a more "subjective" assessment if the private party in question is domiciled in other nations. That implies that in case a PPP/Project Finance transaction bid out globally and involving direct foreign investment, the picture is much more complex.

standards and other publications of the Institute of Chartered Accountants of India (ICAI) listed in Appendix-C, though even that will in all probability need to be supplemented for those without formal training in accounts[12] with reference to standard textbooks on Accountancy.

3.6.1 Equity Convention

It makes sense to start with a key accounting convention that often causes confusion among those new to the subject—the clear separation of the equity investors from the business in which such equity is invested, i.e., the equity convention. In other words, shareholders are thus considered to be distinct from the business entity just like any other external entity that the business entity transacts with. In accounting, the equity investors are thus considered as entities providing funding for the business similar to any other entity providing funding, such as a lender or a creditor who provides goods and services to the business but does not insist on immediate cash payment. All such amounts are recognised in the accounts of the business as liabilities that the business must repay at some point – as far as accounting is concerned, "equity capital" is a separate account representing a class of liabilities just as the accounts "loans" and "creditors" represent other liabilities. This principle, also referred to as the "economic entity assumption" also applies to businesses organised as sole proprietorship firms or partnerships. Thus, even though the owner and a sole proprietorship are considered as one single entity from a legal point of view, the two are viewed as distinct entities for accounting purposes.

When profits are retained by the business rather than being paid out to the equity investors in the form of cash (dividends), these again represent liabilities of the business that appear under reserves on the liabilities side of the balance sheet.

[12]Not every MBA may have absorbed enough of the Accounting principles taught in a typical MBA program at most over 2-3 compulsory courses on Accounting, each spread over a semester of three months in most cases. Thus, those readers who are MBAs should not necessarily skip this Section, i.e. Section 3.6 and take a realistic view of their grasp of accounting principles. Obviously, this caveat does not apply to those with formal education in Accounting before the MBA or other MBAs specialising in finance and with work experience in the function. In terms of formal education, those who are Chartered Accountants, Cost Accountants, hold under-graduate or graduate degrees in Commerce or have had Accountancy as a subject in school over at least 2 to 5 classes/years (the author falls in this last category) should not require a diligent perusal of Section 3.6.

3.6.2 A Simple Mnemonic for Debit and Credit

An extension of the equity convention, often ignored, is the practice of debiting all expenses of the business. To understand why this is so, it should be appreciated that under double entry accounting, any transaction is recorded such that it gives rise to equal values of debit and credit in the relevant accounts. Ignoring for the moment the treatment of revenues earned and expenses incurred by the business, it is clear that any possible transaction has to correspond to one of the following four cases:

- A simultaneous increase in assets and liabilities – for example, equity investors investing cash in the business at the commencement of operations, which increases assets (cash) and liabilities (equity capital).
- A simultaneous decrease in assets and liabilities – for example, the business making payments due to a creditor, which decreases assets (cash paid out) and liabilities (creditors reduced).
- A simultaneous increase and decrease in two (or more) assets so that the total value of assets remains unchanged – for example, the business purchasing raw materials, which leads to a decrease in cash and an increase in the inventory of raw materials, where cash and inventory of raw materials are both assets.
- A simultaneous increase and decrease in two (or more) liabilities so that the total value of liabilities remains unchanged – for example, the business borrows money to buy back equity shares from shareholders, thus increasing loans (a liability) while decreasing equity capital (also a liability).

By convention, any increase in assets is treated as a debit, which means that the corresponding increase in liability is treated as a credit. Conversely, any decrease in an asset is treated as a credit and a decrease in a liability represents a debit. Now, any profit generated by the business is owed by the business to the equity investors (shareholders), i.e., increases the liabilities of the business. Keeping this in mind, it is clear that any revenue earned by the business, which (tends to) increase the liability to equity investors by increasing profits should be treated as an increase in liability and credited. It may be noted that this increase in liability on account of revenues earned has to be accompanied by either an increase in assets (cash or debtors going up on account of the revenues earned) or decrease in liability (for example, advances received from customers now reduced as the revenue is recognised). Similarly, an expense incurred tends to reduce the liability to equity investors and should thus be treated as a decrease in liability and debited. This decrease in liability must be accompanied by a decrease in assets (for example, cash paid out to meet the expense) or an increase in some other liability (for example, recognition of creditors as the amount is owed to the supplier of goods or services giving rise to the expense incurred). Once the accounting treatment of revenues generated and expenses incurred is clear, the whole seemingly complex world of debits and credits can be reduced to a simple table shown below. As long as the rationale for crediting revenues and debiting expenses is well understood, even the table is not necessary – the author has always found the mnemonic D-I-A (debit increase in assets) as sufficient for the purpose.

ILLUSTRATION 3.15

Mnemonic for Accounting Entries (Debit and Credit)

	Increase	Decrease
Assets	Debit	Credit
Liabilities	Credit	Debit

3.6.3 Accrual or Matching Convention

A major reason why there exist significant differences between cash flows and accounting figures is the accrual or matching convention – this essentially means that to the extent possible, revenues generated should be matched to the expenses required to generate that revenue and the matched revenues and expenses recognised in the appropriate accounting period when the revenues accrue to the business. This has numerous implications – revenues are recognised when the goods or services in question are delivered to the buyer though the cash payment from the buyer may not be realised within the accounting period. The cash outflow on purchase of raw materials in any accounting period may be much higher than the amount of expense on raw materials that is recognised in the profit and loss (P&L) accounts of that accounting period since only that value of raw materials that corresponds to the finished goods sold during the accounting period will be recognised as expense – the balance raw materials out of the total purchased would appear as inventories of raw materials, work in progress or finished goods held by the business. Based on the matching convention, the amount invested in plant and machinery is depreciated over the useful life of the assets such that only the amount of depreciation is recognised as expense in any accounting period even though the cash outflow on account of the investment in plant and machinery may take place in a single accounting period.

3.6.4 Flows and Stocks

An important concept underlying the standard ***Accounting Statement***s is the distinction between flows and stocks. The P&L account captures the flow of revenues and expenses for an accounting period whereas the balance sheet shows the stock position (or snapshot) of the assets and liabilities of the business as on a specific date. In line with the basic feature of double entry book-keeping (i.e., each transaction gives rise to equal debit and credit values) and the simple rule of debits and credit discussed earlier, the value of assets and liabilities must be equal for any balance sheet, irrespective of the date on which the balance sheet is drawn up.

3.6.5 Deriving Cash Flows from Accounting Statements

Based on the matching convention and the distinction between flows and stocks, the actual cash flows of the business during any accounting period has to be derived using both the P&L accounts for that period as well as the balance sheets at the beginning and end of the accounting period. It is often useful to distinguish between the cash flows arising from operations and those related to financing and investments – for this purpose, the items of assets and liabilities related to operations (i.e., the short term current assets and current liabilities) have to be distinguished from the long term balance sheet items related to financing and investment such as equity capital, long term loans, fixed assets and investments (long term). Since all cash inflows and outflows must ultimately get reflected in the cash and bank balance (liquid cash or cash equivalent) on the assets side of the balance sheet, the exercise of preparing a cash flow statement from the P&L accounts and balance sheet items should exclude the figure of cash and bank balances in the main body of the statement – the increase or decrease in cash and bank balances between the two successive balance sheets can then be used as a check against the figure derived from the cash flow statement prepared using all the non-cash asset items and all liabilities. The simple rule for balance sheet items is that the increase in any asset between the two successive balance sheets represents a use of cash while the increase in any liability represents a source of cash for the business. Conversely, the decrease in any asset is a source of cash while the decrease in any liability represents a use of cash.

3.7 CHAPTER SUMMARY: APPLYING FINANCE THEORY TO FINANCIAL MODELLING AND ANALYSIS

So far in Chapter 3, the two basic building blocks of finance theory have been covered, largely for the benefit of those readers without formal education/ training in finance. Stated simply, these two building blocks state that:

1. Other things being equal, a Rupee earned (or spent) today is worth more than a Rupee earned or spent tomorrow (or at any future date); and
2. A safe Rupee is worth more than a risky Rupee.

3.7.1 Output of the Financial Model

Taken together, these two building blocks have been used to outline the concept of Discounted Cash Flow (DCF), which is the fundamental basis for most financial analysis. We have also seen that the same DCF can be applied in two forms, namely, the NPV and IRR. These have been outlined in Sections 3.2 and 3.3 respectively. The natural question arising from this is which of the two, i.e., NPV or IRR is to be generally used in financial modelling and analysis. While this aspect is addressed in more detail using a ***Sample Financial Model*** in Chapter 4, some potential pit-falls of IRR have been discussed in Section 3.4. By and large, most finance texts advocate NPV as the most meaningful basis for investment decisions and the more theoretically superior measure but IRR is widely used in practice given that it is easier to communicate and intuitively appealing – this does not pose a serious problem as both NPV and IRR lead to the same decision in a majority of cases but the reader needs to be aware of the potential drawbacks of IRR. Readers should note that there have been attempts to resolve the potential conflict in ranking investment opportunities using NPV and IRR. The MIRR discussed earlier is one such attempt. Another interesting attempt along similar lines as MIRR is the so-called NPV rate of return (NPVR) – this is discussed in the text box "Going Beyond the Obvious (7): NPV Rate of Return"[13]. However, given the much wider usage of NPV and IRR as

[13]The text box covering NPVRR draws largely on the paper by Anderson, Barber and Keys of the Florida International University at Miami cited under "References" at the end of the book, though the author has modified the symbols used to conform to those already introduced earlier in this chapter.

compared to MIRR or NPVR for assessing an investment opportunity, the ***Output*** of the Financial Model covered in Chapter 4 are restricted to NPV and IRR.

To complete the coverage of theoretical aspects of finance relevant for financial modelling, the concept of risk, diversification and the CAPM has been briefly outlined in Section 3.5. However, it has been pointed out that assessing the opportunity cost of capital can be particularly difficult given that there are very few listed companies operating in the infrastructure domain that can be used as reference for working out the cost of equity on the basis of share price movements. The problems can become particularly cumbersome in applying CAPM to different economies and currencies where the degree of volatility of the local stock market, the country default risk and the composition of the revenues of any company being analysed all come into play. Ultimately, deciding on an appropriate discount rate for DCF analysis may often involve judgement with recourse to first principles – "the appropriate discount rate is the opportunity cost of capital or the expected return from an investment with equal risk." Since DCF analysis is based on cash flows while ***Accounting Statement***s are not, Section 3.6 has outlined some key concepts related to accounting needed to link cash flows to the values reported in standard statements of account and vice versa.

Text Box 3.6

Net Present Value Rate of Return (NPVR)

Going Beyond the Obvious 6: NPVR

The NPVR is a financial metric that aims to express the return on a Project in terms of the NPV of the Project, i.e., establish a functional relationship between the Project rate of return and NPV. Using NPVR instead of IRR allows us to resolve the conflicts between NPV and IRR when used for ranking investment opportunities in the following cases:

- Multiple IRR
- Mutually exclusive Projects with the same scale of investment but difference in the distribution of interim cash flows
- Mutually exclusive Projects with different scales of investment
- Cost of capital varies over the life of the Project

Like MIRR, NPVR addresses the implicit assumption of reinvestment of interim cash inflows at IRR by considering that all cash inflows are reinvested to earn a rate of return equal to the opportunity cost of capital, i.e., the discount rate "r" used for calculation of NPV. In line with the symbols used earlier for defining PV and NPV,

(*Contd.*)

we can consider a Project that requires an investment C_0 and yields cash inflows C_1, C_2... Cn over the Project's life of 'n' years. Now, C_1 invested to earn a return "r" will amount to C_1*(1 + r)^(n – 1) at the end of n years, C_2 invested to earn a return r will amount to C_2*(1 + r)^(n – 2) and in general the cash inflow C_i occurring at the end of "i" years from the initial investment will amount to C_i*(1 + r)^(n – i), which is nothing but the future value of C_i at the end of n years when invested to earn a rate of return equal to r. Now, NPVR is defined simply as that rate of return, which applied to the initial investment C_0 will yield at the end of n years the same amount of money as the sum of the future values at the end of n years of the interim cash inflows C_1, C_2… Cn invested to earn a rate of return r. Thus, NPVR is defined by the relation:

$$-C_0 * (1 + NPVR)^n = \sum_{i=1}^{n} C_i * (1 + r)^{(n-i)} \ldots (1)$$

It may be noted that the investment C_0 is a cash outflow and thus a negative value as per the convention adopted – we thus use $-C_0$ to represent the invested amount as a positive number. If we express the right hand side of the above equation simply by FV_n to represent the future value at the end of n years of all the interim cash inflows, we get by simplification:

$$NPVR = (FV_n / -C_0)^{1/n} - 1 \ldots. (2)$$

(2) can be recognized as the simple CAGR formula – NPVR is thus simply the rate of return per year that is required to grow the initial investment $-C_0$ to FV_n at the end of n years. Now, the term FV_n is equivalent to the present value at time t = 0 of all the interim cash inflows C_1, C_2, … C_n (say, PV_0) multiplied by $(1 + r)^n$. So, (2) can be re-written as

$$NPVR = (PV_0 / -C_0)^{1/n} * (1 + r) - 1$$

Now, from the definition of NPV, we have:

$$NPV = C_0 + PV_0, \text{ or } PV_0 = NPV - C_0$$

Substituting the above value of PV_0 allows us to establish a relationship between NPVR and NPV, which is:

$$NPVR = (1 + NPV / -C_0)^{1/n} * (1 + r) - 1$$

$$\text{Or, } NPV = -C_0 * [\{(1+NPVR)/(1+r)\}^n - 1] \ldots (3)$$

An approximation of the relationship given by (3) is possible by using the fact that the natural logarithm of (1 + x), i.e. ln (1 + x) is approximately equal to x for 0 < x < 0.3.

We can re-write (3) as follows:

$$1 + (NPV / -C_0) = \{(1 + NPVR) / (1 + r)\}^n$$

(*Contd.*)

Taking the natural logarithms of both sides and using the properties of logarithms (i) ln (a/b) = ln (a) – ln (b); and (ii) ln $(a)^m$ = m*ln (a), we get:

$$\ln \{1 + (NPV/ - C_0)\} = n^*\{\ln (1 + NPVR) - \ln (1 + r)\}$$

Using the approximation ln (1 + x) = x, we get:

$$(NPV/ - C_0) = n^*(NPVR - r)$$

$$\text{Or, } NPV = -C_0{}^*n^*(NPVR - r) \text{ .... (4)}$$

This relationship is intuitively appealing as it can be interpreted as follows:

The contribution to shareholder wealth as measured by NPV of a ***Project*** varies directly with:

- The amount of initial investment, i.e. the term "$-C_0$" in (4)
- The difference between the ***Project***'s expected rate of return (i.e. "NPVR") and the opportunity cost of capital (i.e. "r") as captured by the term "(NPVR-r)" in (4); and
- The life of the Project, i.e. the term in (4)

The use of NPVR to resolve Project ranking conflicts between NPV and IRR can be demonstrated. Referring back to ***Illustration 3.12***, we saw conflicts between two sets of mutually exclusive Projects (Project A, Project B) and (Project C, Project D), summarized below:

	NPV@12%	IRR		NPV@12%	IRR
Project A	122.4	22.62%	Project C	172.5	61.80%
Project B	154.3	21.98%	Project D	260.5	50.00%
Preferred Project	B	A		D	C

In both the cases, the use of NPVR to resolve the conflict is possible. For these simplistic sample Projects spread over 2 years, the calculation of NPVR is straight forward – the future values of the cash inflows in years 1 and 2 (year 0 being the point of time at which the investment is made, refer to ***Illustration 3.12***) at the end of the Project can be calculated using the same discount rate (12%) as used for NPV, the sum of the two future values divided by the initial investment amount and the resultant value being raised to the power 0.50 (n=2, thus 1/n=0.5) and then one subtracted. For Projects A and B, the values of NPVR work out to 18.66% and 20.33% respectively – the ranking on the basis of NPV is thus supported by NPVR and Project B selected. In case of Projects C and D, the values of NPVR work out to 45.60% and 38.13% respectively. The conflict in ranking is thus apparently not resolved. Here, an adjustment is required to address the difference in scale of investments. For this purpose, the value of $-C_0$*(NPVR-r) requires to be calculated – this works out to 84.0 and 130.7 for Projects C and D respectively, thus resolving the ranking conflict in favour of Project D with both NPV and (NPVR-r)*C_0 being higher for Project D. For mutually exclusive Projects with equal investments and lives the term (NPVR-r) can also be used for ranking.

The use of NPVR to resolve such conflicts is possible even for other situations where IRR runs into problems such as mutually exclusive Projects with different costs of capital or different life spans, Projects with multiple IRRs, etc.

We are thus well positioned to start applying our understanding of finance theory to arrive at the target ***Output*** of a Financial Model, a task we get into in earnest in the following chapter. However, to conclude this chapter, some of the key theoretical and conceptual elements that are essential for the effective development and use of ***Financial Model***s are summarised below:

3.7.2 Only Cash is Relevant

The entire concept of DCF is based on cash flows. It is essential that the ***Financial Model*** focuses on cash flows only for arriving at ***Output*** such as project IRR or equity IRR. In order to do this consistently and well, some understanding of accounting concepts is required. As discussed in Section 3.6, the reader should in particular appreciate that double entry book keeping is based on the accrual concept and not on the cash basis – i.e., revenues and expenses are recognised not when the related cash flows occur but on the occurrence of the event of a sale, with expenses being apportioned to the revenues that are recognised. Accounting is driven by conventions and standards that are no doubt based on sound logic but leads to a divergence between cash flows and statements of account – for example, accounting convention will lead to the recognition of income even if the customer has not yet paid (i.e., cash inflow has not occurred). Accounting also requires a distinction between current and capital expenditure. Even though the cash outflow for installing a piece of machinery may occur in the current year, accounting will treat this outflow as an expense in the form of depreciation over the useful life of the machinery rather than recognising the expense in the current year. However, this apportionment of capital expenditure for the purpose of accounting is not relevant for DCF and the Financial Model should reflect the cash outflow on capital expenditure as and when it occurs and since the depreciation charged in later years does not reflect a cash outflow, should not include depreciation in the cash outflows during later years that are included in the calculations. As an extension of this point, the Financial Model should avoid the inclusion of allocated costs and costs that are not incremental in nature, i.e., costs that will have to be incurred even if the project is not taken up. In the ***PPP/Project Finance Context***, it is likely that the human resource and support inputs prior to the setting up of the SPV would be provided by the promoter/sponsor – however, while accounting procedures may well call for an allocation of a part of the salary cost of the promoter/sponsor to the project, such allocated costs that will be incurred by the promoter/sponsor even if the project is not taken up should not get reflected in the Financial Model. In developing a Financial Model, such distinctions between cash flows and the figures resulting from accounting treatment must always be kept in mind and DCF measures such as IRR or NPV should be evaluated using arguments that represent the actual cash flows, unaffected by the accounting treatment or allocation. At the same time, projection of P&L accounts and balance sheets must reflect standard accounting treatment – it is not possible to do away with this requirement because some cash flow items, in particular outflows on account of income tax payable on profits generated by the project are driven by the accounting treatment.

3.7.3 Treatment of Working Capital

In the ***PPP/Project Finance Context***, some simplification of the approach required to capture the project's impact in terms of cash is possible. In many such projects, and particularly in case of toll roads, the revenues typically accrue in the form of cash only and there are effectively no debtors related to the project as users do not get any credit period for making payments – the payment of toll by the user and the use of the project road occur at the same point of time. Such projects also typically involve no inventories of raw materials, work-in-progress and finished goods, unlike a manufacturing concern. Given these characteristics, it is possible to develop the Financial Model ignoring working capital requirements. This is different from the standard approach used for a manufacturing project, where apart from the cash outflow on account of capital expenditure, some cash is also required to fund the net working capital – i.e., the current assets like debtors and inventories that are not funded by current liabilities such as payables to suppliers. Typically, the net working capital is linked to the scale of operations and with increasing revenues being projected over a period of time, it is also necessary to consider increasing amounts of cash required to fund the net working capital. As a result, a part of the cash inflows generated in every period effectively does not become available to the investors in the project because it has to be invested back into the business and any DCF analysis would be required to consider this aspect.

In case of infrastructure projects, it may be reasonable to ignore the impact of net working capital on cash generated. However, this is by no means the norm for all kinds of infrastructure projects. For a power plant that requires raw materials such as fuel and sells to customers who enjoy some credit facility, it would be necessary to project net working capital requirements as in case of any manufacturing project. However, if it is likely that the level of net working capital (NWC, i.e., non-cash current assets less current liabilities) will not change from one accounting period to another during the period of operations, the only material effect on cash flows that needs to be reflected in the Financial Model will be the use of some amount of cash in the first period of operations to fund NWC (if NWC is positive) and the release of the same amount of cash in the last period of operations. If NWC is negative, this effectively means that it serves as a source of cash that becomes available in the first period of operations but has to be repaid on liquidation of current assets and liabilities in the last year of operations, i.e., negative NWC becomes a use of cash in the last period of operations. In any case, irrespective of the treatment of NWC in the ***Financial Model***, cash should not be included under current assets – given that the cash is used as a balancing figure in projected balance sheets in most Financial Models, the inclusion of cash in NWC gives rise to unnecessary complication that is entirely avoidable.

3.7.4 Variation in Gearing and Cost of Capital

A characteristic feature of ***Project Finance***, already mentioned earlier in Section 2.3 given its importance, is that the capital structure of the SPV (hence the project since the project serves as the only *raison d'être* for the SPV in Project Finance) will change over time as debt is repaid. Now that we have an understanding of financial metrics such as NPV and IRR, we should re-visit this important point. Since the weighted average cost of capital (WACC) for the project depends on the capital structure (more specifically the debt-equity ratio), it is clear that WACC in the ***PPP/Project Finance Context*** does not remain constant but increases over time. How does this impact NPV? Clearly, there is no single value of WACC that can serve as the natural choice for the discount rate to be used. However, this is not a serious problem if we recall that the most general case for DCF metrics like PV and NPV does allow for the discount rate to differ in each period – in Chapter 4, we will address the calculation of NPV using WACC that changes from period to period. When it comes to IRR, however, we do have a problem – the decision rule using IRR is to accept projects if the IRR is more than the opportunity cost of capital. Now, with WACC varying from one period to another, what is the appropriate cost of capital – is it the WACC based on maximum gearing as in the first year of operations when all loans have been drawn down but repayment of these loans is yet to commence or the higher value of WACC when all the loans have been paid off? Should we then look at an average value of WACC against which we can compare IRR? If so, should it be a simple average or weighted average? Which measure of average is more appropriate – arithmetic mean or geometric mean? It is clear than any attempt to use IRR where the cost of capital varies from one period to the next opens up a Pandora's Box of difficult questions. For answers, readers have to go through Chapter 4, where we can tackle this issue after making a distinction between equity IRR and project IRR.

CHAPTER 4

Financial Model – Components, Outputs and Development

INTRODUCTION

This chapter provides the foundation for development of a Financial Model, armed with which the reader should be in a position to start developing a Financial Model independently.

The typical components that comprise any Financial Model irrespective of sector are first identified – these correspond to a standard set of nine worksheets that can be used across all Financial Models. The arrangement of these worksheets (i.e., components) for a logical flow is discussed. A standard format of cash flow projections for calculation of project IRR and equity IRR is then introduced. Having outlined the components as well as the target Output of the Financial Model, the last part of the chapter details the logical process of development of each component worksheet of the Financial Model such that these can then come together to produce the target Output. The reader is thus expected to understand first the typical components of the Financial Model, then the calculation of output values and lastly the logical development of components to arrive at the outputs. Through the second and third parts of the chapter, a Sample Financial Model for a road project is used to illustrate the calculation of Output as well as the development of the worksheets required to reach the Output.

Key Topics Covered in this Chapter

- The standard components/worksheets of the Financial Model
- The organisation of the standard worksheets in the Financial Model
- The standard Output of the Financial Model – project IRR, equity IRR, NPV and debt service coverage ratios
- The impact of leveraging on equity IRR; the use of grants and loans at subsidised rates to cover the viability gap of projects
- The coverage and sequential development of the components/ worksheets that lead to the Output

4.1 TYPICAL COMPONENTS OF A FINANCIAL MODEL

In developing a spreadsheet Financial Model, flexibility is a key objective, since projects can have unique features and develop over a period of time with increasingly more comprehensive and accurate data and bases for assumptions generally becoming available. However, it is still instructive to try and first identify the common features across projects, or even in case of a given project at different points of time in its development cycle.

4.1.1 Typical Inputs

All Financial Models start from a set of basic data and assumptions. Typically, these include:

Capital Cost: This is generally in the form of data from a project report but can even be based on benchmarks such as construction cost per square foot or cost per lane kilometre at an early stage of project development. Apart from the base capital cost, other pre-operative expenses such as consultant/ architect's fees, legal charges, fees for funding, etc., need to be assumed to ensure that the total investment required is captured. In general, all cash expenses, (outflows of cash) that have to be incurred in order to put the project assets into regular operation should be captured as part of the capital cost.

Construction Period and Phasing of Capital Costs: This covers the spread of capital costs over the initial construction period of the project, i.e., what proportion of the total cost will be incurred in each period during construction. This by extension means an assumption about when the project will become operational and start producing revenues. In a standard project, the capital costs spread over the construction period represent the negative cash flows (outflows) that form the initial part of the set of cash flows that characterise the project, followed by cash inflows over the balance period of the Project Time-Line with the project assets created by the investment becoming operational and producing revenues. However, real life projects are not necessarily characterised by such a standard set of cash flows, i.e., negative cash flows in the initial periods (construction period) followed by positive cash flows for the balance useful life of the project assets. The investment in a real life project may well be spread over several phases, with capacity being augmented in line with growing demand. In such cases, negative cash flows in the initial periods (first phase of investment) may well be followed by some periods of positive cash flows as the first phase assets become operational and then by negative cash flows as the second phase is taken up. In many cases, the timing of subsequent phases after the initial one may not be fixed up front but driven by growth in demand – the second and subsequent investment phases are taken up when demand catches up with the capacity created by past investments.

Financing: Broadly, this relates to the proportions of the capital cost, i.e. as to how much will be funded by equity and how much by debt. In addition, assumptions about the cost of debt and its tenure including moratorium on repayment (if any) are required. In case of any grants being available for funding the projects, the quantum of such funding also forms part of this set of data/assumption forming part of the Input of the Financial Model.

Revenues: Typically, projection of revenue requires assumptions about the level of output/usage over the operations period and projection of the prices at which this output/usage will be purchased in each relevant period, in effect, a demand schedule for each period of the Project Time-Line. For example, in the case of a road project we need assumptions about the level of traffic using the project road including break-up of the total traffic into categories tolled at different rates as well as the toll rates for each category and how these will change over time. Typically, a base level of traffic in the first period and the growth rate in subsequent periods is assumed based on traffic surveys forming part of the project report. The assumptions may get more complex if there is a differential pricing such as different toll rates for frequent users and vehicles returning the same day. Tolls or other charges and operating expenses may be linked to inflation, which then needs to be assumed. Similarly, a port project would require assumptions about the port's throughput of cargo and its composition in the future years, along with assumptions on the tariff rates for different types of cargo and vessels, in order to project the revenue stream over the port's Project Time-Line. To summarise, it may be said that for every type of infrastructure project, the Financial Model requires the assumption of two functions with time period as the independent Project Variable for revenue projection – one relating demand/output to time over the Project Time-Line and another expressing price of the project's output as a function of time. To the extent that there are different categories of users (for example, cars and commercial vehicles for a toll road or feeder vessels and mainline vessels for a port), a function for each category is required, both for the level of use and the price paid for such use. Of all the components of the Financial Model, revenue projections have the greatest scope for project and sector specific characteristics requiring good understanding of the project and sector on the part of the modeller.

Operating Expenditure: Such expenses during the operation of the project covering salaries, raw materials including power/fuel, maintenance, etc., need another set of assumptions similar to that required for revenue projection, with each component of the operating expenditure being driven by the level of input required (either driven by output or relatively fixed in nature) and the unit cost for such components and the sub-components/categories for each component.

Miscellaneous Data: Lastly, general assumptions/data on applicable depreciation and taxation rates are required, along with assumptions about economic variables like inflation rate.

4.1.2 The Nine Standard Worksheets

In developing a Financial Model, rather than using one or two worksheets to cover all of the above, which becomes incredibly messy in all but the simplest cases[1], it makes sense to broadly use at least nine standard worksheets in all Financial Models with the abbreviations indicated being useful for naming the worksheets using a brief and descriptive label, though these are by no means sacrosanct. It may be noted that each of these standard worksheets will have a Project Time-Line row, right at the top (say, row 3 or 4) in worksheets other than the "A&D" worksheet. The first column in the time-line row (typically, column A) will typically have a label such as "Financial

[1]For the simplest type of Financial Models, the worksheets described may be replaced by sections placed vertically one below the other on a single sheet, clearly demarcated.

Year (FY) Ending March 31st" while the subsequent columns of the time-line row (column B onwards) will have time-line values corresponding to years such as "2009"," 2010", etc. Of course, other time-line scales such as half years, quarters or months are possible, but it is the author's experience that such further splitting of the time-line is justified only if detailed values/assumptions for Project Variables such as "construction expense" or "debt draw-down" are available on a similar semi-annual, quarterly or monthly basis. The nine (9) standard work-sheets are as follows:

"A&D" Worksheet – Assumptions and Data: covering in effect all the assumptions and data relating to the project. By definition, the "A&D" worksheet should not contain calculations or formulae beyond very basic ones related to data or assumptions such as summing up of capital cost components to arrive at the total capital cost.

Miscellaneous Data: For convenience and ease of reference/use the A&D sheet should be divided into sections corresponding to the various aspects discussed in the previous Section 4.1.1. As an example, the A&D sheet may be divided into covering:

A. Capital Expenditure
B. Time-lines & Phasing of Capital Expenditure
C. Financing Assumptions
D. Revenue Assumptions
E. Operating Expenditure Assumption
F. Other Assumption-Miscellaneous

"C&F" Worksheet – Capital Expenditure and Funding: covering the phasing of capital expenditure over the construction period, calculation of Interest During Construction (IDC) and funding. In particular, the loan schedule showing repayment of loans and other sources of debt or grant funding used to meet the capital expenditure (i.e., except equity) should be covered in this worksheet.

"Rev" Worksheet – Projected Revenue Generated by Operations: typically this requires projection of rates and the volumes to which such rates are applied, driven by the assumptions in this regard on the "A&D" worksheet. For example, in case of a toll road project, the rates to be projected would be the tolls to be charged for various categories of vehicles while the volumes in question would be the projected level of traffic including the break-up of this projected traffic into different vehicle categories corresponding to the toll rates.

"Opex" Worksheet – Projected Operating Expenditure: covering the projection of expenses related to the operation and maintenance of the project assets. Typically, operating expenditure would comprise components for manpower costs, raw material/inputs required for operation and expenses related to the maintenance of the project assets.

"Dep" Worksheet – Depreciation of the Project Assets: covering the calculation of depreciation, both from Income Tax point of view and accounting depreciation for every year/period covered by the Financial Model.

"Tax" Worksheet – Income Tax Calculation: taking into account any tax benefits such as Section 80IA of the Income Tax Act, Minimum Alternate Tax (MAT), carry-forward losses, the difference between depreciation as calculated for reporting purpose (typically using rates specified by the Companies Act, 1956) and depreciation as per the Income Tax Act, 1961 as well as any other relevant provisions related to tax on income.

"P&L" Worksheet – Projected Profit & Loss Accounts: bringing together elements of revenue, operating expense, interest payment, depreciation, tax, etc. from the other worksheets in a standard P&L format, for every period covered by the Financial Model.

"CFlo" Worksheet – Projected Cash Flows: bringing together elements such as cash flows generated from operations, capital expenditure, loan repayment, etc., from other worksheets in a standard format to project the cash outflows and inflows for the project SPV. This worksheet will generally include the calculation of primary Output such as project IRR, Equity IRR and NPV values that are all based on cash flows rather than accounting measures.

"BS" Worksheet – Projected Balance Sheets: showing the projected level of assets and liabilities as at the end of every period covered by the Financial Model. As in case of the "P&L" and "CFlo" worksheets, the "BS" worksheet will typically draw on the other worksheets.

The first six sheets named above represent the back-end of the Financial Model, i.e., covering the Input for the Financial Model (data and assumptions on the "A&D" worksheet) and the Model Core comprising the five intermediate worksheets covering the calculations that together provide the output values used on one or more of the three Output sheets – "P&L", "CFlo" and "BS", which in effect represent the Output or front-end of the Financial Model that gets presented to users. Broadly, the "A&D" worksheet represents the input or data entry section of the Financial Model, the five worksheets “C&F”, “Rev”, “Opex”, “Dep” and “Tax” represent the Model Core or calculation section while the balance three worksheets represent the Output sheets of the Financial Model that draw on values arrived at in the Model Core. However, it should be recognised that this distinction is not completely valid. For example, the “Tax” worksheet will use as a starting point the Profit Before Tax (PBT) figure from the “P&L” worksheet, which is in effect an Output sheet. Similarly, the “BS” worksheet will use inputs from other Output sheets such as “P&L” (to project the addition to reserves due to profits generated but not distributed, for example) and “CFlo” (the cash balance shown on the “BS” worksheet is typically a balancing item that is drawn from the “CFlo” worksheet). The Output sheets contain only elementary manipulations such as addition and subtraction of line items along with formulae using functions such as IRR. Any formula that involves more complicated working should rightly not be on these worksheets.

While projected balance sheets are at times not vital and can be omitted without much effect, the projection of balance sheets, with its inherent equality of assets and liabilities in the double entry accounting system is a good check on the rest of the Financial Model. If the rest of the Financial Model is correct, it should be possible to create a projected balance sheet in which figures are drawn from other sheets with the cash balance (from the “CFlo” worksheet) becoming the balancing item on the assets side and the figure corresponding to the portion of net profit (post tax) not distributed to shareholders as dividend from the “P&L” worksheet the corresponding balancing figure of the liabilities. The three Output worksheets thus get linked on the “BS” worksheet. However, projecting balance sheets also requires a reasonably good grasp of the accounting principles at least at the conceptual level, without which a modeller may find himself or herself increasingly frustrated by the inability to “make the balance sheets balance” while it is not really essential to the financial evaluation of the project. However, projected balance sheets should form part of the standard set of worksheets in a Financial Model and should be discarded only in case of Financial Models that are developed during an early stage of the project development cycle.

The rationale underlying some of the above components, such as the “A&D” worksheet has been developed in the next chapter (Chapter 5) under best practices in financial modelling. For the time being, the reader may take the organisation of the Financial Model into worksheets outlined above as given and proceed. The astute reader is also likely to have noted the correspondence of the Financial Model’s structure in terms of worksheets as described here with the schematic of the Financial Model in the opening chapter (***Illustration 1.2***). The standardisation in terms of the above worksheets is in itself a good practice – however, this does not mean that there is no scope for judgement in modelling a particular project. The modeller can always add (rarely reduce)[2] from the basic set of nine worksheets shown above, depending on the complexity and importance of any particular aspect like operating expenditure and/or operating expenditure. Of course, any such worksheet should be named as descriptively as possible for the benefit of future users of the Financial Model. For example, in case of a large road projects it may make sense to have a separate sheet for projected traffic as this typically involves complicated assumptions for projection of traffic besides being a key driver of project returns.

A “Presentation” or “Key Results” worksheet is a good practice for finally presenting the Financial Model in a report created as a Word document or in a presentation, one or both of which is generally the case. While it is possible to copy various ranges from the Financial Model file and edit the same in Word (generally as tables), it is advisable to create the presentation formats in the Excel file itself and minimise editing after copying to Word to minor aspects like font type, font size, table formats, etc., as required. Similarly, at the end of the development cycle, it often makes sense to create links to some of the key Output like project IRR and equity IRR (calculated on the “CFlo” sheet) on the “A&D” sheet itself. This simplifies the task of sensitivity analysis considerably as one does not have to keep skipping between the “A&D” and “CFlo” sheets in order to see the impact of a change in any Project Variable on the Output.

4.1.3 Arrangement of Standard/Other Worksheets

For the more complex Financial Model, it is a good idea to include an “Index” worksheet listing the contents of the other worksheets with hyperlinks to these worksheets, a description of any colour coding used in the Financial Model as well as documentation of instructions for users, data sources used and an explanation of the logic underlying the development of the Financial Model. This is also a good way of ensuring that the modeller explicitly considers and documents the rationale used for developing the Financial Model, though for a complex Financial Model the “Index” worksheet may not suffice for the

[2] In some Financial Models, especially if not much detail about various categories of fixed assets are not available and the income tax calculations are reasonably straight forward, it may be possible to combine the “Dep” and “Tax” worksheets.

required documentation and separate documentation explaining the code may be required.

In organising the worksheets, it makes sense to go with the flow of data and intermediate outputs from one sheet to another such that any worksheet makes use of (or refers to in the formulae used) only results/cells of worksheets that lie to its left. Thus, the worksheets going from left to right should generally be as follows:

- "Index" (left-most sheet)
- "A&D"
- "C&F"
- "Rev"
- "Opex"
- "Dep"
- "Tax"
- "P&L"
- "CFlo"
- "BS"
- "Presentation" (right most sheet)

It should not be expected, however, that there will be no instance of an intermediate output moving from right to left across worksheets. As mentioned earlier, the "Tax" worksheet will take as the starting point the PBT figure from the "P&L" worksheet to its right – in other words, the intermediate output PBT moves from right to left from "P&L" worksheet to the "Tax" worksheet. Put differently, the "Tax" worksheet will contain formulae referring to cells on the "P&L" worksheet that lies to the right of the "Tax" worksheet. However, barring a few such exceptions, arranging the worksheets left to right in the order shown above will ensure that most formulae contain references to cells on worksheets to the left of the worksheet where the formulae is being entered. In Section 4.3 the sequential development of the worksheets is covered in greater detail using a Sample Financial Model for a road project.

4.2 FINANCIAL MODEL – TARGET OUTPUT

4.2.1 Project IRR, Equity IRR and Leveraging

The standard objective of a Financial Model is to assess the viability of the project being modelled. Obviously, the viability of a project is indicated by the return generated by the project and measures of return are typically the primary Output of the Financial Model that we are interested in. In this context, a pre-requisite for calculating and using returns correctly is the ability to (at least) conceptually distinguish between the investment required in a given project and the financing of that investment (in broad terms, the equity financing vis-à-vis debt funding). In most standard corporate finance textbooks, a distinction is made between these two essential aspects of finance – generally, the analysis of investment opportunities (i.e., the investment decision) is covered first without considering the financing of the investment if it is accepted for implementation (i.e., the financing decision). As a start, it should be appreciated that any given project has an intrinsic rate of return not affected by the financing decision, known as the project IRR. The project IRR is essentially the return generated if the project is funded entirely by equity – it is thus a measure of project profitability or return without considering how the project is funded.

To appreciate the distinction between the project IRR and the equity IRR, it is necessary to understand the concept of financial leveraging or gearing, which is measured by the ratio of debt funding to equity funding commonly referred to as the debt-equity ratio. Thus, if a project requiring an investment of ₹ 100 is funded by ₹ 60 of debt and ₹ 40 of equity, the debt-equity ratio is 1.5 or 60:40. Financial leveraging as a concept basically reflects the fact that equity investors in a project are in a position to earn a rate of return higher than the project's overall rate of return, if this overall rate of return is higher than the cost at which debt can be raised for the project. On the other hand, in case the project IRR turns out to be lower than the cost of debt, leveraging will tend to lower the return (or amplify the losses) accruing to the equity investors.

To understand better the concept of leveraging, consider the fact that any project can generally be funded at least partly by debt. The fundamental difference between debt and equity funding is that the return on debt (i.e., the interest payable) is fixed up-front regardless of the actual performance of the project (though default risk exists) while the return on equity is uncertain and is essentially the return generated by the residual cash flows from the project after taking care of debt servicing, which has priority in terms of the allocation of free cash flows – debt thus involves a lower degree of risk as compared to equity[3]. Even in case of default, the lenders can expect to recover their invested principal amount and the accumulated interest income provided that the borrower's assets can be sold to yield a realisation that is greater than the amount due to lenders. As in the case of the cash flows generated by operations, lenders have priority over equity investors when it comes to appropriating the proceeds from the sale of the assets of a corporate entity that has defaulted on its obligations and has in consequence been declared bankrupt.

Apart from the default risk, investors in debt instruments also face an interest rate risk, arising from the inverse relationship between bond prices and interest rates described in Text Box 5 – in case the investors have to sell their holdings of debt instruments at any point of time when interest rates have increased, they would realise a value lower than that invested (or in other words, book a capital loss). However, in relation to an investment in equity, it can be said that debt investment carries lower risk. Accordingly, in line with our earlier discussions on the risk-return trade-off in Chapter 3, the lower risk associated with debt funding in comparison to equity funding is reflected in a lower expected return on debt funding (or cost of debt) as compared to the expected return on equity funding (or cost of equity) for any project with a given level of risk. With the relationship between the cost of debt (say, r_d) and cost of equity (say, r_e) for a project being always such that $r_e>r_d$, the actual return generated by the project (say, r_p) has to be in any one of the following three positions relative to r_d and r_e:

- $r_p<r_d<r_e$
- $r_d<r_p<r_e$
- $r_d<r_e<r_p$

The impact of leveraging is directly linked to the three relative positions of r_p, r_d and r_e. To understand this easily, it is best to consider a simple one-period project funded by debt to the extent of D and an equity amount of E, such that the total project cost is (D+E). Suppose the project generates a

[3] Another difference that can be considered to be of a fundamental nature is that the return on debt, i.e. interest is paid out of pre-tax cash flows – in other words, interest paid by the borrowing corporate entity is tax deductible. On the other hand, returns can be distributed to equity investors in the form of dividend only out of post-tax cash flows of the corporate entity under most (so called "classical") tax systems, i.e. dividend paid to shareholders is not a tax deductible expense for the corporate. This in turn implies that there is an element of double taxation as far as dividends are concerned – in the first instance, dividend is paid out of the corporate entity's net income after payment of corporate income tax and secondly taxed as personal income of the shareholder. This aspect is explored in more detail subsequently – for the time being, the concept of leveraging is illustrated ignoring taxation of income, both corporate and personal.

return of r_p and the debt funding carries a cost represented by r_d. The total cash generated by the project is given by:

Total cash generated by the project = $(1+r_p)*(D+E)$

Of this, the amount required for debt servicing is given by:

Total cash required for debt servicing = $(1+r_d)*D$

As mentioned above, the cash available to the equity investors is the residual amount of cash generated by project remaining after debt servicing. Thus, the cash available for equity investors is given by:

$$\text{Cash available to equity investors} = (1+r_p)*(D+E) - (1+r_d)*D$$
$$= E*(1+r_p) + D*(r_p-r_d)$$

If r_e be the return earned on the equity, we must have:

$$(1+r_e)*E = E*(1+r_p) + D*(r_p-r_d)$$

OR, $$(1+r_e) = (1+r_p) + (D/E)*(r_p-r_d)$$

OR, $$r_e = r_p + (D/E)*(r_p- r_d)$$

Thus, in a leveraged project (i.e. one funded partly by debt), the rate of return on equity r_e is higher than the project return if $r_p-r_d > 0$, i.e. $r_p > r_d$ and less than the project return if $r_p < r_d$. The extent to which the return on equity gets increased or decreased obviously depends on D/E, which is nothing but the debt-equity ratio for the project (also known as its leveraging). The above concept holds even for a project that extends over several periods with debt servicing in any given period comprising both interest payments and repayment of principal. Of course, it is not possible to increase the leverage beyond a point because lenders view excessive leverage as increasing the financial risk associated with the project. This is understandable given that the extent of "over collateralisation" available to lenders corresponds to the equity funding of the project. "Over collateralisation" may be thought of as the excess of the value of project assets over the amount of debt funding, which represents the room available for absorbing any decline in the value realised from the sale of the project assets in case of a default by the borrower. In any case, increase in leverage beyond a point can be achieved (at least in theory) only by offering to pay a higher rate of interest to lenders in line with the increased risk, thus negating the advantage of higher returns to equity investors (provided $r_d>r_p$). For all practical purposes, the extent of leverage thus tends to be driven by the market, i.e., what is acceptable to lenders, though this may vary from one infrastructure sector to another. It is theoretically possible in case of corporate borrowing that a strong and well established corporate entity may be able to leverage slightly more than the market driven level on the strength of its reputation but this is an unlikely scenario in Project Finance, where the only determinant of leverage (and the cost of debt) apart from the market could be the structure of the project itself – a better structured project with comprehensive identification and allocation of project related risks may be able to leverage slightly more than the average project. In the Indian context, debt-equity ratios ranging from 60:40 to 80:20 are seen for PPP infrastructure projects, with the mid-point of the range, i.e., a debt-equity ratio of 70:30 being fairly typical.

To appreciate the application of the leveraging fully, consider the following numerical examples:

If r_p = 15%, r_d = 12% and D/E = 2, r_e = 15% + 2*(15% - 12%) = 21%

If r_p = 10%, r_d = 12% and D/E = 2, r_e = 10% + 2*(10% - 12%) = 6%

If r_p = 15%, r_d = 12% and D/E = 3, r_e = 15% + 3*(15% - 12%) = 24%

If r_p = 10%, r_d = 12% and D/E = 3, r_e = 10% + 3*(10% - 12%) = 4%

Thus, we see that leveraging can have a dramatic impact on the return on equity, with higher levels of leveraging leading to greater impact on the return on equity. As special cases arising out of the above concept, it is clear that the provision of capital grants or loans at subsidised (lower than market) interest rates by the Government for certain categories of infrastructure projects rely on the concept of leveraging to ensure that the return on equity is high enough to attract private sector investors even though the return on the project r_p is low and the stand-alone return on equity r_e generated without grants or loans at subsidised interest rates lower than that required to induce private sector equity investment in the project, i.e., the so-called "viability gap". Moreover, it is also clear from the above that the subsidised rate on the loan has to be lower than the return on the project r_p for leveraging the return on equity. For example, with r_p=8%, and the subsidised interest rate on the loan provided, i.e., r_d being 4% and twice the equity investment provided as a loan at this subsidised rate (i.e. D/E = 2), the return on equity r_e would be 16% i.e. 8% + 2*(8% - 4%).

The case of capital grants is different in that, unlike a loan at a subsidised interest rate that has to be repaid, the grant does not have to be repaid. With the amount of grant provided being represented by D and assuming the balance is funded be equity (E) no cash is required for debt servicing. We would thus have:

$$(1+r_e)^*E = (1+r_p)^*(D+E)$$

OR, $$r_e = (D/E)^*(1+r_p) + r_p$$

It should be noted that the above relation holds only for grants, where no interest is payable and the principal amount does not have to be repaid, so that the term $D^*(1+r_d)$ representing debt servicing can be dropped in the relationship between return on equity and residual cash available for equity investors discussed earlier.

Supposing, as in the earlier example of a loan made available at the subsidised interest rate, that the project generates a return r_p=8% and 15% of the equity investment is made available as capital grant (i.e. D/E = 0.15). In this case, the return on equity r_e would be 24.2% i.e. 8% + 0.15*(1 + 8%). Thus, even a small amount provided as grant can serve to leverage the return on equity significantly – this is an important consideration in trying to structure projects with low project returns for private sector participation. In other words, the provision of grants can be a powerful tool in PPP Project Structures.

Armed with the understanding of financial leveraging, it is easy to see that we would be interested in capturing as Output of the Financial Model at least the project return r_p and the return on equity r_e, which are nothing but the project IRR and equity IRR introduced at the start of this Section. The project return r_p would tell us what intrinsic return the project generates considering it to be funded entirely from equity, which is an important starting point for exploring financing structures that can be used to increase the return on equity so as to make the project viable for private sector equity investment. The essential points to be noted is that the project IRR is calculated on the cash-flows for the project as a whole as if it were financed entirely by equity while the equity IRR is calculated on the cash-flows that are either contributed by the equity investors to the project (equity infusion) or accrue to the equity investors after all other expenses and outflows including debt servicing (both interest and principal) as well as the other (non-equity) sources of funding have been taken into account.

In other words, the cash-flows to be considered for calculation of equity IRR are essentially residual in nature. Of the cash going into the project, the equity investors contribute the residual amount required to meet the capital expenditure after all other sources of funding have been used in each period during construction. Of the cash generated by the project during operations, the amount accruing to the equity investors and hence relevant for the calculation of equity IRR are the residual amounts left over, after all other expenses and outflows in the form of debt servicing, tax, etc., have been met in each period. In case the cash generated by the project in any given period during operations is less than the requirement of cash for meeting expenses, debt servicing and tax, the residual nature of the equity cash-flows imply that the equity investors have to invest additional amounts in such a period to make good the shortfall, meaning that the investment by equity investors continues into the operation phase of the project.

4.2.2 Calculation of IRR in the Financial Model

Having looked at the concepts of project IRR, equity IRR and the impact of leveraging on equity IRR, we now consider the calculation of project IRR and equity IRR in a typical Financial Model that involves funding through a mix of equity, debt and capital grant. ***Illustration 4.1*** overleaf provides an example of projected cash flows and the calculation of project IRR and equity IRR.

In the sample "CFlo" worksheet shown in ***Illustration 4.1***, the components are drawn from various worksheets of the Sample Financial Model. The capital expenditure, IDC, repayment of debt and all sources of debt funding and grants are all values taken from the "C&F" (Capital Expenditure & Funding) worksheet. The values of interest (distinguished from IDC), OPBDIT and Tax are taken from the "P&L" worksheet. With all these values in place, the equity cash flows (i.e., the equity invested by the developer as well as the cash available to the equity investors during operations) are calculated as residual values on the cash flow sheet itself. In the illustration, for example, the equity cash flows shown in row 19 represent the difference between cash from sources other than equity (row 18) and total uses (row 10, which is essentially the sum of values in rows 5 to 9. It may be noted that there are cash inflows to equity investors only when the cash generated (row 14) exceeds the sum of all uses (row 9). Typically, the total uses of cash will exceed the cash available from all sources excluding equity during the construction period and the situation will get reversed only after operations commence and revenues are generated. After commencement of operations, there is essentially only one source of cash, which is the OPBDIT or cash generated by operations.

ILLUSTRATION 4.1

Standard Cash Flow Projection Format for Calculation Project IRR and Equity IRR (Sample Financial Model)

	A	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
3	FY ending March 31,	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
5	USES:															
6	Capital Expenditure (excl. IDC)	743	2,535	614	398	0	0	0	0	0	0	0	0	0	0	0
7	IDC	7	143	44	0	0	0	0	0	0	0	0	0	0	0	0
8	Interest	0	0	219	279	265	240	215	190	165	140	115	90	52	13	0
9	Repayment of Debt	0	0	0	250	250	250	250	250	250	250	250	250	500	250	0
10	Income Tax Paid	0	0	0	0	0	0	0	0	0	0	0	33	31	79	85
11	Total Uses (Sum: Rows 6 to 10)	750	2,678	877	928	516	491	466	441	416	391	366	373	584	342	85
13	SOURCES:															
14	Grant	134	478	117	71	0	0	0	0	0	0	0	0	0	0	0
15	Term Loan	419	1,496	367	223	0	0	0	0	0	0	0	0	0	0	0
16	Bonds	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Cash from Operations (OPBDIT)	0	0	139	252	362	383	405	359	516	543	639	673	541	924	971
19	Sources Excluding Equity	553	2,473	624	546	362	383	405	359	516	543	639	673	541	924	971
21	Equity Cash Flows (Post-Tax): Row 19 minus Row 11	(197)	(205)	(253)	(383)	(153)	(108)	(61)	(81)	100	153	274	299	(42)	583	886
24	Project Cash Flows (Before Funding/ Tax): Row 17 minus Row 6	(743)	(2,535)	(475)	(147)	362	383	405	359	516	543	639	673	541	924	971
27	Equity IRR (Post-Tax)	18.0%	Calculated on cash flows in row 21													
30	Project IRR (Pre-Tax)	14.1%	Calculated on cash flows in row 24													

Note: IRR is calculated on cash flows projected till FY ending March 31^{st}, 2041 in column AM, with the later FY's not shown in the illustration above. Some rows have been deleted for the purpose of presentation. Readers may refer to the Sample Financial Model on the CD. The hidden columns B, C and D may be ignored – the purpose of hiding these columns is explained in Chapter 5.

Having examined the calculation of equity IRR and issues related to it, we can now turn our attention to the calculation of project IRR. Keeping in mind the definition of project IRR discussed earlier, it is clear that we must seek the set of cash flows that represent the project as a whole if it were to be funded by equity only. It is clear that in such a scenario, there would be no IDC, interest or repayment of loans and these components of the "CFlo" worksheet should not enter into our calculation. Given the understanding that financing decision should not affect the project IRR, we can immediately see with reference to ***Illustration 4.1*** that apart from Capital Expenditure (excluding IDC), i.e., row 3 and Cash from Operations (OPBDIT), i.e., row 13, all the other components are affected by the financing decision or in case of the Financial Model, the assumptions made regarding financing on the "A&D" worksheet. If we consider the project to have been funded entirely by equity, the cash outflows during construction would be equal to the capital expenditure and the inflows available to the equity investors after commencement of operations are equivalent to the cash from operations (OPBDIT), since there would be no interest and loan repayment to consider with 100% equity funding.

Thus, the relevant cash flows for calculation of project IRR are arrived at using only rows 6 and 17 in row 24 of the illustration, which has the formula "row 17 values minus row 6 value". The IRR calculated on the set of cash flows thus generated in row 24 represents the project IRR. Note that this is the pre-tax project IRR since the outflows on account on tax on profits generated by the project have not been considered. The reasoning for this is simple. The amount of income tax depends on the financing of the project due to the fact that interest payments are deductible for income tax purpose – this is the tax shield provided by borrowing or debt. Since project IRR is essentially independent of the financing decision (i.e., the quantum of loans and therefore the rate of interest paid on such loans), it does not make sense to talk about post-tax project IRR since income tax is affected by financing.

However, should one wish to make an "oranges to oranges" comparison between equity IRR and project IRR both on post-tax basis, it is possible to look at the post-tax project IRR by deducting the tax amount (in row 10) from the pre-tax project cash flows in row 24 to create a row that represents the post-tax project cash flows. The IRR formula can then be applied to this row to arrive at the post-tax project IRR – in the illustration shown, this would work out to 13.2% as compared to the pre-tax project IRR of 14.1% shown in the illustration. It should be kept in mind, however, that post-tax project IRR makes sense only for the purpose of comparison with post-tax equity IRR in the context of a given financing structure since it goes against the basic concept of project IRR as being independent of the financing structure. On the other hand, one may also wish to calculate the equity IRR on a pre-tax basis, possibly for comparison with the expected pre-tax return on equity. This can be easily accommodated in the format shown by adding a row that adds back the amount of tax in row 10 to the post-tax equity cash flows in row 21 and then calculating IRR on this row. Though such a row is not shown in the illustration due to the limitations of space, the pre-tax equity IRR in the illustration works out to 19.2% as compared to the post-tax equity IRR of 18.0%.

4.2.3 Cash and Dividends – Key Issues

It should be noted that the equity IRR is not affected in any way by dividend payouts assumed in the Financial Model. In fact, the cash flow format shown in ***Illustration 4.1*** does not even provide for dividends. The reasoning for this is simple – dividends would have to be paid out of the residual cash flows available to the equity investors and such residual cash flows are already taken into account in the calculation of equity IRR shown in the cash flow format. The effect of deducting dividend payments out of these residual cash flows and then adding back these dividend payments to the cash flows accruing to the equity investors would thus be nil. From the equity investors' point of view, it is immaterial whether the residual cash flows accruing to them are paid out as dividend or retained on the balance sheet – in the latter case the value of the cash retained on the balance sheet would get reflected in the value of the shares held by the equity investors. Some would argue against this point by pointing out that most SPVs for PPP projects are unlisted entities and there is no ready market where the equity investors in such companies can realise the increase in the value of equity shares held in the SPV due to cash retained on the balance sheet. This is not quite correct as equity investors in the SPV should be able to find buyers for their equity stakes at a fair value that reflects the liquid assets of the SPV as well as its ability to generate cash in the future even outside stock exchanges – private equity players being one example of such buyers.

In any case, the point being made here is not related to whether the SPV implementing the PPP project should pay dividends or not. As in the case of any other corporate entity, it is expected that the SPV will retain cash rather than paying it out as dividends to equity investors only if it has opportunities to re-invest such cash to earn the rate of return expected by equity investors. Otherwise, it would only make sense for the SPV to pay out all residual cash accruing to equity investors as dividends so that such investors may then invest the dividends received by them in other investment opportunities available to them that yield their expected rate of return on equity investments. Given the basic nature of the SPV for a PPP project, i.e., its formation solely for the purpose of implementing the project, it is only to be expected that the opportunities available to the SPV to re-invest cash not paid out to equity investors would be limited as compared to a more general purpose corporate entity that can expand and diversify its operations. To that extent, it is all the more likely that the SPV will pay out most of the residual cash accruing to equity investors as dividend rather than retaining such cash. The limited point being made here is that assumptions regarding dividend pay-out and incorporation of dividend into the cash flow format of the Financial Model are not necessary for the calculation of equity IRR.

At the same time, it should be borne in mind that a Financial Model built without dividend pay-out being incorporated as illustrated in this text will typically use cash as the balancing item on the assets side of the balance sheet. In other words, whereas the PAT from the "P&L" worksheet will get added to shareholders' reserves on the liabilities side of the "BS" at the end of every year or period covered by the projections, the change in cash as derived from the "CFlo" worksheet of the type shown will get added to the cash balance shown on the assets side of the "BS" worksheet. This approach will thus show up in the form of high cash balances in the projected balance sheets of later years/periods – some issues arising out of this approach are discussed later in this chapter. Some modellers do ignore the lack of relevance of dividends by explicitly assuming distribution of dividends and factoring this into the Financial Model, then calculating equity return based on the cash flows distributed as dividend to equity investors rather than the residual cash flows available to the equity investors. While such explicit treatment of dividend does help to address the issue of ballooning cash balances projected in later periods, there is limited rationale for preferring cash distributed as dividend to equity investors over the residual cash available to equity investors for calculation of equity IRR as illustrated. One possible scenario where the distinction may make sense is if there are any legal constraints that apply to dividend distribution. For example, the lenders to the project may impose restrictions of dividend pay-outs through the loan agreements for the project and require a debt redemption reserve to be created. In such cases, considering the amount set aside in the debt redemption reserve as being available for debt servicing is acceptable.

It should be noted that in case of the Sample Financial Model, which is for a road project, working capital requirements are not significant and therefore ignored[4]. In any project where working capital requirements are significant, the cash generated by operations will not be reflected only by OPBDIT but by OPBDIT+ΔNWC, where NWC is net working capital given by (non cash current assets less current liabilities) and ΔNWC represents the change in net working capital from the balance sheet date of the previous financial year/period. Thus, wherever working capital requirements are significant, OPBDIT in this discussion should be replaced by OPBDIT+ΔNWC.

As mentioned earlier, the payment of interest and repayment of loans (i.e., debt servicing) have the first claim on the cash generated from operations (i.e., OPBDIT) and it is only in the event of cash being left over after debt servicing, that the equity investors have cash inflows that represent returns on the equity invested. It should be noted that it is not essential that there be cash inflows to equity investors in every period after commencement of operations. It is possible that the cash generated by operations (OPBDIT) during the initial years of operation are not adequate for debt servicing and require the equity investors to pitch in with additional equity investments even after commencement of operations. Such a situation may arise even in later periods – for example, it is possible that a road project will require additional equity infusion in periods when the road requires periodic maintenance. This is indeed the case for the road project underlying the sample cash flow in ***Illustration 4.1***, where equity infusion is required during the financial year ending March 31st 2019 due to periodic maintenance coupled with redemption of bonds – this abnormally high requirement of cash being higher than the cash from operations in that financial year (no other source of cash being relevant), additional equity infusion is projected in that financial year due to the residual nature of equity cash flows inherent in the cash flow format used. However, recalling for a moment the discussion in Chapter 3 on calculation of IRR, one should look out for situations where a single value of equity IRR cannot be calculated because unlike the standard cash flow set, the cash flow set being used for IRR calculation has more than one change of sign.

The elegance of the cash flow format shown in the illustration is that all such possibilities in terms of additional equity infusion being necessary in later periods and not just during construction are covered by the format. This is because of the fact that the format is based on equity cash flows that are residual in nature – the format simply considers the total use of cash in every period and reduces from this figure the total non-equity sources of cash

[4] Refer to Section 3.7 for a discussion on this aspect.

in the same period to arrive at the equity cash flows to be used for calculating equity IRR. Many people have apprehensions about any negative equity cash flow in later years after commissioning of the project. The argument typically offered by these people runs like this – "after commissioning of the project there are several periods when equity cash flows are positive and this cash is projected to accumulate on the balance sheet; therefore, there is no need for additional equity infusion as the cash available on the balance sheet can be used to meet the cash shortfall in any subsequent period when the requirement (projected use) of cash is abnormally high and cannot be met from the cash generated from operations in that period." This argument seems intuitively appealing – why should equity investors have to invest additional equity when the cash inflows accruing to equity investors in earlier periods is accumulated over the earlier periods and available on the project company's balance sheet?

The answer to this rather relevant question is not apparent – it has to be understood that the projection of increasing cash balances on the project Company's balance sheet is simply a convenient tool used for projecting the balance sheets in the Financial Model. There is in reality no requirement that the residual cash flows accruing to equity investors remain on the project Company's balance sheet and thus be available for meeting any shortfall in cash during later periods. As a thought exercise, consider a situation where any residual cash inflows accruing to equity investors in a given period gets paid out completely as dividend in the same period (i.e., when such inflows occur). In such a scenario, no cash would be available on the project company's books to meet a cash shortfall in any subsequent period. The correct treatment of the cash shortfall situation in this scenario would be to provide for an infusion of equity in the relevant period when there is a cash shortfall, which is exactly what is projected by the cash flow format illustrated with its calculation of equity cash flows as the difference between total non-equity sources of cash and total use of cash in any given period.

Consider the alternative approach where in case of a cash shortfall in any period, the projected cash on the balance sheet is first examined to see if this is adequate for meeting the cash shortfall. If the cash balance is adequate, the equity cash flow for that period is shown as nil (neither inflow nor outflow as far as equity investors are concerned) and the cash balance on the balance sheet is reduced to the extent of the shortfall. In case the projected cash balance is not adequate, additional equity infusion is projected, i.e., there is a cash outflow in that period as far as equity investors are concerned. With such an approach, it would effectively mean that equity cash flows and hence the equity IRR calculated on the basis of these equity cash flows are influenced by the assumption regarding past dividend pay-out – if dividend pay-out in the past has been low resulting in a higher projected cash balance that is adequate for meeting the shortfall, the equity cash flow for the period would be nil because of a drawdown in the cash balance whereas high dividend pay-outs in the past leading to an inadequate cash balance would mean a negative equity cash flow. It is evident that such an approach where assumptions about past dividend pay-outs influence equity IRR cannot be correct. If the cash shortfall in any period is assumed to be met using the cash accumulated on the balance sheet during earlier periods by projecting the equity infusion in that period as zero and simply reducing the cash balance projected on the balance sheet to that extent, this approach ignores the fact that the cash inflows to equity investors in earlier periods have already been considered for the calculation of equity IRR. Using these equity cash inflows already incorporated into equity IRR to improve the equity cash flow in the period when there is a shortfall (i.e., equity cash flow shown as zero rather than negative by drawing down cash on the projected balance sheet) thus effectively amounts to double counting and the equity IRR so calculated is over-stated as a result.

A related point that could be made is that a cash shortfall in later periods after project commissioning could be funded from debt rather than additional equity, especially since some of the original debt funding availed for the project would have been paid off, thereby releasing debt capacity. This is a more valid consideration and in case of cash shortfalls in some periods after commissioning, it may be worthwhile considering the incorporation of specific assumptions about debt funding of such shortfalls in order to further improve equity IRR. Of course, such assumptions involve trade-offs – by assuming debt funding of a cash shortfall that occurs in any period after commissioning, a negative equity cash flow (i.e., equity infusion) in that period is avoided but the servicing of the additional debt that is assumed will reduce equity cash inflows in subsequent periods. However, recalling our earlier discussions on the effect of leveraging on equity returns, it should be evident that as long as the overall return generated by the project is higher than the cost of debt, the assumption of debt funding of a cash shortfall in any period subsequent to the project's commissioning will improve the equity IRR as compared to the base case where the cash shortfall is funded by an infusion of equity.

It is also natural to wonder if a Financial Model that projects high cash balances in later years/periods without recognising any income on the deployment of such cash in earning assets is realistic. Actually, this approach involving the use of cash as the balancing item on the assets side of the projected balance sheets does not lead to an error in the equity IRR calculated – nor is it necessary to modify such models to factor in a return from the increasing cash balances projected in later years. This is a common fallacy in many Financial Models that goes against the implicit assumption of re-investment of all intermediate cash flows so as to earn a return equivalent to IRR that underlies the concept of IRR as discussed in Chapter 3. Recognising income on cash balances and including the cash inflows arising out of such income while calculating IRR completely distorts the Output. Once a cash inflow is considered for the purpose of calculating IRR, the measure in any case considers re-investment of these inflows and separately adding income based on the projected cash balances to the project cash flows for the purpose of IRR calculation would thus be completely wrong.

As in our earlier discussion on whether projected cash balances on the balance sheet should be considered as being available for meeting cash shortfalls in any period post-commissioning as an alternative to the further equity infusion in such a period that is thrown up by the cash flow format illustrated, it should be borne in mind that the projected increasing levels of cash is simply a convenient tool used in the Financial Model to project balance sheets. In reality, the cash surplus generated by a project in the later periods, once the operations and revenues have grown and debt has been paid off partly or fully and therefore accruing to the equity investors would not be retained on the balance sheet of the project SPV. In the absence of suitable opportunities for redeployment by the SPV, such cash would be paid out as dividend to shareholders who would then re-invest such cash in investment opportunities available to them. In the event that the SPV retains the cash generated instead of paying it out as dividend, the equity investors would expect such retained earnings to be deployed to earn at least the return that they are obtaining on their initial equity investment in the SPV. After all, the retained cash rightfully belongs to the equity investors who are entitled to the residual cash flows. There is no logical reason why such investors would accept the deployment of cash retained by the SPV in some low-risk and low return debt instruments when they expect a higher rate of return on their equity investments and are in a position of take the cash in the form of dividend and invest it in alternative opportunities that provide such expected return.

To summarise at the possible cost of repetition that is justified by the importance of these points, readers should note that not incorporating explicit assumptions about dividend payout as well as the use of cash as a balancing item in the projected balance sheets are features of a Financial Model that do not affect the Output of the Financial Model. These features should be viewed as convenient tools for meeting that end. The projected cash balances are not necessarily realistic and consequently both of the following practices are conceptually unsound:

- Considering such a projected cash balance as a valid source for meeting a cash shortfall as an alternative to equity infusion in case of such a cash shortfall in any period and modifying the equity cash flows accordingly for calculation of equity IRR; and
- Modifying the cash flows to include income generated by deployment of the projected cash balances and calculating IRR using such modified cash flows.

4.2.4 The Role of Financing

In the context of Financial Models, we can by and large take it that financing or capital structure, especially in terms of the extent of debt funding (leverage), cost of debt (interest rate) and repayment of debt (i.e., tenure of the borrowing), will be largely driven by the market for debt funds. There is thus limited scope for altering the intrinsic feasibility of a project as measured by the project IRR through clever financing or indeed for creating value out of the financing decision. This is in line with a fairly influential school of thought in finance theory that views capital structure as immaterial – this thinking is based on the fact that the value created by a project is driven by the cash generated by the project and how that stream of cash inflows is distributed among different sources of financing does not affect value in any manner. Strictly speaking, the non-existent role of the financing decision in creating value for equity investors holds only when a set of conditions are fulfilled, which is often not the case in real life.

Basically, readers should note that the use of debt funding does not change in any manner the inherent cash flows associated with the project, assuming it to be funded entirely by equity – the intrinsic value of the project driven by these cash flows thus remains unchanged. However, in return for the lower risk associated with debt financing because of the priority in terms of distribution of cash flows generated by the project and the security provided by the project assets, lenders are willing to accept as their share a lower proportion of the total value (or cash flows) generated by the project. Since the value accruing to equity investors is essentially residual in nature, the equity investors end up with a higher proportion of the project value in relation to their share in the investment. It is thus often possible to improve the returns for equity investors through gearing and reduce the risk of default by spreading out the debt servicing through longer tenure loans (or the issue of bonds with bullet repayment) – however, the basic caveat is that one should not rely solely on financing to ensure the feasibility of a PPP project holds. One significant exception is "viability gap funding" through capital grants, which should nevertheless be viewed as a conscious decision on the part of the Government, taking into account the potential benefits of the project that may not be amenable to appropriation by the equity investor(s), i.e., benefits to society at large.

Another aspect of financing that is important in the PPP/Project Finance Context is the possibility of take-out financing or refinancing. Even if lenders are willing to accept a lower proportion of the project value, there is no doubt that the level of risk borne by the lenders is higher before the project has been implemented and declines after commissioning when the project assets start generating cash. Given this decline in the risk profile of the project, other lenders may be willing to accept an even lower proportion of the project value against debt financing – in other words, it may be possible for the original loans to be replaced by loans at a lower cost, thereby further increasing the returns earned by equity investors. Of course, any such refinancing of the debt component of the project's capital structure once the project has become operational will not be in the interest of the original lenders who have borne a higher level of risk by funding the project at the development phase but now find their returns getting squeezed due to pre-payment by the project SPV, which uses lower cost debt funding for this purpose. Typically, the original lenders would incorporate clauses in the loan agreements to discourage this type of refinancing.

However, it has long been propounded that such an arrangement could be put in place even at the time when the original debt funding is provided, the need of the original lenders to manage asset-liability mismatch being cited as the motivation for recovering their original investment through refinancing by another lender stepping into the project. Such take-out finance was considered logical given that the primary source of debt funding would be banks with short term deposits as liabilities that curbs their appetite for deploying funds for the longer tenures required by infrastructure projects – it was thus thought that such banks would welcome another lender stepping in after a few years to refinance the balance amount of loans, ensuring a "win-win" situation. Possibly because the exposure of Indian banks to infrastructure projects still remains low as a proportion of their overall loan portfolio, take-out financing has not become as popular as was thought possible a few years back. Given that the extent of their asset-liability mismatch because of deploying short term funds in long tenure loans to infrastructure projects has remained low, banks have so far not been very open to giving up on their profitable and mature loans by going in for take-out financing. This situation may change in the years to come and the incorporation of take-out financing in Financial Models for PPP projects to improve returns to equity investors may then become more relevant. In any case, as in case of debt funding of the cash shortfall in one or more period after commissioning of the project to improve equity IRR discussed earlier, it is possible to incorporate take-out financing into the Financial Model as specific assumptions on the "A&D" worksheet.

It is possible to use the sample cash flow worksheet shown in ***Illustration 4.1*** to demonstrate the impact of financing on equity IRR and its lack of impact on project IRR. ***Illustration 4.2*** overleaf shows the same sample worksheet with the proportion of debt funding assumed for the project being increased marginally from 67% as in the earlier case to 70%. It should be noted that the amount of capital grant is considered as part of equity for the purpose of defining the proportions of debt and equity used for funding the project, i.e., the extent of financial leverage or gearing. The increase in leveraging is reflected in the increase in equity IRR (post-tax) from 18.0% to 18.3%. It should also be noted that the pre-tax project IRR remains unchanged at 14.1%, in line with the definition of project IRR. The impact of changes in financial leverage or gearing on equity IRR and the lack of impact on project IRR are important checks to be used once the first complete version of the Financial Model is ready. This aspect is discussed in greater detail later in Section 5.4.

However, an important exception to the rule that the financing decision has no impact on project IRR should be noted in the PPP/Project Finance Context. There are potential projects where the investment decision cannot be completely independent of the financing decision – for example, such a situation arises where the tariff for the project is subject to regulation and is decided on a cost plus basis by the regulator. With the cost plus approach, the tariff is set so as to allow the investor to cover all operating expenses and earn a fair return on capital. Now, where the interest cost of loans taken to finance the project is allowed as an admissible element of the fair return on capital, any change in the financing decision especially in terms of the applicable interest rate will typically drive changes in the tariff allowed, which in turn will impact project revenues and expected returns from the project. As mentioned earlier, the development of the Financial Model in any case requires assumptions about financing to be made, even though financing does not affect project IRR and we should be in a position to work out the project IRR assuming all equity financing.

ILLUSTRATION 4.2

Impact of Increased Leverage on Equity IRR (Sample Financial Model)

	A	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
3	FY ending March 31,	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
5	USES:															
6	Capital Expenditure (excl. IDC)	743	2,535	614	398	0	0	0	0	0	0	0	0	0	0	0
7	IDC	7	149	46	0	0	0	0	0	0	0	0	0	0	0	0
8	Interest	0	0	228	292	277	251	224	198	172	145	119	92	53	13	0
9	Repayment of Debt	0	0	0	265	265	265	265	265	265	265	265	265	515	250	0
10	Income Tax Paid	0	0	0	0	0	0	0	0	0	0	0	24	31	79	85
11	Total Uses (Sum: Rows 6 to 10)	750	2,678	886	955	542	515	489	463	436	410	383	380	598	342	85
13	SOURCES:															
14	Grant	134	478	117	71	0	0	0	0	0	0	0	0	0	0	0
15	Term Loan	442	1,580	389	235	0	0	0	0	0	0	0	0	0	0	0
16	Bonds	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Cash from Operations (OPBDIT)	0	0	139	252	362	383	405	359	516	543	639	673	541	924	971
19	Sources Excluding Equity	575	2,558	645	557	362	383	405	359	516	543	639	673	541	924	971
21	Equity Cash Flows (Post-Tax): Row 19 minus Row 11	(175)	(126)	(243)	(398)	(179)	(132)	(84)	(103)	80	134	256	292	(57)	583	886
24	Project Cash Flows (Before Funding/Tax): Row 17 minus Row 6	(743)	(2,535)	(475)	(147)	362	383	405	359	516	543	639	673	541	924	971
27	Equity IRR (Post-Tax)	18.3%	Calculated on cash flows in row 21													
30	Project IRR (Pre-Tax)	14.1%	Calculated on cash flows in row 24													

Note: IRR is calculated on projected cash flows till the FY ending March 31st, 2041 in column AM, with the later FY's not shown in the illustration above. Some rows have been deleted for the purpose of presentation. Readers may refer to the Sample Financial Model on the CD. The hidden columns B, C and D may be ignored – the purpose of hiding these columns is explained in Chapter 5.

Clear examples of infrastructure sectors where the tariffs and returns for any given project get affected by the financing decision are power generation and transmission in India. Under the current regulations[5] for setting tariff for new power generation projects and power transmission project, the interest cost on long term loans is allowed to be recovered through the tariff charged based on the actual rates of interest. On capital structure, however, these regulations do not provide complete flexibility – the debt-equity ratio to be used for tariff calculation is set at 70:30 irrespective of the actual debt-equity ratio. In case the proportion of equity funding is greater than 30% of the landed project cost, the WACC for tariff calculation will still be based on debt-equity ratio of 70:30. Equity funding lower than 30% is considered at actuals, the intent being to use the lowest value of WACC for tariff setting. Similarly, the repayment of loans is not considered at actuals but is limited in any year to the amount of depreciation in that year, with the relevant depreciation rates also being specified by the regulation. To summarise, projects where tariff is subject to cost plus regulation based on specified norms covering capital structure, operational expenses, etc., may have Financial Models where the standard features of project IRR (for example, project IRR being independent of financing) and/or equity IRR (for example, equity IRR should increase with an increase in gearing or decrease in interest cost) may not hold.

4.2.5 Pre-Tax and Post-Tax Cost of Capital for Calculation of NPV

Having dealt with the calculation of equity IRR and project IRR as ***Output*** of a Financial Model, we can turn to a consideration of the other measure of project viability covered in Chapter 3, i.e., NPV. Just as equity IRR and project IRR are calculated on different sets of cash flows (i.e., different rows) in the earlier illustrations, it is also possible to calculate NPV on various sets of cash flows. However, it is important that the logical discount rate should be selected based on the nature of the cash flows selected. Applying the post-tax WACC to the post-tax equity cash flows or the pre-tax WACC to the post-tax project cash flows would only yield absurd values of NPV that are not amenable to logical interpretation.

[5] The Central Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2009 issued by the CERC on 19th January, 2009.

A discussion of the pre-tax cost of different sources of funding vis-à-vis the post-tax cost of such sources is pertinent at this point[6]. In case of debt funding, the relation between the pre-tax cost and post-tax cost as generally explained is quite simple - this is driven by the fact that interest paid on debt by any entity is tax deductible, i.e., the interest payment is allowed to be adjusted against income for the purpose of calculating the taxable profit of the borrowing entity. Thus, the effective post-tax cost of debt for the borrowing entity is lower than the nominal pre-tax cost of debt at which the interest payment is calculated.

As a simple example, consider a loan of ₹ 100 carrying an interest rate of 14% - the borrower thus pays ₹ 14 as interest annually. However, since this ₹ 14 can be treated as an expense by the borrower, it reduces the tax payable by the borrowed. Assuming the relevant income tax rate applicable to the borrower is 30%, the tax liability gets reduced by ₹ 4.2 (30% of ₹ 14), which is known as the interest tax shield (product of the tax rate and amount of interest payable). The effective post-tax cost of the loan to the borrower per year is thus ₹ 9.8 (₹ 14 minus ₹ 4.2). In general terms, where the applicable interest rate is "I" and the tax rate for the borrower is "t_c" ("c" to denote that the tax rate is applicable to corporate income), the post-tax cost of debt is given by:

Post-tax cost of debt carrying an interest rate of I, say, $I' = I*(1-t_c)$

Of course, this argument assumes that the borrower generates taxable profits and is liable to pay tax. If that is not the case, there would not be any tax saving associated with the interest payment and therefore no rationale for applying the above formula. Barring that possibility, the argument in terms of the effective cost of debt being lower for the borrower since interest payments are tax deductible is fairly convincing and intuitively appealing. In

[6] This aspect is of particular importance where Financial Models are used in a regulated tariff environment, where the formula adopted by regulators for arriving at the tariff often uses a "fair" return on capital employed as the basis. Correct estimation of tariff using such an approach obviously requires agreement about the correct treatment of tax in arriving at the cost of capital, in other words the calculation of the pre-tax costs of debt and equity vis-a-vis the corresponding post-tax costs. However, there has been much disagreement in this regard between regulators and the regulated operators in the past even in countries with an established history of autonomous regulators. For example, the approach adopted by Oftel in the United Kingdom has been challenged as being based on an incorrect understanding of the relation between the pre-tax and post-tax costs (or expected returns) of funding sources like debt and equity. This is even without getting into the differences between returns calculated on the basis of accounting typically used by regulators and returns as more correctly calculated on the basis of cash flows.

case of equity, returns to investors in the form of dividends must be paid out by any corporate entity to its shareholders only from its post-tax cash flows – in other words, dividend pay-outs are not tax deductible. To that extent, there is no rationale for assuming that the effective post-tax cost of equity for the firm is lower than the pre-tax cost of equality.

Related to the argument that the post-tax cost of debt is lower as compared to the nominal interest rate (pre-tax cost of debt) holds only if the borrowing corporate entity generates taxable income, it is also true that assuming a common value of t_c (generally referred to as the statutory tax rate) for all corporate borrowers may not be valid. Real-life corporate income tax regimes typically contain various provisions that allow the effective tax rate to vary considerably from one corporate entity to another – for example, a corporate entity that has recently made large capital investments or invested heavily in research and development (R&D) may benefit from higher rates of depreciation on fixed assets or be allowed to charge as tax deductible expenses more than the actual R&D expenditure incurred for calculating taxable income and end up paying tax at a lower effective tax rate as compared to a similar corporate entity that has not invested in new fixed assets or R&D. Thus assuming a uniform statutory corporate tax rate "t_c" for all corporate entities for the calculation of the post-tax cost of debt may lead to misleading results. It is thus advisable to check the effective rate of tax for the relevant entity rather than assuming the statutory corporate tax rate without question.

Moreover, the reader should note that the above argument regarding the lower effective cost of debt due to the tax treatment of interest payments vis-à-vis dividends paid by a corporate entity is based entirely on the point of view of the corporate entity rather than the lenders or equity investors – we are looking at the cost of capital for the corporate entity and ignoring the point of view of the lenders and equity investors who are interested in the returns earned before and after tax is paid on the income earned in the form of interest (for lenders) and dividend and capital gains (for equity investors). As a start, if we take the point of view of the equity investors, it is clear that the effective return received by them in the form of dividends get reduced by the tax payable by the equity investors on such dividend income. This is often described as double taxation because the dividend has in the first place been paid out of corporate income remaining after tax has been paid by the corporate entity. It is not that the interest paid to the lender is not subject to tax – indeed, the lender's interest income is also taxed but since the interest is paid out of pre-tax cash flows (unlike dividend), there is no double taxation involved.

When we are considering at the returns earned by the equity investors and not the cost of equity funding from the corporate entity's point of view, it is perfectly valid to state that the post-tax return re' earned is given by the relation:

$$r_e' = r_e*(1-t_e),$$

where "r_e" is the rate of return earned by the equity investors before paying tax at the effective tax rate applicable to them (i.e. equity investors) on such income, which is represented by t_e. Similarly, when we are looking at the returns earned by the lenders and not the cost of debt funding from the corporate entity's point of view, it is valid to state that the post-tax return earned by lenders is given by a similar relation:

$$r_d' = r_d*(1-t_d),$$

where "r_d" is the rate of return earned by the lenders, before paying tax at the effective tax rate applicable to them (i.e., lenders) on such income, which is represented by t_d.

Thus, when we add the points of view of the equity investors and lenders to the "cost of capital perspective" of the corporate entity, we have to consider not one single tax rate "t" but three different rates t_c, t_d and t_e. Of course, this additional complexity would cease to matter if all three tax rates t_c, t_d and t_e were equal, i.e. if it were true that $t_c = t_d = t_e = t$ (say). The reality is somewhat more complicated by a number of factors. Firstly, only a small proportion of the return on equity is in the form of dividends and most equity investors derive a significant part of the return on their investment from capital gains when they sell the equity shares held by them – this income is due to the increase in the market price of equity shares as the corporate entity generates profits and re-invests a part of these profits (plus any additional funding raised by the corporate entity) in new investments that yield additional revenues in the future. Even though it is theoretically possible to state the market price (or value) of an equity share as the present value of all future dividends (theoretically for perpetuity as a corporate entity can continue to remain in operation despite the demise of several generations of mortal shareholders), the fact remains that a significant part of the return from investment in equity may be in the form of capital gains, which are typically taxed differently from income. Secondly, the tax authorities in many economies have recognised the element of double taxation inherent in taxing dividend income and offer tax credits for such income that reduce the effective taxation rates for equity investors. Taking into account the possibility of different rates of taxation on corporate income, interest income of lenders, dividend income and income in the form of capital gains of the equity investors, it is not correct to blindly adopt in every situation or for any form of DCF analysis requiring an appropriate discount rate the approach that the post-tax cost of debt to be used in the calculation of WACC is invariably the lower value obtained by multiplying the pre-tax interest rate by the factor (1-t) while the cost of equity needs no such adjustment. The appropriate discount rate will depend on the choice of cash flows to be used in the analysis. It is also advisable not to use the terms "pre-tax" and "post-tax" without qualification since it is not always evident which out of the several possible tax rates is the correct one to be applied. At the very least, we should avoid confusion by remaining clear on whether the relevant point of view is:

- That of the corporate entity in which case we are considering the cost of capital, the interest tax shield is effective in reducing the post-tax cost of debt for the borrowing corporate entity, the relevant tax rate is t_c and there is no rationale for assuming that the effective cost of equity is lower in the same manner as debt; or
- That of the lenders and/or equity investors in which case we are considering the rates of return earned (or expected) rather than cost, the post-tax return is lower for both lenders and equity investors with similar relationships governing the pre-tax and post-tax rates of return in both cases and the relevant tax rates are t_d and t_e.

In line with the above, when we are applying the concept of WACC for tariff setting using a "fair" return on capital approach, we should consider carefully the appropriate rates of return (or cost) to be used for debt and equity. It is necessary to be clear whether the tariff regulations define the "fair" return that is allowed in pre-tax or post-tax terms, which aspects related to capital structure and taxation are based on norms in the tariff regulation and the corresponding treatment of tax paid by the corporate entity implementing/operating the project (i.e., the SPV) as an expense or cash outflow for the purpose of setting tariff. The calculation of tariff based on regulations should be logically consistent in the use of either pre-tax or post-tax rates for cost of capital – for example, if the return on capital employed (RoCE)[7] as an element of cost that is allowed to be recovered through tariff is specified in pre-tax terms for use in the tariff calculation, it would be illogical for the tax payable by the SPV to be simultaneously allowed as a cost to be recovered through the tariff determined. This would amount to double counting of the tax paid (or projected to be paid) by the SPV in arriving at the tariff, whereas the intent of the regulator is that return on investment be considered at

[7] Typically, RoCE will be split into return on equity (RoE) and the interest cost of debt funding.

pre-tax level. Similarly, if the tariff setting regulations allows for tax paid by the SPV as a cost to be recovered through tariff in addition to the "fair" RoCE, the "fair" RoCE has to be calculated using post-tax rates.

4.2.6 NPV with Varying WACC

Another aspect with regard to the calculation of NPV as an Output of the Financial Model that needs consideration is the change in gearing and therefore WACC over the Project Time-Line alluded to earlier in Chapter 2 (Section 2.3: Implications for the Financial Model) and Chapter 3 (Section 3.6). The use of a constant discount rate and the in-built NPV function in Excel will lead to incorrect results for NPV in a Financial Model as the WACC varies from one year/period to another as debt is repaid. Unlike the standard corporate entity that might be expected to take up new projects as the debt funding raised for earlier projects is paid off and thus maintain a more or less constant level of financial leverage and WACC, the SPV in a Project Finance transaction generally has only the project assets on its balance sheet. As a result, the capital structure of the SPV becomes all-equity once the loans contracted for the project are paid off. In the Financial Model for a Project Finance transaction, NPV has to be calculated using variable WACC, with the WACC for each year/period being separately calculated and the resultant discount factors applied to the relevant cash flows.

In the earlier discussion on project IRR vis-à-vis equity IRR based on a simple one-period project, what often gets glossed over is the fact that leveraging does not remain constant in the PPP/Project Finance Context. Since the project is the only asset on the books of the SPV and the only liabilities are related to the funding of the project assets, the leveraging declines over the operating period as the debt is paid off. This is in contrast to a corporate finance setting where the company generally holds a portfolio of assets and continually seeks new investment opportunities – in such a scenario the leveraging of the company as a whole (calculated from its balance sheet) may remain more or less unchanged as new loans taken for new projects replace the earlier loans getting paid off. However, it should be kept in mind that the change of leveraging over time does not materially affect the calculation of the project IRR or equity IRR, the calculation of which takes into account only the pattern of cash flows over the project's life and does not require as input any discount rate. This is not the case for NPV that does require specification of a discount rate. For the calculation of NPV in the context of a variable WACC, the choice of the appropriate discount rate poses a problem.

In other words, since the gearing or leveraging generally reduces over the Project Time-Line in the PPP/Project Finance Context, this creates a problem in using the NPV concept for investment decisions. Typically, the discount rate used in such investment decision analysis is what is called the Weighted Average Cost of Capital (WACC). WACC uses as weights the proportion of equity and debt in the total funding and applies these to the cost of equity and debt respectively in order to arrive at the relevant cost of capital for the project, which is then used as the discount rate for calculating NPV. If the NPV is positive, the investment in the project is considered feasible and desirable. However, in a Project Finance transaction, where the proportion of equity keeps increasing as debt is repaid, the WACC does not remain constant but changes from year to year. In such cases, using the WACC based on the proportion of debt and equity at the commencement of the project's operations would tend to overstate NPV. To correctly calculate NPV, it thus becomes necessary to apply different discount rates to each year's cash flows, which is conceptually sound, being the most general form of present value calculation discussed in Chapter 3 and definitely possible[8] by setting up the spreadsheet to discount the cash flows for each year/period using an entered formula rather than the NPV function in Excel. This can be done quite easily as illustrated later in this Section.

Even in case of project IRR, while calculation of this element of the Output per se does not pose a problem, the use of project IRR for making an investment decision becomes an issue once the variation of WACC from one period to another is factored into the discussion. The investment decision rule using IRR tells us to go ahead with the investment if the IRR is higher than the cost of capital. While our cash flow format gives us project IRR as an Output, to what value of WACC should we compare this project IRR? The WACC in fact varies from year to year and once debt has been fully paid off, the WACC is effectively the cost of equity[9]. This is a question that has to be addressed if the Output project IRR is to be of any use.

Before turning to the calculation of NPV using different discount rates for each period of the Project Time-Line and demonstrating the relevant WACC for use with reference to the project IRR to make an investment decision, there are two other issues that the reader should keep in mind with regard to calculation of NPV in a Financial Model involving Project

[8] See the text box "Going beyond the Obvious (2): The Discount Rate and the Term Structure of Interest Rates".

[9] In the Sample Financial Model there is an element of grant funding. The WACC after debt is paid off is thus not equal to the cost of equity but a lower value, given that the grant funding carries zero cost.

Finance. In calculating the debt-equity ratio or the values of debt and equity used for calculation of WACC for a corporate entity, the correct approach is to use the market values of debt and equity rather than the accounting values. This is based on the understanding that the total value of the corporate entity is given by the sum of the market values of debt and equity on the entity's balance sheet. Moreover, since the equity investors have the option of liquidating their equity holdings on the market and investing the proceeds elsewhere, the market value of equity represents the correct value on which equity investors will expect to earn the return. The same is true for any listed debt instrument issued by the company in question, where the market value of such debt will represent the amount on which investors in such instruments will expect to earn returns. For other non-listed debt like standard bank loans, the accounting figure representing the principal amount of such loans is quite acceptable for the calculation of WACC. In case of a project in the ***PPP/Project Finance Context***, it is possible for the SPV to be listed but this is generally not the case. Certainly, during the project development cycle when the Financial Model is being developed and used, there is hardly any basis for assigning any market value to the equity component of the project's financing. As such, we can go ahead with projected accounting values of debt and equity as per the balance sheet to calculate WACC without bothering about the non-existent market values.

Having said that, a more serious issue arises from the standard approach for projecting balance sheets as part of the Output of the Financial Model, using cash on the assets side and reserves on the liabilities side as the balancing items. As explained earlier, the projected PAT as per the P&L account is added to the value of reserves at the end of the previous accounting year/period on the liabilities side of the balance sheet while the increase in cash as per the projected cash flow statement is added to the figure of cash at the end of the previous accounting year/period on the assets side of the balance sheet. In effect, no cash is assumed to be paid out as dividends to equity investors. As discussed, this does not affect the calculation of IRR since the reinvestment of any interim cash inflow at the same rate as the IRR is implicit in the calculation of IRR. For similar reasons, we have arrived at the understanding that the projected cash on the balance sheet is merely a tool for developing the Financial Model to include projected balance sheets and considering either any return earned on such cash balances or the availability of these balances for debt servicing are both conceptually unsound and should be avoided in all but exceptional circumstances where a specific reserve for redemption of debt is required to be created as per the agreement executed with lenders and there exist restrictions on dividend pay-out till such reserves are in place.

However, in the context of NPV, this practice does have an impact as the overstatement of the value of equity (net worth) as reflected in the balance sheet will tend to increase the value of WACC as calculated since the proportion of equity in the capital structure gets increased. Of course, this will not be relevant after all the loans have been paid off, when the relevant WACC will be equal to the cost of equity as the capital structure comprises only equity (i.e., the initial equity capital invested for commissioning the project plus the retained earnings reflected in the reserves) after all loans have been paid off. Nevertheless, there still remains a possibility of the WACC getting over-stated if the funding of the project involves some capital grants that carry no costs. Such capital grants are fairly common as "viability gap" funding in the context of PPP projects in India – in fact, the Sample Financial Model used for illustration involves a capital grant of ₹ 800 lakh that was required to make the project viable for a private investor. In these cases, the grant element in the funding brings down the WACC – however, with the amount of equity getting overstated the impact of the grant on WACC gets diluted. Thus, in the Sample Financial Model the WACC gets over-stated even in later years after debt has been paid off because the weight applied to the cost of equity (i.e. amount of equity in the projected balance sheet) keeps increasing whereas the weight applied to the zero cost grant remains constant at ₹ 800 lakh.

Having touched upon the issues that arise in the calculation of NPV in the Financial Model for a PPP project funded on the Project Finance basis, let us turn to illustrations on calculating NPV using the Sample Financial Model that has already served to demonstrate the calculation of project IRR and equity IRR as key elements of the Output of any Financial Model earlier in this Section. For this purpose, we assume that the equity investors are subject to the same rate of income tax as the project SPV, i.e., 33.66%. Thus, assuming that these investors require a pre-tax return of 18%, the corresponding post-tax return is given by (1-33.66%)*18%, i.e. 11.94%.

The pre-tax costs of loans and bonds in the Sample Financial Model are 10% and 10.5% respectively, while the capital grant obviously has nil cost associated with it. It is possible to work out both the pre-tax WACC and post-tax WACC for every year covered by the Sample Financial Model, as shown in ***Illustration 4.3***. The amounts of each source of funding at the end of each year are drawn from the projected balance sheets and WACC calculated as a weighted average of the cost of each source of funding, using the amounts as weights. It should be noted that the amount of equity corresponds to the net worth, i.e., equity capital plus reserves representing the accumulated profits. This is the correct approach since any profits that are generated but not distributed to the equity investors effectively represents investment by the equity investors. The pre-tax costs of the four sources of funds (i.e. equity, capital grant, loans and bonds) are shown in the cells E50 to E53 and the post-tax costs in cells F50 to F53, while the corresponding amounts of the four sources at the end of each FY are drawn from the "BS" worksheet and displayed in the rows 55 to 58 (in the same order as the costs). The variable WACC for each FY can then be calculated as a weighted average of the costs – for example, the pre-tax WACC for the FY ending March 31st, 2007 is calculated in cell E60 using the following formula:

=SUMPRODUCT($E$50:$E$53,E56:E58)/sum(E53:E58)

For post-tax WACC, the array $E$50:$E$53 is replaced by $F$50:$F$53. With the values of WACC for each FY covered by the Sample Financial Model in place, it is a simple matter to work out the discount factors (pre-tax and post-tax) for any FY, say n, using a formula of the type:

$$\frac{1}{(1+\mathrm{WACC}_1)} \times \frac{1}{(1+\mathrm{WACC}_2)} \times \frac{1}{(1+\mathrm{WACC}_{n-1})}$$

In the above formula, WACC_1 represents the WACC in FY 1, WACC_2 in FY2 and so on. Of course, cell references are used in the spreadsheet in place of values shown above – the $1/(1+\mathrm{WACC}_n)$ values are first calculated in row 65 (for pre-tax WACC, row 76 for post-tax WACC). The discount factors are then generated for each period in the next row (66 for pre-tax WACC, 77 for post-tax WACC) by using the PRODUCT function to multiply the values in the row above from column D (absolute reference used) up to the column immediately to the left of the period/FY/column in question. It may be noted that the formulae in rows 65 and 76 are also copied to the hidden column D.

With discount factors in place, the corresponding cash flows can be drawn from the cash flow statement shown earlier in ***Illustration 4.1*** (relevant rows lying above on the same worksheet). Here, instead of using the NPV function, NPV is worked out using the SUMPRODUCT formula that simply multiplies the corresponding values of two arrays/rows of cells (for example, the values of pre-tax project cash flows in the array E63:AM63 and the corresponding discount factors in the array E66:AM66) and sums up the products of every pair of such values to generate the NPV. Thus, the NPV using variable values of WACC can be worked out without using the in-built NPV function in Excel.

In ***Illustration 4.3***, we see two different values of NPV for the project as whole:

- The NPV of pre-tax project cash flows, using the pre-tax values of WACC for discounting is shown in cell E68, which works out to ₹ 1,326 lakh.
- The NPV of post-tax project cash flows, using the post-tax values of WACC for discounting, which works out to ₹ 3,724 lakh.
- There is thus a significant impact of using the variable WACC for NPV calculation. If the pre-tax WACC of the first FY (10.32%) is simply used with the NPV formula to discount the pre-tax project cash flows, the NPV works out much higher at ₹ 2,223 lakh or 65% higher than the NPV using variable WACC, i.e. ₹ 1,326 lakh. Similar results are obtained for post-tax project cash flows and NPV. Thus, not taking into account the variation in gearing and WACC in the PPP/Project Finance Context is not a viable option.
- Though not shown in the illustration, the NPV of pre-tax equity cash flows using the pre-tax cost of equity (18%) as the discount rate works out to ₹ 162 lakh. This is as may be expected in line with the pre-tax equity IRR of 19.2% obtained, which is only slightly over the pre-tax cost of equity taken as 18%.
- In contrast, the NPV of post-tax equity cash flows is much higher at ₹ 1423 lakh in line with the fact that post-tax equity IRR is 18.0%, much higher than the post-tax cost of equity of about 12% used to calculate the NPV.
- Similar logic applies in case of the NPV calculated on project cash flows. The value of the project thus arises at least partly because of the income tax benefits available to the project. The impact of the effective reduction in post-tax cash flows (both for the project and for equity investors) is much less than the impact of increase in discount factors due to the change from (higher) pre-tax cost to post-tax cost, yielding higher NPVs on a post-tax basis.
- At the same time, readers should keep in mind the earlier discussion on the difference between pre-tax and post-tax costs of debt financing vis-a-vis equity. While there is a clear basis for translating pre-tax cost of debt to the equivalent post-tax cost because of the tax deductibility of interest payments, the relation in case of cost of equity need not be so if equity investors are taxed on their returns from the project over and above the income tax paid by the project SPV. If the effective rate of taxation for equity investors over and above tax paid by the SPV has to be factored in, we may choose to use a higher value of post-tax cost of equity than the 11.94% suggested by applying the tax rate adjustment factor (1-t) to the assumed pre-tax cost of equity of 18%. The NPV of post-tax equity cash flows would then be lower than the NPV of ₹ 1,423 lakh arrived at using the discount rate of 11.94%.

ILLUSTRATION 4.3

Calculation of WACC and NPV on the "CFlo" Worksheet of the Sample Financial Model

	A	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	NPV Using Variable WACC	Pre-Tax	Post-Tax												
50	Cost of Equity	18.00%	11.94%												
51	Cost of Capital Grant	0.00%	0.00%												
52	Cost of Loans	10.00%	6.63%												
53	Cost of Bonds	10.50%	6.97%												
54	As at March 31st,	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
55	Amount of Equity	197	402	449	587	621	655	688	722	858	1,050	1,362	1,701	1,989	2,611
56	Amount of Capital Grant	134	612	729	800	800	800	800	800	800	800	800	800	800	800
57	Amount of Loans	419	1,914	2,282	2,254	2,004	1,753	1,503	1,252	1,002	751	501	250	0	0
58	Amount of Bonds	0	500	500	500	500	500	500	500	500	500	500	500	250	0
59															
60	Variable WACC (Pre-Tax)	10.32%	9.23%	9.13%	9.26%	9.29%	9.32%	9.36%	9.40%	9.72%	10.21%	11.00%	11.80%	12.65%	13.78%
61	Variable WACC (Post-Tax)	6.85%	6.12%	6.06%	6.14%	6.16%	6.18%	6.21%	6.23%	6.45%	6.77%	7.29%	7.83%	8.39%	9.14%
62															
63	Project Cash Flows (Pre-Tax)	-743	-2,535	-475	-147	362	383	405	359	516	543	639	673	541	924
65	1/(1+Pre-Tax Variable WACC in row 60)	0.9064	0.9155	0.9164	0.9152	0.9150	0.9147	0.9144	0.9141	0.9114	0.9074	0.9009	0.8944	0.8877	0.8789
66	Discount Factor Using Pre-Tax Variable WACC	1.0000	0.9064	0.8299	0.7605	0.6960	0.6368	0.5825	0.5327	0.4869	0.4438	0.4027	0.3628	0.3245	0.2881
68	NPV of Pre-Tax Project Cash Flows Using Variable WACC (Pre-Tax)	₹1,326	lakh												
70	Project Cash Flows (Post-Tax)	-743	-2,535	-475	-147	362	383	405	359	516	543	639	640	510	846
76	1/(1+Post-Tax Variable WACC in row 61)	0.9359	0.9423	0.9429	0.9421	0.9419	0.9418	0.9416	0.9413	0.9394	0.9366	0.9320	0.9274	0.9226	0.9163
77	Discount Factor Using Post-Tax Variable WACC	1.0000	0.9359	0.8819	0.8316	0.7834	0.7380	0.6950	0.6544	0.6160	0.5786	0.5419	0.5051	0.4684	0.4322
78	NPV of Post-Tax Project Cash Flows Using Variable WACC (Post-Tax)	₹ 3,724	lakh												

Note: WACC is calculated till the FY ending March 31st, 2041 in column AM. Similarly, NPV is calculated on projected cash flows till column AM. The later FY's are not shown in the illustration above. Some rows have also been deleted for the purpose of presentation. Readers may refer to the Sample Financial Model on the CD. The hidden columns B, C and D may be ignored – the purpose of hiding these columns is explained in Chapter 5.

4.2.7 Correcting WACC for NPV Calculation

Recalling the earlier discussions on the distortion of WACC values due to the method adopted for projecting the balance sheets with cash and reserves as the balancing items on the assets and liabilities sides of the balance sheet respectively, we may want to check if this distortion has a significant impact on NPV. In order to eliminate the bias in the WACC calculated for the later years of the Project Time-Line, one simple method would be to restrict the amount of equity capital that is retained in the SPV. From the projected balance sheets, we find that the maximum amount of equity capital that is projected for the SPV is ₹ 1,482.5 lakh – this represents the amount of equity investment required to meet the equity funded portion of the initial capital investment as well as the amount needed to meet cash deficits in the initial years of operation. In ***Illustration 4.1*** showing the standard cash flow format, it is clear that equity cash flows remain negative till FY2013-14, beyond which equity cash flows are positive, barring a small amount of additional equity investment required in FY2018-19 on account of higher expenditure in that FY on account of periodic maintenance. As such, there is no reason for the SPV to retain profits generated instead of distributing the same to the equity investors and therefore build up its reserves such that the total net worth becomes much in excess of the maximum required equity investment . The assumption that no dividend is paid out was used simply to project the balance sheets in the Financial Model given that the assumption does not affect equity IRR in any way. However, given the possible impact on NPV, we may now like to consider a scenario where the amount of equity in the SPV is limited to ₹ 20 crore – this amounts to the same as assuming that once the total net worth reaches ₹ 20 crore, all subsequent profits are distributed as dividends to the equity investors.

Illustration 4.4 shows the calculation of WACC with the maximum value of equity restricted to ₹ 20 crore (₹2,000 lakh). Both pre-tax and post-tax WACC get limited to a maximum value in contrast to the situation where the projected amount of equity is not limited but drawn directly from the balance sheets, which in turn have been projected with reserves and cash as the balancing figures. We can observe a significant difference between the NPV value calculated without restricting the amount of equity and that calculated with the amount of equity restricted – the NPV of pre-tax project cash flows increases from ₹ 1326 lakh to ₹ 1836 lakh with equity restricted. Similarly the NPV of post-tax project cash flows increases from ₹ 3724 lakh to ₹ 4375 lakh. Thus, the impact is significant.

ILLUSTRATION 4.4

Calculation of NPV with Equity Restricted to a Maximum of ₹ 2,000 Lakh in the Sample Financial Model

	A	E	F	G	H	I	J	K	L	M	N	O	P
92	NPV calculation with Equity limited to ₹ Lakh	2,000											
93	As at March 31st,	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
94	Amount of Equity	197	402	449	587	621	655	688	722	858	1,050	1,362	1,701
95	Amount of Capital Grant	134	612	729	800	800	800	800	800	800	800	800	800
96	Amount of Loans	419	1,914	2,282	2,254	2,004	1,753	1,503	1,252	1,002	751	501	250
97	Amount of Bonds	0	500	500	500	500	500	500	500	500	500	500	500
98													
99	Variable WACC (Pre-Tax)	10.32%	9.23%	9.13%	9.26%	9.29%	9.32%	9.36%	9.40%	9.72%	10.21%	11.00%	11.80%
100													
101	Variable WACC (Post-Tax)	6.85%	6.12%	6.06%	6.14%	6.16%	6.18%	6.21%	6.23%	6.45%	6.77%	7.29%	7.83%

	A	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
93	As at March 31st,	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
94	Amount of Equity	1,989	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
95	Amount of Capital Grant	800	800	800	800	800	800	800	800	800	800	800	800
96	Amount of Loans	0	0	0	0	0	0	0	0	0	0	0	0
97	Amount of Bonds	250	0	0	0	0	0	0	0	0	0	0	0
98													
99	Variable WACC (Pre-Tax)	12.65%	12.86%	12.86%	12.86%	12.86%	12.86%	12.86%	12.86%	12.86%	12.86%	12.86%	12.86%
100													
101	Variable WACC (Post-Tax)	8.39%	8.53%	8.53%	8.53%	8.53%	8.53%	8.53%	8.53%	8.53%	8.53%	8.53%	8.53%

(Contd.)

	A	E	F	G	H	I	J	K	L	M	N	O	P
107	1/(1+Pre-Tax Variable WACC in row 99)	0.9064	0.9155	0.9164	0.9152	0.9150	0.9147	0.9144	0.9141	0.9114	0.9074	0.9009	0.8944
108	Discount Factor Using Pre-Tax Variable WACC	1.0000	0.9064	0.8299	0.7605	0.6960	0.6368	0.5825	0.5327	0.4869	0.4438	0.4027	0.3628
109													
110	1/(1+Post-Tax Variable WACC in row 101)	0.9359	0.9423	0.9429	0.9421	0.9419	0.9418	0.9416	0.9413	0.9394	0.9366	0.9320	0.9274
111	Discount Factor Using Post-Tax Variable WACC	1.0000	0.9359	0.8819	0.8316	0.7834	0.7380	0.6950	0.6544	0.6160	0.5786	0.5419	0.5051

	A	D	E	F	G	H
103	NPV of Pre-Tax Project Cash Flows Using Variable WACC (Pre-Tax)	Rs. 1,836	lakh	Rs. 510	lakh	Difference from Illustration 4.3
104						
105	NPV of Post-Tax Project Cash Flows Using Variable WACC (Post-Tax)	Rs. 4,375	lakh	Rs. 650	lakh	Difference from Illustration 4.3

To conclude the discussion on calculation of NPV as a key Output of the Financial Model in the PPP/Project Finance Context, the following points should be noted:

- The impact of variation in WACC is significant and should be captured in calculation of NPV rather than simply using WACC based on funding of the capital expenditure. However, where equity and cash are used as balancing items in projecting balance sheets, the varying WACC should be further corrected by limiting the amount of equity used as weight in the calculation of WACC, as shown in ***Illustration 4.4***. The standard approach of projecting balance sheets using the reserves and cash balance as balancing items can significantly over-state the values of WACC in later periods and therefore under-state NPV. In calculating NPV, due care has to be taken to either restrict the maximum value of equity that is used for the calculation of WACC or making explicit assumptions about dividend pay-out. Such an assumption about dividend pay-out can be based on the amount of cash likely to be required in relation to the size of operations, with the amount of cash projected on the balance sheets being so restricted with a consequent restriction on the reserves on account of accumulated profits. The resultant values of NPV should be considered as the best indicator of the returns from the project.
- In calculating NPV, care must be taken to apply the correct discount rate to any set of cash flows – pre-tax rates should be applied to pre-tax cash flows, post-tax rates to post-tax cash flows, WACC to project cash flows and the cost of equity to equity cash flows. If this is not the case, the resultant NPVs will be misleading.
- Though WACC should be correctly calculated using the market values of debt and equity, this is not generally applicable in the ***PPP/ Project Finance Context*** where SPVs are not listed and hence the market value of the equity is typically unavailable. The accounting figures can thus be used.

4.2.8 Assessing Debt Servicing Capacity

Apart from the project IRR, equity IRR (i.e., the rates of return) and NPV, the other aspect that one may wish to evaluate using the ***Financial Model*** is typically the debt servicing capacity of the project. While the project may generate acceptable levels of return, given the long gestation period of many infrastructure projects such returns may not correspond to a situation where the cash flows in the initial years of operation are adequate to meet the debt service requirement, i.e., the interest and repayment of principal. In the initial years of operation, the revenue generated may grow slowly from a low base as operations are ramped up while debt service obligations are high due to high interest cost arising from the high outstanding balance of debt that is yet to be repaid. In taking the project to financial closure, the lenders to the project will have to be convinced that the project has a reasonably high probability of generating enough cash to meet the debt servicing requirement. This is all the more vital in a Project Finance transaction as the lenders do not have recourse to the balance sheet of the promoters. Even if the promoters of a Special Purpose Vehicle (SPV) are sitting on a pile of cash generated from their other business interests, the lenders will typically not have access to such cash for meeting any shortfall in debt servicing by the SPV. Thus, apart from looking at the returns generated by the project, we typically have to use the Financial Model of the project to evaluate debt servicing capacity. For this purpose, the amount of cash available for debt servicing has to be considered for each period - the starting point is the projected Operating Profit Before Depreciation, Interest and Tax (OPBDIT) for any given period, which is a reasonably accurate proxy for the cash generated from the operation of the project for that period, barring changes in the net working capital. As we have noted earlier, working capital requirements may not be significant in some infrastructure projects, in which case we can ignore the change in net working capital (ΔNWC). Else, the cash available from operations can be taken as the sum of OPBDIT and ΔNWC. Since any tax payable by the SPV would have priority, the cash available from debt service in any period can be taken as:

$$\text{Cash Available for Debt Service} = \text{OPBDIT} + \Delta\text{NWC} - \text{Tax}$$

It may be noted where non-cash expenses are projected to arrive at the OPBDIT, such as transfers to major maintenance reserve (MMR) to meet periodic maintenance expenditure, the Cash Flow Available for Debt Service should be adjusted accordingly. With the cash available for debt service becoming available for any given period, the Debt Service Coverage Ratio (DSCR) simply expresses this as a multiple of the debt service obligation during that period, where debt service obligation is the sum of interest payments and repayment of the principal amount of loans that is due during the period. Obviously, a value of DSCR less than one indicates that the cash available for debt servicing is not adequate. For lenders, the higher the value of DSCR, the more is the level of comfort – high values of DSCR indicate more room for absorbing events that affect the project adversely without affecting its capacity for debt servicing. Some banks or financial institutions may even specify a minimum value of DSCR (say, 1.33) that has to be maintained. To summarise, DSCR for any given period is given by:

DSCR = Cash Available for Debt Service in a Period/Scheduled Debt Service Obligation in that Period

i.e. $$\text{DSCR} = \frac{\text{OBDIT} + \Delta\text{NWC} - \text{Tax}}{(\text{Interest} + \text{Repayment of Debt})}$$

DSCR is thus specific to a period under consideration and will vary from period to period. The above calculation of DSCR is simple and can be easily accommodated on the standard "CFlo" worksheet discussed earlier, which has all the required values. The toll road project underlying the Sample Financial Model of course does not have significant working capital requirements and hence ΔNWC does not appear as a line item in the earlier illustrations showing the "CFlo" worksheet – for projects where ΔNWC has to be considered, this would not be the case. However, a complete understanding of cover factors such as DSCR requires some further discussion beyond the simple DSCR calculation.

An aspect that has to be considered is whether available or projected cash deposits/balances should be factored into the DSCR calculation or not. As we have seen earlier, cash is often used as the balancing item for projecting the balance sheets and although this means that the amounts of cash on the balance sheets projected for the later periods are not realistic, this does not affect the calculation of equity IRR. We have also seen that this approach does lead to problems in calculating NPV using varying values of WACC and how this can be addressed by restricting the maximum value of equity capital (retained earnings) and cash balances for WACC calculations. However, in a general sense, it is true that cash generated from the project in any period and not utilised or paid out to equity investors as dividends will be available in any later period for meeting debt service obligations when the cash generated in that period is not adequate. Thus, a modification of the simple DSCR measure introduced earlier is to also consider available cash balances in the numerator. However, this is not generally recommended and should never be done using cash balances projected as a balancing item. The relevant question to ask when including cash balances for assessing debt service capacity is advocated is why such cash balances would be maintained in the first place? Since cash earns no (or at best limited) returns when held in a liquid form, would it not make sense to use such cash surplus whenever it is generated to repay at least part of the debt and thus save interest costs that are higher than the returns earned on cash maintained in liquid form?

One exception to the general rule that cash balances should not be considered as being available for debt servicing is cash maintained in the form of a Debt Service Reserve Account (DSRA). Some lenders require such a DSRA to be maintained to guard against the risk that the cash flows available from operations fall short of the debt service obligation in any period. Typically, the amount to be maintained in the DSRA is specified in terms of months of debt servicing obligation – for example, the borrower may be required to maintain at all times an amount equivalent to the debt servicing obligation over the next six months. The DSRA is generally included as part of the project cost and funded up-front along with the capital expenditure on creation of project assets. In fact, it was fairly common for lenders in India to fund DSRA as part of the project cost – in effect, the lenders would provide funding over and above that required to meet capital expenditure so that this excess could be set aside in liquid form and become available if the cash generated from operations fell short of debt service requirements in any period after commencement of operations. This would effectively mean that in the event that the DSRA was tapped to meet a shortfall in debt service, the lenders would be getting funds that had been largely lent by them in the first place. This is a somewhat dubious mechanism to ensure that the loan continued to be classified as a standard asset on the books of the lenders. In fact, apart from the timing aspect such a mechanism is really no different from a case where the lender increases exposure to a borrower in trouble by lending more so that the borrower can use the additional loan to service the original loan. However, most lenders now insist that the DSRA be funded through equity, to which some borrowers with strong promoters/sponsors have responded by negotiating that the DSRA be in the form of a bank guarantee. In any case, what is relevant with regard to the Financial Model is that where a DSRA is maintained, it is reasonable to project some interest income on the DSRA – this interest income would obviously be reflected in the OPBDIT for any period and thus improve DSCR, though marginally. However, it still does not make sense to include the DSRA in the calculation of DSCR since that would distort assessment of the project's intrinsic debt servicing capacity as measured by DSCR. The correct approach would be to cite the provision of the DSRA as a source of comfort in case the DSCR is projected to dip below one in some period(s).

An alternative approach used in some cases is to consider the overall annual cash flows in the form of a cash flow waterfall. This approach focuses on a measure generally termed Cash Flow Available for Debt Service (CFADS) and considers capital expenditure and its funding. Using CFADS may be more appropriate in case of project finance transactions where some capital expenditure has to be continuously incurred in order to keep the operations going and therefore for generating the projected cash flows from operations. Similarly, in case of complex projects with senior and subordinated debt that differ in terms of priority in servicing, a detailed cash flow waterfall may be necessary to work out the relevant coverage ratios for senior and subordinated debt.

An alternative measure of debt servicing capacity is provided by the loan-life cover ratio (LLCR), which has the advantage of being a single measure that covers debt servicing over the entire tenure of the debt rather than being in the form of a series of period specific measures as is the case with DSCR. LLCR is calculated as follows:

LLCR = PV of (Cash from Operations less Tax till the Debt is Repaid)/Debt Outstanding

For working out the present value of the cash flow from operations over the period that the debt is serviced, the effective interest rate on the debt can be used as the discount rate. In effect, LLCR indicates the extent to which the projected cash flows from operations (less tax) over the tenure of the debt cover the outstanding debt. For "like to like" comparison, the projected cash flows from operations over the tenure of the debt is converted to its present value by discounting and the ratio then expresses the cover available for debt service as a multiple of the existing level of debt. Obviously, the higher the multiple, the more is the comfort for lenders that debt servicing obligations will be met in time. For discounting the projected cash flows from operations, the appropriate discount rate is the weighted average interest rate of the outstanding debt. With such a discount rate, the present value of the cash flows from operations is then equivalent to the amount of debt carrying the same rate of interest that can be serviced by the projected cash flows from operations. The illustration below shows the calculation of DSCR and LLCR for projected cash flows of a project.

ILLUSTRATION 4.5

Sample Calculation of DSCR and LLCR (Figures in ₹ Mn)

Row Label	Financial Year ending March 31st	2015	2016	2017	2018	2019	2020	2021	2022	2023
A	Total Cash From Operations	1,289	1,356	1,498	1,585	1,663	1,823	2,045	2,302	2,576
B	Less: Income Tax Paid	0	24	69	118	168	222	281	346	415
A-B	Cash Flow Available for Debt Service	1,289	1,332	1,429	1,467	1,495	1,601	1,765	1,956	2,161
Debt Schedule:										
	Opening Balance	5,833	5,185	4,536	3,888	3,240	2,592	1,944	1,296	648
	Draw-down	0	0	0	0	0	0	0	0	0
C	Repayment	648	648	648	648	648	648	648	648	648
	Closing Balance	5,185	4,536	3,888	3,240	2,592	1,944	1,296	648	0
	Effective Interest rate	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%	11.0%
D	Interest	606	535	463	392	321	250	178	107	36
	Average Debt during the FY	5,509	4,860	4,212	3,564	2,916	2,268	1,620	972	324
C+D	Total Debt Service	1,254	1,183	1,111	1,040	969	898	826	755	684
(A-B)/(C+D)	Debt Service Coverage Ratio (DSCR)	1.03	1.13	1.29	1.41	1.54	1.78	2.14	2.59	3.16
	Weighted Average DSCR (Weight=Average Debt during the FY)	1.41								
E	PV of Cash Flow Available for Debt Service (Discounted at 11%)	9,480								
F	Outstanding Debt	5,833								
E/F	Loan Life Coverage Ratio (LLCR)	1.63								

As discussed earlier, the terms and conditions of debt funding for a project (tenure, interest rate, moratorium on principal repayment and extent of financial leverage) will be by and large driven by the market but it is possible to look at improving the DSCR through longer tenures and moratorium on principal repayment. The issue of bonds with bullet repayment is one way to improve DSCR in the initial years when it is likely to fall below the required minimum. For example, the Sample Financial Model used in illustrations earlier in this chapter involves funding of ₹ 500 lakh through the issue of bonds even though this source comes at a higher cost (fifty basis points more than the plain vanilla loan). Of course, a bond issue of this size is not very realistic, given the high transaction costs associated with a bond issue which typically dictate a minimum economic size. Also, the issue of bonds may not be very feasible for a SPV given regulatory requirements such as a minimum number of years of profitable operations before bonds can be issued, though private placement of such instruments may still be possible. The essential point being made here is that the DSCR can be a tool for structuring the debt component of funding.

Apart from project IRR, equity IRR, NPVs and DSCR, there are several other measures such as pay-back period and book return that are considered by some. However, these being somewhat weak in terms of conceptual clarity have not been touched upon in this text. Nor are such measures recommended for use without adequate reason and even then with caution.

4.3 LOGICAL DEVELOPMENT OF THE FINANCIAL MODEL

Having dealt with the typical components of the Financial Model and the ***Output*** that the Financial Model should be capable of producing, we can now turn to the crux of the matter – i.e. how does one go about obtaining the required intermediate and final output values from the ***Input***, putting the components of the Financial Model in place and linking the same in a phased manner so as to arrive at the required ***Output***? This question is addressed in this Section.

4.3.1 Listing Assumptions and Data

Of the nine standard worksheets mentioned earlier, the starting point is obviously the “A&D” sheet listing the assumptions and data required for developing the Financial Model. The “A&D” sheet can be fairly lengthy – even for the small road/bridge project underlying our ***Sample Financial Model***, the “A&D” sheet runs to over two hundred rows with a reasonable number of blank rows for clarity of presentation. This is likely to be the case for any real life project and it makes sense to divide the "A&D" sheet horizontally into discrete sections covering the key aspects of the project, the typical ones being:

- Project Cost
- Financing
- Effective Dates & Phasing of Capital Investment
- Output/Usage (e.g., traffic for a road project, power produced for a power project, etc., with break-up by category of users/consumers)
- Pricing (e.g., toll rates for different categories of vehicles, power tariff for different categories of power consumers, etc.)
- Operating Expenditure
- Other miscellaneous assumptions covering the assumed/projected rate of inflation, depreciation and income tax

As noted in Chapter 1, the input for the Financial Model includes not only data/assumptions relating to Project Variables but also functions relating such Project Variables to other Project Variables or time periods. In the spreadsheet based Financial Model, these functions are not listed on the "A&D" sheet but are reflected in the design of the formulae used for calculations in the Model Core – essentially the five intermediate worksheets "C&F", "Rev", "Opex", "Tax" and "Dep" as discussed earlier in this chapter. However, these formulae or functions obviously need the data and assumptions on Project Variables to be in place on the "A&D" worksheet in the first place.

Of all data, the most fundamental is the project cost estimate, i.e., the projected capital expenditure on the project, and entering this data in the "A&D" worksheet is the most logical starting point for developing the Financial Model. After all, the exercise of developing a Financial Model can start only when there is a reasonably accurate project cost estimate in place. Typically, the project cost would be estimated as part of a technical report prepared for the project as the estimate would depend on the specifications, design and the implied volumes of various materials and civil works. The Financial Model, however, does not need to cover the detailed estimation of the project cost but it starts from the base cost figures for various components of the project. This is shown in the illustration below. It is also possible to start the modelling exercise with the total estimated base project cost, without getting into the break-up of components. The modeller can exercise discretion in this regard, the key point being that justification or explanation of the estimated project capital cost is generally not a primary objective of the Financial Model and should be addressed elsewhere.

ILLUSTRATION 4.6

Project Cost Data from the Sample Financial Model

E49 =E44+E46+E48

	A	B	E	F	G
15	B	**Project Cost (Rs.)**			
16		**Note: After any change in assumptions, IDC macro (Ctrl+a) has to be run**			
17		Site Clearance	217,876		All figures from Appendix E of DPR, except Environment Management
18		Earthwork	35,108,681		from Pg. 32 of techincal consultant's report of June 2005
19		Pavement	36,790,923		
20		Bridge (Main)	142,616,935		
24		Street Lighting	4,932,160		
25		Toll Equipment	2,378,000		
26		Toll Plaza	7,500,000		
28		Environment Management	1,180,000		
29		**Base Project Cost (Rs. Lakh)**	***3,278.27***		The base project cost calculated takes into account value in E32
30		Base Project Cost Estimate for FY ending March 31,	2005		
31					
32		Sensitivity Factor for Change in Base Project Cost - % incr/(decr)	**0.0%**	Go to key	Enter negative percentage for reduction in base project cost
33					
34		Preliminary & Pre-Operative Expenses	0.50%	16.39	
35		Insurance	0.50%	16.39	
38		Project Development/Success Fee	2.50%	81.96	
39		Service Tax on Fees - % of Fees	12.24%	18.06	
40		Contingencies	2.50%	81.96	
41		Consultancy/Legal Fees	2.00%	65.57	
42		Other Costs (Lump-sum)		40.00	
43					
44		Sub-Total	3,696.94		
45					
46		Escalation in Cost	593.81		Calculated on "C&F" sheet
47					
48		IDC	193.61		Calculated on "C&F" sheet using IDC macro (Ctrl+a)
49		**Total Cost of Project - Landed Project Cost (LPC - Rs. Lakh)**	**4,484.36**	OK	

Index | A&D | C&F | Rev | Opex | Dep | Tax | P&L | BS | CFlo | Result

Another relevant point in this regard is that comments can be inserted as part of a "Comments" column or using the "Insert-Comment" menu feature to record the sources of data for the benefit of future users of the Financial Model, as shown in the illustration below. Apart from comments, another useful feature that can be incorporated in any Financial Model is a colour code. In the illustration shown below, for example, cells containing data from any source have been distinguished from cells containing assumptions using different colours. Similarly, figures obtained from calculations (only basic manipulations should figure on the "A&D" worksheet, as discussed earlier) are displayed in cells with another background colour to distinguish such cells containing formulae from cells containing data and assumptions that can be changed by users[10]. The project cost section from the "A&D" worksheet of the Sample Financial Model is shown in the illustration below. A few rows have been hidden to save on the space required for displaying the illustration but the illustration should give the reader a fair idea about the typical project cost section in the "A&D" worksheet.

Apart from the base project cost, the Financial Model should include as part of the capital cost, all the pre-operative expenses that are likely to be incurred in implementing the project. Typically, these would include costs involved in preparation of detailed designs, legal fees, insurance, financing charges, supervision of construction, taxes, etc. It is not always possible to estimate accurately these costs but an estimate based on percentage of the base project cost can be used, basing the percentages on inputs from experts in the relevant areas or the experience in other projects of a similar nature implemented in the past. Apart from this, a figure for "contingencies" should be included to cover unforeseen expenses that may have to be borne during construction/implementation.

A few key points about the incorporation of the project cost in the Financial Model should be noted as these may not be apparent from the illustration. Apart from the additional costs over and above the estimated base project cost, the other essential feature that the Financial Model should include is the ability to calculate and include in the capital expenditure, the cost escalation element. This is essential as many projects have significant gaps between the preparation of the technical report from which the base project cost is taken and the actual start of construction. The increase in cost due to inflation over this intervening period has to be estimated and

[10] The use of a colour code has been covered in more detail in Section 5.2 of the next chapter.

included in the ***Financial Model***. Thus, it is essential to include along with the project cost related data, the period when the project cost estimate was prepared – this should be in line with the time-line used in the Financial Model. In the ***Sample Financial Model***, the financial year ending March 31^{st} is used as the time-line – hence, it is recorded in row 30 that the base project cost was estimated in the FY ending March 31^{st}, 2005. With this piece of information in place, the Financial Model becomes flexible for the purpose of calculating the cost escalation element, irrespective of the actual start date of the project.

It should also be noted that the calculation of escalation and Interest during Construction (IDC) is not done on the "A&D" worksheet (which, at the cost of repetition, should contain minimal calculations) but on the "C&F" worksheet. Thus, the "A&D" worksheet only has a reference to the cells containing the calculated figures on the "C&F" worksheet. The calculation of escalation and IDC is covered later in this section. However, with the cost escalation and IDC values in place, the landed project cost can be worked out as the sum of the base project cost, the pre-operative expenses, escalation and IDC, as shown in the cell E49 of the illustration. Showing these figures on the "A&D" sheet may seem to flout the label in being neither assumption nor data, but having a convenient break-up of the project cost justifies this. Of course, the same can be replicated in an Output sheet in any desired format – the key point is that anything beyond rudimentary summing of cells is calculated on a sheet other than "A&D", i.e., "C&F" in this case.

While entering the project cost data, it also makes sense to include a factor for sensitivity analysis with respect to changes in the project cost, as shown in cell E32 and apply the value of this cell to the calculation of the base project cost, i.e., the sum of various components of the project cost in the cells E17 to E28 as calculated in cell E29 is multiplied by a factor (1+value entered in cell E32). This type of feature, based on anticipated requirements to be met by the Financial Model allows for a sensitivity analysis on key project parameters, like project cost to be incorporated into the model directly at the data source itself rather than first developing the model and then finding a way to incorporate sensitivity analysis by modifying interim calculations, which may lead to errors getting introduced. In this case, the value entered in E32 will be zero per cent to start with but any percentage entered in E32 will get reflected in the base project cost value calculated in E29, from where it is used for all subsequent calculations in the Financial Model.

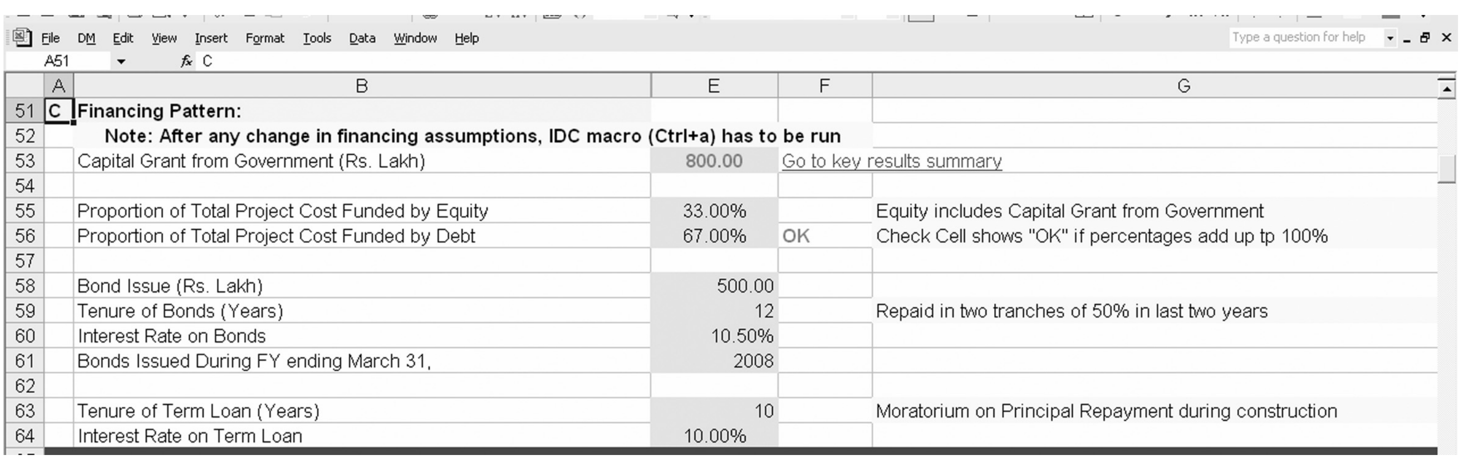
Having entered the project cost details as shown in the illustration above, the next step in developing the Financial Model is to make assumptions about funding. This may appear somewhat unusual in light of the earlier observations on project IRR as the intrinsic return generated by a project without any consideration of funding (or, all equity funding). However, in developing the Financial Model, it becomes necessary to make assumptions about funding at a fairly early stage. This does not affect the Financial Model's ability to generate project IRR as part of the required Output, as shown subsequently. As shown in the illustration, the data on funding should cover the capital structure (proportions or amounts of debt and equity financing, also referred to as gearing or financial leverage), the cost of debt funding and the tenure of loans, i.e., how many years are allowed for repayment of the entire principal amount. Typically, repayment of the loans start after the completion of construction – there is thus a moratorium on principal repayment (note: not interest payment). Of course, any debt funding by issue of bonds will mean bullet repayment towards the end of the bond's tenure – in case of the Sample Financial Model, the bond is assumed to be repaid in two equal instalments in the years 11 and 12 from the time when bonds are placed/issued. Obviously, the extent of detailing of funding or capital structure is closely linked to the phase of the Project Time-Line. At the preparation phase, very broad assumptions about funding based on benchmarks may be used whereas at a later stage, say for deciding on the bid at the procurement phase, a prospective bidder may take a much closer look and use assumptions about funding, based on discussions with potential lenders.

It may be noted that a key aspect of the Sample Financial Model, reflected in the illustration above, is the use of capital grants to make the project financially feasible for private investment.

After entering the details of funding, the next step is to enter the time-line data relating to the start of construction, the construction period and the proportion of capital cost to be incurred in each year/period. The sample data for funding and time-lines entered in the "A&D" worksheet are shown in the next illustration. While it is possible to enter the construction start and end dates directly into cells, the Financial Model becomes much more flexible if the construction end date is calculated from the start date and the construction period. This makes the Financial Model flexible and allows easy updating without extensive re-entry of data for any delays during project development (which as we all know are more likely than not).

ILLUSTRATION 4.7

Data on Funding from the Sample Financial Model



	A	B	E	F	G
51	C	**Financing Pattern:**			
52		**Note: After any change in financing assumptions, IDC macro (Ctrl+a) has to be run**			
53		Capital Grant from Government (Rs. Lakh)	800.00	Go to key results summary	
54					
55		Proportion of Total Project Cost Funded by Equity	33.00%		Equity includes Capital Grant from Government
56		Proportion of Total Project Cost Funded by Debt	67.00%	OK	Check Cell shows "OK" if percentages add up tp 100%
57					
58		Bond Issue (Rs. Lakh)	500.00		
59		Tenure of Bonds (Years)	12		Repaid in two tranches of 50% in last two years
60		Interest Rate on Bonds	10.50%		
61		Bonds Issued During FY ending March 31,	2008		
62					
63		Tenure of Term Loan (Years)	10		Moratorium on Principal Repayment during construction
64		Interest Rate on Term Loan	10.00%		

ILLUSTRATION 4.8

Entry of Project Time-Lines on the A&D Worksheet (Sample Financial Model)

File DM Edit View Insert Format Tools Data Window Help Type a question for help

B66 fx Effective Dates & Phasing of Capex

	A	B	E	F	G	H
66	D	**Effective Dates & Phasing of Capex**				
67		**Note: After any change in assumptions, IDC macro (Ctrl+a) has to be run**				
68		Construction Starts on first day of month, i.e. day =	1	OK	Enter date for first day of month only	39052
69		Enter month (1 to 12) for construction start	12	OK		
70		Enter year (yyyy) for construction start	2006			
71		Construction Period (Months)	18	OK	Maximum 36 months provided for in this model	
73		Date - end of construction (dd-mmm-yyyy)	31-May-2008			39599
74		Construction ends in FY ending March 31,	2009			
75		Nos. of months available post-construction during the FY	10			
76		Toll-free operation period after construction end (months)	3			
78		Concession Period from Commercial Operations Date (COD)	30	years		
80		Calculated COD (dd-mmm-yyyy)	01-Sep-2008			39692
82		COD in FY ending March 31,	2009			
83		Nos. of months operation in first FY	7			
84		Concession ends during FY ending March 31,	2039			
85		Nos. of months operation in last FY	5			
86						
87		Construction commences during FY ending March 31,	2007			
89		Nos. of months construction in FY ending March 31,	2007	2008	2009	2010
90		*Nos. of months*	4	12	2	0
91			OK			
93		% of base project cost (C) retained for defect liability	10.00%			
94		Defect Liability released - years after end of construction	1			
95		i.e. defect liability released on	31-May-2009			39964
96		Defect Liability released during FY ending March 31,	2010			
98		% of balance capex incurred during FY ending March 31,	2007	2008	2009	2010
99			20.00%	65.00%	15.00%	0.00%
100				OK	means % of capex figures add up to 100%	
101					In addition, ensure that 0% for years with no construction	

Prabuddha Das:
Balance Capex is the landed cost less amount held back for defect liability.

Index A&D C&F Rev Opex Dep Tax P&L BS CFlo Result

This approach obviously requires some manipulation of time-line based Project Variables but can be used to ensure that the first period (generally financial year) of the Financial Model shown on every worksheet is calculated based on the construction start date rather than being fixed by the modeller when the Financial Model is first created and then becoming subject to change every time the project is delayed. In case of the Sample Financial Model, the entered date for the start of construction (cells E68, E69 and E70 in the illustration) is used to calculate (in cell E87) that the first relevant financial year for the Financial Model is the one ending March 31st, 2007. This calculated value of 2007 on the "A&D" worksheet is then referred to by the formulae in the row showing the Project Time-Line on every other worksheet – for example, cell E4 on the "C&F" sheet will simply be a reference to E87 on the "A&D" worksheet while E5 will have a formula that adds one to the value in E5 and so on. This ensures that any change in the value in E87 on the "A&D" worksheet is immediately reflected in the time-line labels across the model.

It may be noted, however, that the modeller may choose to incorporate different time-line labels on some worksheets based on need – however, this has significant implications which the modeller should be aware of. This is primarily because this violates the best practice of having uniform time-lines or periods on every sheet of the Financial Model as highlighted in Chapter 5 . Simply put, the best practice means that a particular column on any worksheet refers to the same period – for example, column E corresponding to the financial year ending March 31st, 2007. The modeller has to remain conscious about any such violation and be particularly careful to ensure that the values calculated on the worksheet violating the best practice are picked appropriately on other worksheets. In general, the mixing up of time-line values, such as using quarters or months in one or two worksheets while other worksheets have financial year as the time-line value should be avoided.

To understand this, consider the Sample Financial Model where this violation is required on the "Rev" worksheet since the base level of traffic was for the financial year ending March 31st, 2005. On the "Rev" worksheet, the time-line label cells in row eight (8) thus incorporate a reference to a different cell on the "A&D" worksheet. On the "Rev" worksheet, cell C8 refers to cell G108 on the "A&D" worksheet (that has "2005" entered as the base year for traffic projection) and the value in every subsequent column of row 8 on the "Rev" worksheet adds one to the value of the cell in the previous column. Note that the violation may not occur in a base case scenario and the modeller has to ensure that the Financial Model can handle violations when these occur due to some change in the assumptions. In the Sample

Financial Model, with the construction start date as shown earlier, column E on the "Rev" worksheet corresponds to the financial year ending March 31st, 2007 just like the other worksheets. However, if we change the construction start date to 1st December, 2008 from 1st December, 2006 as shown in the base case illustrations, the column E on all worksheets other than "Rev" will correspond to the financial year ending March 31st, 2009 while on the "Rev" worksheet, this column E will continue to correspond to the financial year ending March 31st, 2007. In such a scenario, a formula that links the value of toll revenues in column E of the "P&L" worksheet to that of column E on the "Rev" worksheet would lead to an error. However, using the HLOOKUP formula on the appropriate range of cells of the "Rev" worksheet allows the violation to be addressed. As a safety measure, the appropriate range of cells on the violating worksheet "Rev" referred to in the HLOOKUP formula should be kept wider (have more columns). We will re-visit this aspect in Chapter 5.

The problems arising out of less than twelve months being relevant in the first and last period (generally financial year) of the concession period and/or operation period and/or construction period can also be solved with the proposed approach to time-line data, which allows the number of months of construction and/or operation during a given time period to be specifically calculated, as shown in rows 83, 85 and 90 of the previous illustration. The entry, use and manipulation of date variables to handle such calculations are dealt with in detail later in Chapter 6. However, the reader should note at this point itself the importance of making the Financial Model flexible in terms of time-lines and the possible pit-falls of violating the best practice regarding uniformity of time-lines across worksheets.

Having reached this stage of the data entry exercise, we are ready to start creating the first elements of the Financial Model that use calculations based on the data entered so far. The only other data item that is required is the rate at which the capital expenditure gets escalated (or inflation rate). While the rate of escalation of capital expenditure and the inflation rate applied to items of revenue and operating expenditure can be the same, the modeller can also choose to incorporate a different rate for capital expenditure if steel/cement prices are expected to change at rates different from the general inflation rate, which is often the case given the cyclical nature of these industries. Based on recent experience the modeller may also decide to have a higher rate for escalation of capital expenditure in order to be conservative, remembering that the construction period is typically much shorter than the operating period. Over a long operating period, deviations of the actual inflation rate from that assumed in the Financial Model will tend to cancel out and will in any case affect NPV and IRR to a lesser degree, given that the cash flows are further in the future compared to capital expenditure and therefore discounted to a greater extent. Thus, applying a realistic inflation rate to cash outflows during the construction period is of far greater importance than capturing inflation correctly on a period-to-period basis over the operating period.

However, unless there exists a strong rationale for believing that the inflation rate over the operating period will be different from that over the construction period, it is best to apply the same rate – this is the case in the Sample Financial Model, with a common inflation rate of 5% per annum applied to both capital expenditure and operating expenditure. This assumption is entered in cell E193 as part of other assumptions on the "A&D" worksheet, as shown below:

ILLUSTRATION 4.9

Inflation/Depreciation Rates and Other Assumptions (Sample Financial Model)

File DM Edit View Insert Format Tools Data Window Help

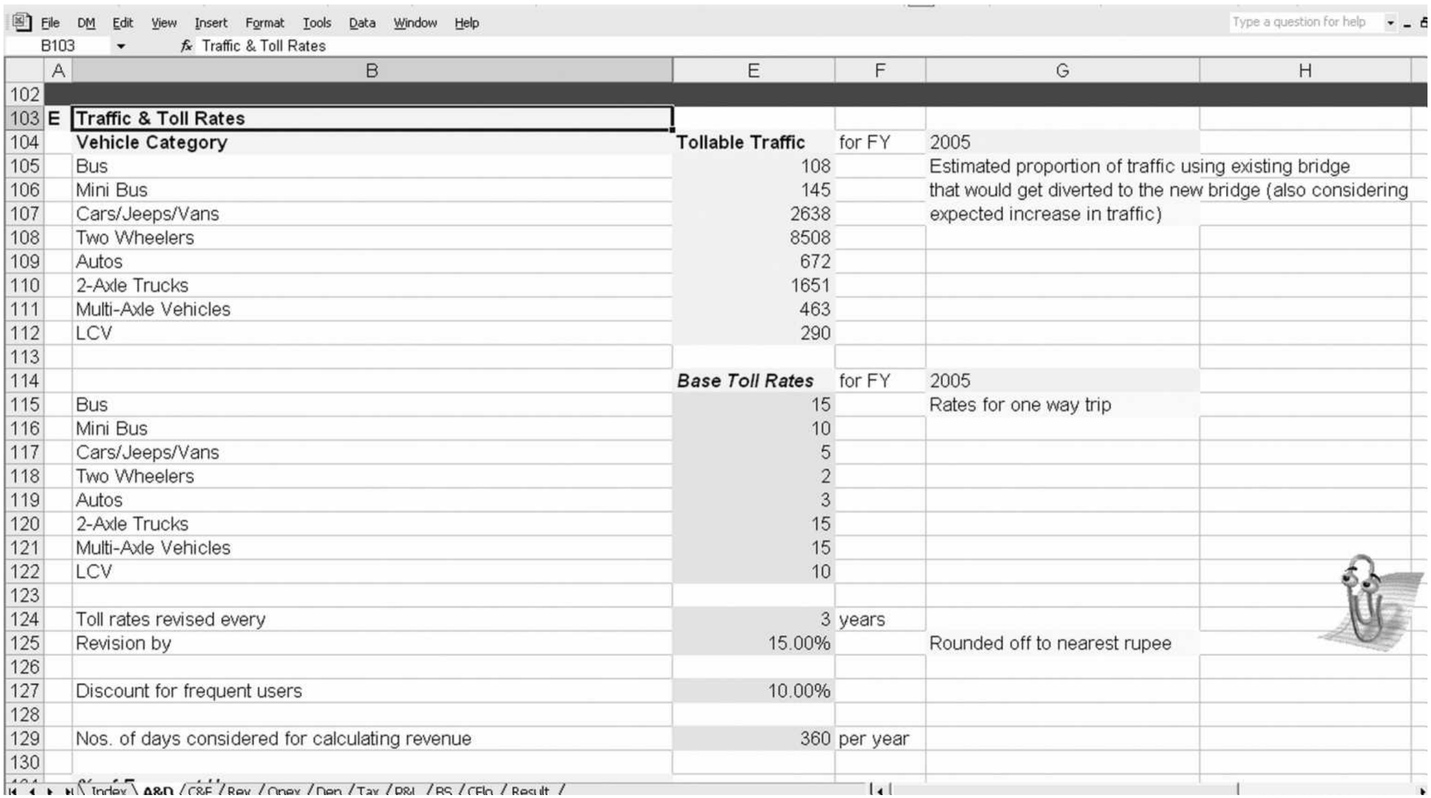
B192 fx Other Assumptions

	A	B	E
192	G	**Other Assumptions**	
193		Escalation Rate for Capex/Inflation Rate	5.00%
194			
195		Other Revenues (Advertising) as % of Toll Revenues	5.00%
196			
197		Depreciation Rate (Companies Act - SLM) - Toll Eqpmt	16.21%
198		Depreciation Rate (Companies Act - SLM) - Others	4.75%
199		Depreciation Rate (IT Act - WDV) - Toll Eqpmt	60.00%
200		Depreciation Rate (IT Act - WDV) - Others	10.00%
201			
202		Income Tax Rate - Normal	33.66%
203		Income Tax Rate - MAT	11.22%
204		Nos. of Years from COD within which S80 IA benefits to be claimed	20
205		Nos. of Years that Losses can be carried forward for setting off	8
206			

Before moving on to the first of the intermediate worksheets, i.e., the "C&F" worksheet, using the project cost, time-line and funding related data and assumptions in place on the "A&D" worksheet, it makes sense to first cover the other categories of data and assumptions that are typically required on the "A&D" worksheet. The first of such categories relates to the level of projected usage or physical output of the project and the pricing of such usage/output. The nature of the data/assumptions required will obviously depend on the sector and project characteristics but the general requirement

ILLUSTRATION 4.10

Project Usage/Pricing Data from the "A&D" Worksheet of the Sample Financial Model



	A	B	E	F	G	H
102						
103	E	**Traffic & Toll Rates**				
104		**Vehicle Category**	**Tollable Traffic**	for FY	2005	
105		Bus	108		Estimated proportion of traffic using existing bridge	
106		Mini Bus	145		that would get diverted to the new bridge (also considering	
107		Cars/Jeeps/Vans	2638		expected increase in traffic)	
108		Two Wheelers	8508			
109		Autos	672			
110		2-Axle Trucks	1651			
111		Multi-Axle Vehicles	463			
112		LCV	290			
113						
114			***Base Toll Rates***	for FY	2005	
115		Bus	15		Rates for one way trip	
116		Mini Bus	10			
117		Cars/Jeeps/Vans	5			
118		Two Wheelers	2			
119		Autos	3			
120		2-Axle Trucks	15			
121		Multi-Axle Vehicles	15			
122		LCV	10			
123						
124		Toll rates revised every	3	years		
125		Revision by	15.00%		Rounded off to nearest rupee	
126						
127		Discount for frequent users	10.00%			
128						
129		Nos. of days considered for calculating revenue	360	per year		
130						

that has to be met is that the data and assumptions should be adequate to project the revenues generated by the project. The detailed calculation of projected revenues may be carried out in the "Rev" worksheet but all the required data and assumptions should be in place on the "A&D" worksheet. The data/assumptions relating to traffic and toll rates as used in the ***Sample Financial Model*** are shown in the illustrations below.

Apart from the base data on the level of usage and pricing, it is also necessary to provide for changes in these over the Project Time-Line as provided for in the PPP Project Contract period. This would of course be driven by the nature of the project – as an example, a power generation project may not show much variation in the level of output over the Project Time-Line. Also, given the current demand-supply and tariff regulation framework (refer CERC); complete sale of output with the pricing linked to assumptions on operating expenditure would have to be considered. In a road project, while pricing may be driven by inflation or as provided for in the relevant PPP Project Contract, the level of traffic as compared to the design capacity may build up only slowly. Assumptions in these regard are obviously major drivers for the project's feasibility. The entry of assumptions and data on the level of usage and pricing may thus vary somewhat from one project/sector to another. Careful study of the available documentation (PPP Project Contract, feasibility reports, tariff regulations, etc.) is advisable where such documents are available in setting up this section of the "A&D" worksheet to be flexible enough to evolve as well as address likely questions on the assumptions made. For the sake of comprehensive coverage, the balance data and assumptions pertaining to traffic and toll rates from the Sample Financial Model is shown in the ***Illustration 4.11***.

The only other category of assumptions and data yet to be illustrated relate to the operating expenditure, barring depreciation. The foundation for calculating depreciation has been already laid with the capital expenditure related assumptions and data and requires only the appropriate depreciation rates to be incorporated on the "A&D" worksheet (part of "Other Assumptions" shown in an earlier illustration). As in case of the usage/pricing related assumptions and data, there is a fairly wide range of operating expenditure characteristics that are driven by the specific project/sector. For example, a large part of the operating expenditure of a power generating project would be accounted for by fuel while a road project would require major periodic maintenance expenditure. In any case, the amount of expenditure required to both operate and maintain the project assets to produce the projected revenue stream without interruption should be considered. Typically, most

ILLUSTRATION 4.11

Project Usage/Pricing Data from the "A&D" Worksheet (Balance)

File DM Edit View Insert Format Tools Data Window Help

B131 % of Frequent Users

	A	B	E	F
131		*% of Frequent Users*		
132		Bus	50.0%	
133		Mini Bus	50.0%	
134		Cars/Jeeps/Vans	60.0%	
135		Two Wheelers	70.0%	
136		Autos	70.0%	
137		2-Axle Trucks	25.0%	
138		Multi-Axle Vehicles	25.0%	
139		LCV	25.0%	
140				
141		*Traffic Growth Rates As At FY*	2005	
142		Bus - Growth Rate Projected	3.4%	
143		Mini Bus - Growth Rate Projected	3.4%	
144		Cars/Jeeps/vans - Growth Rate Projected	5.7%	
145		2 - Wheeler - Growth Rate Projected	7.2%	
146		Autos - Growth Rate Projected	4.6%	
147		2-Axle Trucks - Growth Rate Projected	5.3%	
148		MAV - Growth Rate Projected	5.3%	
149		LCV - Growth Rate Projected	5.3%	
150				
151		Growth Rates assumed to decline by	5.0%	
152		Every	5	years
153				

projects are fairly sensitive to changes in operating expenditure and it makes sense to include a sensitivity parameter for operating expenditure on the "A&D" worksheet itself, as shown in the ***Illustration 4.12*** (cell E157).

4.3.2 Developing the Model Core

Having laid the foundation for the ***Sample Financial Model*** in terms of the assumptions and data on the "A&D" worksheet, we can now proceed to illustrate the logical build-up of the entire Financial Model. It is proposed to lay down the contours of the entire process in brief. This will not entail detailing of the specific calculations in each step but list the inputs and outputs for each of the five intermediate worksheets ("C&F", "Rev", "Opex", "Dep" and "Tax") and the flow of the intermediate outputs from these worksheets to other worksheets. The aim will not be so much the explanation of each formula used (readers are expected to refer to the ***Sample Financial Model*** on the attached CD for this) but to outline the logic of how the various assumptions and data on the "A&D" worksheet are used to build up the Financial Model.

ILLUSTRATION 4.12

Assumptions on Operating Expenditure from the Sample Financial Model

File DM Edit View Insert Format Tools Data Window Help

B154 fx Assumptions on Operating Expenditure

	A	B	E	F	G	H
154	F	**Assumptions on Operating Expenditure**				
155		Estimates based on costs prevailing during the FY ended March 31st, 2005				
156						
157		Sensitivity Factor for O&M expenses	0.00%	Go to key results summary		
158						
159		**Materials Cost**				
160		Estimated Materials Cost - Routine Maintenance	4.14	Rs. Lakh		
161		Estimated Materials Cost - Periodic Maintenance	84.27	Rs. Lakh		
162		Periodic Maintenance Carried Out Every	5	Years		
163						
164		**Manpower Costs**				
165		**Position**	**Nos.**	**Nos. incl. LR**	**Cost Per Month**	**Annual Cost (Rs. Lakh)**
166		CEO	1	1	120,000	14.40
167		Secretary to CEO	1	1	8,000	0.96
168		Accounts Officer	1	1	60,000	7.20
169		Company Secreatry	1	1	50,000	6.00
170		Clerical Staff (Accounts/Admin)	2	2	12,000	2.88
171		Engineer	1	1	40,000	4.80
172		Tolling Supervisor	3	4	12,000	5.76
173		Maintenance Supervisor/Asst. Engineer	1	1	25,000	3.00
174		Toll Collectors	18	22	8,000	21.12
175		Maintenance Workers	3	4	6,000	2.88
176		Security Guards	6	7	5,000	4.20
177		Peon	1	1	5,000	0.60
178		Driver	1	1	5,000	0.60
179						
180		***Total Manpower Cost***				**74.40**
181						
182		**Other Overheads**	**Rs. Lakh**			
183		Auditor & Independent Engineer	4.00			
184		Insurance	1.00			
185		Repairs & Maintenance - Toll Plaza, Equipment,Vehicles	2.00			
186		Power & Water	2.00			
187		Other Misc. Expenses	5.00			
188						
189		**Total Other Overheads**	***14.00***			

Prabuddha:
Increases all items of operating expense by the percentage entered. Items decreased if negative percentage entered.

Prabuddha:
Leave Reserve (LR) of 20% considered only for categories where 20% of base number is greater than 0.5

Index / A&D / C&F / Rev / Opex / Dep / Tax / P&L / BS / CFlo / Result /

Step 1: "C&F" Worksheet

Inputs from "A&D" worksheet

- Total estimated capital cost (without escalation), along with the base period during which the estimate has been made
- Phasing of capital expenditure – percentage incurred in each period of construction
- Financing of capital expenditure including interest rates and repayment terms of debt funding
- Annual rate of inflation to be used for escalating capital expenditure from the base period estimates

Intermediate Output	Forward Linkage(s) of Intermediate Output	Reference
Capital Expenditure incurred during each period of construction, including escalation and IDC shown separately	Capital WIP shown on the projected balance sheet ("BS" worksheet) – capital expenditure in each period of construction being added to the balance of capital WIP of the previous period (this is zero in the period when construction commences)	(a)
	Capital expenditure including escalation shown on the cash flow sheet ("CFlo" worksheet) during each period of construction as a use of cash	(b)
	IDC shown separately on cash flow sheet ("CFlo" worksheet) as a use of cash for each period of construction	(c)
Total capital expenditure, escalation and IDC – summation of period-wise figures above	Total escalation and IDC shown on "A&D" worksheet for a convenient summary of the landed project cost, as discussed earlier	(d)
	The total landed project cost is capitalised and shown as gross fixed assets on the "BS" worksheet in the period when commercial operations commence and in every subsequent period (assuming no further capital expenditure incurred)	(e)
	After applying any assumption on the break-up by type of fixed asset (depreciation rates being different for each type of fixed asset) in the total landed project cost, used as the opening balance for each category of fixed assets to be depreciated on the "Dep" worksheet	(f)

Schedule for each type of debt funding showing the opening balance (zero in the first period of construction), draw-down of funding in each period of construction (i.e., debt funding availed), repayment of debt funding and the resultant closing balance of debt, i.e., opening balance plus draw-down less repayment.	Draw-down of debt funding (as well as grant in the ***Sample Financial Model***) is shown as a source of cash in each relevant period on the "CFlo" worksheet	(g)
	Repayment of debt funding is shown as a use of cash in each relevant period on the "CFlo" worksheet	(h)
	Closing balance of each type of debt funding (as well as grant in case of the ***Sample Financial Model***) shown on the "BS" worksheet on the liabilities side for each relevant period	(i)
Interest payable on each form of debt funding is then calculated on the average of the opening balance and closing balance.	Interest is shown on the "P&L" worksheet as an expense and also as a use of cash in the "CFlo" worksheet	(j)
Release of the defect liability amount is shown as a separate row, with the release of the amount being shown in the period/column that is immediately after the period/column when the construction is completed and the project is commissioned.	For the period/column corresponding to the construction completion and project commissioning, the amount of defect liability is shown as a liability on the "BS" worksheet while it is shown in the subsequent period/column as a use of cash for meeting capital expenditure on the "CFlo" worksheet	(k)

Step 2: "Rev" Worksheet

Inputs from "A&D" worksheet

- Estimated level of physical output or usage of the Project asset for each period starting from the first period of commercial operation, including break-up into categories as may be required (for example, category of vehicle for road Project) – this may take the form of a base level of usage for a particular period along with the projected annual growth rates required for projecting usage in subsequent periods
- Price related assumptions, including details of pricing for each category of usage/output and assumptions on periodic revision of pricing
- Any assumption relating to the capacity of the Project asset, beyond which level of usage/output additional revenue generation should not be considered
- Any assumption relating to other income that may be generated from the Project asset – for example, advertising revenues from billboards as a form of income accruing in addition to the toll revenues for a road Project

Intermediate Output	Forward Linkage(s) of Intermediate Output	Reference
Revenue generated in each relevant period, being the product of physical output/usage of the project asset and the price per unit of usage/output projected for that period (category-wise if relevant)	Shown as revenue on the "P&L" worksheet Also, if any item of operating expense is related to revenue, the revenue calculated on the "Rev" worksheet may be used on the "Opex" worksheet	(l)
Other revenue generated depending on assumptions in this connection	Shown on the "P&L" worksheet [11]	

Step 3: "Opex" Worksheet

Inputs from "A&D" worksheet

- Assumptions related to each item of operating expense such as materials consumed, manpower, overheads, etc.

Intermediate Output	Forward Linkage(s) of Intermediate Output	Reference
Operating expense in each relevant period during the commercial operation of the project – these may be calculated for each category of expense such as materials, manpower, overheads, etc.	The total operating expense for each relevant period from the start of commercial operation to the last period of commercial operations as per the PPP Project Contract shown as operating expense on the "P&L" worksheet – various categories of expenses need not necessarily be shown on the "P&L" sheet	(m)

Step 4: "Dep" Worksheet

Inputs from "A&D" worksheet

- Assumptions related to depreciation rates for each category of physical asset; typically, the rates for reporting under corporate law and for calculation of income tax may differ and both sets of rates are required
- Assumptions relating to the break-up of fixed assets into categories that differ in terms of the applicable depreciation rate – for example, categories such as civil works, plant & machinery, computers, etc. will typically be subject to different depreciation rates. The depreciation rates for different sub-categories of plant & machinery may also vary depending on the nature of such plant & machinery and the usage.

[11] In the Sample Financial Model, this is calculated directly on the "P&L" worksheet.

Intermediate Output	Forward Linkage(s) of Intermediate Output	Reference
Schedules showing for each category of fixed asset the opening/gross block for each relevant period, the depreciation during the period and the closing/net block[12] – the schedules for depreciation as per Companies Act and Income Tax have to be prepared separately on the "Dep" worksheet	The total depreciation as per the Companies Act across all asset categories for each relevant period shown as an expense for that period on the "P&L" worksheet	(n)
	The total depreciation as per Companies Act for any period gets added to the figure of accumulated depreciation for the previous period on the "BS" worksheet (accumulated depreciation being zero in the first period when commercial operations commence)	(o)
	The depreciation as per Income Tax Act to be used on the "Tax" worksheet	(p)

Step 5: "Tax" Worksheet

Before taking up the "Tax" worksheet, it is necessary to complete the "P&L" worksheet till the line item Profit Before Tax (PBT). At this stage of the development of the Financial Model, we are in a position to do this. To ensure that is indeed the case, consider the relevant P&L line items in the illustration below, which indicates clearly that each item is already available from the worksheets already in place after completion of Steps 1 to 4 outlined above or can be obtained by simple manipulation of the line items on the "P&L" worksheet itself.

ILLUSTRATION 4.13

Line Items on "P&L" Worksheet up to PBT

Sr. No.	Line Item	Forward Linkage Identified or Operation Required	Reference
1	Revenues	"Rev" worksheet - Forward Linkage (l)	
2	Operating Expenses	"Opex" worksheet – Forward Linkage (m)	
3	OBDIT	Item 1 less Item 2 – this is turn is used as a source of cash on the "CFlo" worksheet	(q)
4	Interest	"C&F" worksheet – Forward Linkage (j)	
5	PBDT	Item 3 less Item 4	
6	Depreciation	"Dep" worksheet – Forward Linkage (n)	
7	PBT	Item 5 less Item 6	

[12] The assumption here is that there are no additions to fixed assets in subsequent periods after the commencement of commercial operations – however, investment occurring in distinct phases can also be catered to with depreciation schedules prepared for each phase separately.

Having completed the "P&L" worksheet till the line item PBT, we can take up the last of the intermediate worksheets, i.e., the "Tax" worksheet.

Inputs from "A&D" worksheet

- Assumptions related to rates of Income Tax, carry forward of losses and exemptions from Income Tax

Output	Forward Linkage(s) of Intermediate Output	Reference
The income tax payable for each period of operation, using the relevant assumptions from the "A&D" worksheet, the figure of PBT for the relevant period drawn from the "P&L" worksheet (completed till that line item as outlined earlier) and the figure of Income Tax depreciation from the "Dep" worksheet, i.e., Forward Linkage (p)	• Income tax payable for each period is shown on the "P&L" worksheet, which stands completed with the addition of the line item Profit After Tax (PAT), being PBT less income tax as calculated • Income tax for each period is also shown as an use of cash on the "CFlo" worksheet	(r) (s)

4.3.3 Completing the Output

At this stage, we thus have all the five intermediate worksheets in place along with the completed ***Output*** worksheet "P&L". All we now need to do is complete the two remaining ***Output*** worksheets "BS" and "CFlo". Some of the line items required for the completion of the "BS" and "CFlo" worksheets are already available on the completed intermediate worksheets as indicated by the forward linkages already discussed and just need to be referred to appropriately on the "BS" and "CFlo" worksheets. Some manipulation on these worksheets involving the sum/difference of line items is also required. However, a few of the required line items need referencing between the ***Output*** worksheets, and these should be carefully noted. These are:

- Cash[13] on the assets side of the "BS" worksheet: this serves as one of the two balancing items that link all the three ***Output*** worksheets together. For any period ending on a given balance sheet date (say, 31st March of Year N) the difference between sources and uses of cash during that period as reflected in the "CFlo" worksheet is taken to the "BS" worksheet and added to the figure of cash as on the previous balance sheet date (i.e., 31st March of Year N-1) to generate the value of cash for the projected balance sheet as at 31st March of Year N.

[13] The term "cash" as used here means funds held in liquid form either as currency or bank deposits – it should thus be regarded as cash and bank balances combined.

- Reserves on the liabilities side of the "BS" worksheet: this serves as the other balancing item linking the ***Output*** worksheets and the accretion to reserves as at any balance sheet date is equated to the PAT during the period ending on that date. In other words, as at any balance sheet date (say, 31^{st} March of Year N), the figure of reserves for the projected balance sheet is derived by adding to the figure of reserves as on the previous balance sheet date (i.e., 31^{st} March of Year N-1) the value of PAT generated in the intervening period, as reflected in the "P&L" worksheet.

Equity capital on the liabilities side of the "BS" worksheet: This figure is derived from the post-tax equity cash flow figure on the "CFlo" worksheet. As discussed earlier in this chapter while looking at the ***Output*** of the Financial Model, the equity cash flow on the "CFlo" worksheet is essentially residual in nature. In any period where the total use of cash exceeds the cash available from non-equity sources, additional equity capital has to be infused. As in the two examples outlined above, in any period (say, ending March 31^{st} of Year N) where the line item "post-tax equity cash flow" on the "CFlo" worksheet is negative (meaning equity capital is infused) that value of equity infusion should get added to the value of equity capital as shown on the projected balance sheet as at March 31^{st} of Year N-1 to yield the value of equity capital on the balance sheet as at March 31^{st} of Year N.

It should be noted that the above assumes that no dividend is paid out. However, it is easy to incorporate dividend payment by adjusting dividend paid out as a use of cash on the "CFlo" worksheet (after calculating equity IRR on the unadjusted cash flows) and carrying only this increase/decrease in cash net of dividend to the balance sheet on the assets side. Similarly, instead of using PAT for calculating the projected reserves on the liabilities side, the value of PAT less the dividend paid out is used. Such adjustments are not really essential for the reasons discussed earlier, essentially amounting to the fact that assumptions about dividend do not affect equity IRR. The item-wise details of the "BS" worksheet are shown below.

ILLUSTRATION 4.14

Line Items on "BS" Worksheet

Sr. No.	Line Item	Forward Linkage Identified or Operation Required
1	Capital WIP	"C&F" worksheet – Forward Linkage (a)
2	Gross Fixed Assets	"C&F" worksheet – Forward Linkage (e)
3	Accumulated Depreciation	"Dep" worksheet – Forward Linkage (o)
4	Net Fixed Assets	Item 2 less Item 3
5	Cash	From the "CFlo" worksheet as discussed above – the difference between the sources and uses of cash during any period N gets added to the figure of "Cash" as at the balance sheet date of period N-1 to yield the figure of "Cash" as at the balance sheet date of period N on the "BS" worksheet – in the row showing "Cash" on the "BS" worksheet the change in cash from the "CFlo" worksheet for any given period/column gets added to the "Cash" balance of the previous period/column on the "BS" worksheet
6	Total Assets	Item 1 plus Item 4 plus Item 5; Item 1 will be nil when Item 4 has a positive value (i.e., all periods after the start of commercial operations) and vice versa for periods prior to commercial operations
7	Equity Capital	Like "Cash", this is also derived from the "CFlo" worksheet. In any period N where the post tax equity cash flow is negative on the "CFlo" worksheet, an equivalent amount gets added to the figure of "Equity Capital" as at the balance sheet date of period N-1 to yield the figure of "Equity Capital" as at the balance sheet date of period N on the "BS" worksheet – in the row showing "Equity Capital" on the "BS" worksheet, infusion of equity capital in any given period/column (negative equity cash flow) on the "CFlo" worksheet gets added to the figure of "Equity Capital" in the previous period/column
8	Reserves	The value of PAT in any period N from the "P&L" worksheet gets added to the figure of "Reserves" as at the balance sheet date of period N-1 to yield the figure of "Reserves" as at the balance sheet date of period N on the "BS" worksheet – in the row showing "Reserves" on the "BS" worksheet, the value of PAT in any period/column as per the "P&L" worksheet gets added to the figure of "Reserves" in the previous period/column
9	Net Worth	Line Item 7 plus Line Item 8

10	Grants	"C&F" worksheet – since there is no schedule prepared for grants on that worksheet showing the closing balance, the amount of grant financing in any period of construction (say period N) on the "C&F" worksheet gets added to the figure of "Grants" as at the balance sheet date of period N-1 to yield the figure of "Grants" as at the balance sheet date of period N on the "BS" worksheet – in the row showing "Grants" on the "BS" worksheet, the figure of grant financing in any given period/column on the "C&F" worksheet gets added to the figure of "Grants" in the previous period/column
11	Bonds	"C&F" worksheet – Forward Linkage (g)
12	Loans	"C&F" worksheet – Forward Linkage (g)
13	Defect Liability	"C&F" worksheet – Forward Linkage (k)
14	Total Liabilities	Sum of Items 9, 10, 11, 12 and 13

The item-wise details of the "CFlo" worksheet are shown below.

ILLUSTRATION 4.15

Line Items on "CFlo" Worksheet

Sr. No.	Line Item	Forward Linkage Identified or Operation Required
1	Capital Expenditure	"C&F" worksheet – Forward Linkage (b) and (k); the use of cash for capital expenditure on the "CFlo" worksheet comprises the capital expenditure including escalation for each relevant period as well as the release of defect liability, which represents a cash outgo in the period immediately after the period when the construction is completed and the project is commissioned
2	IDC	"C&F" worksheet – Forward Linkage (c)
3	Interest	"C&F" worksheet – Forward Linkage (j)
4	Repayment of Debt	"C&F" worksheet – Forward Linkage (i)
5	Income Tax	"Tax" worksheet – Forward Linkage (s)
6	Total Uses	Sum of Items 1 to 5
7	Grants	"C&F" worksheet – Forward Linkage (h)
8	Term Loans	"C&F" worksheet – Forward Linkage (h)
9	Bonds	"C&F" worksheet – Forward Linkage (h)
10	Cash from Operations	"P&L" worksheet – Forward Linkage (q)
11	Sources Excluding Equity	Sum of Items 7 to 10
12	Cash Flows for Equity IRR (Post-Tax)	Item 11 less Item 6
13	Cash Flows for Equity IRR (Pre-Tax)	Item 12 plus Item 5
14	Cash Flows for Project IRR (Pre-Tax)	Item 10 less Item 1
15	Cash Flows for Project IRR (Post-Tax)	Item 14 less Item 5

4.3.4 A Step in the Development Process Explained

Having outlined broadly the development of the Financial Model, we now take a more detailed look at a specific step involved in the development process to conclude this discussion. Similar logic is to be followed for other steps - readers wishing to understand the specific formulae used should refer to the soft copy of the ***Sample Financial Model*** on the attached CD. To understand the type of reasoning that underlies each step of the development process, let us take a detailed look at the first logical step for any ***Financial Model*** – the calculation of the capital expenditure and the financing of this expenditure on the "C&F" worksheet, as shown in the illustration drawn from the ***Sample Financial Model*** below.

The calculations on the "C&F" worksheet are all based on data and assumptions already entered on the "A&D" worksheet. As a first step, the amount of capital expenditure including escalation incurred during each period is calculated in row seven (7) of the "C&F" worksheet. To achieve this, the total capital cost excluding the escalation component in cell E44 of the "A&D" worksheet serves as the starting point. This is reduced to the extent of the defect liability, which in this case means that ten percent of the base project cost (cell E29 of the "A&D" worksheet) payable to the EPC contractor is held back as a guarantee against defects. Thus, with reference to the "A&D" worksheet, the value in cell E44 less ten percent (value of defect liability as entered in cell E93) of the base capital cost (cell E29) represents the capital cost that is actually incurred during construction, excluding escalation and IDC. For the first FY during which construction is carried out, the proportion of capital expenditure incurred as shown in cell E99 on the "A&D" worksheet is 20% - this is applied to the capital cost actually incurred as calculated.

As the next step, the value arrived at so far is escalated. To do this, a factor of 1.05 is used, with the rate of escalation being referenced to cell E192 of the "A&D" worksheet where 5% is entered as the relevant assumption. The value of the FY in row four of the "C&F" worksheet now comes into play – this value (2007 in cell E4, "C&F" worksheet) represents two years (2007 less 2005) from the time that the capital cost estimate was made, i.e., 2005 as entered in cell E30 on the "A&D" worksheet. The relevant escalation factor for the first year of construction is thus 1.05 raised to the power of two (2, i.e. 2007 less 2005). The steps involved in calculating the period-wise capital expenditure for each period covered by the Financial Model are summarised below. Readers should distinguish between absolute and relative cell references that are used. Also, the formula used in row seven is identical

ILLUSTRATION 4.16

“C&F” worksheet from the Sample Financial Model

File DM Edit View Insert Format Tools Data Window Help

A2 fx Capex & Funding (Rs. Lakh)

	A	E	F	G	H	I	J	K	L	M
1	**Project: Sample Road & Bridge Project**	Go to Index								
2	**Capex & Funding (Rs. Lakh)**	Go to A&D								
3	**Capital Expenditure**									
4	**FY ending March 31,**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
5	Months of Construction	4	12	2	0	0	0	0	0	0
6										
7	Capital Expenditure (with escalation)	742.89	2,535.11	614.28	0.00	0.00	0.00	0.00	0.00	0.00
8	Release of Defect Liability	0.00	0.00	0.00	398.48	0.00	0.00	0.00	0.00	0.00
9										
10	Capex During Year Including IDC	749.87	2,678.02	658.00	398.48	0.00	0.00	0.00	0.00	0.00
11	Of which, IDC	6.98	142.91	43.72	0.00	0.00	0.00	0.00	0.00	0.00
12	Total Capex for Project	4,484.36								
13										
14	Notional Funding for IDC Calculation using IDC macro (Ctrl+a)									
15	Funding by Capital Grant	133.77	477.75	117.39	71.09	0.00	0.00	0.00	0.00	0.00
16	Funding by Bonds Issued	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Funding by Term Loan	418.80	1495.68	367.49	222.55	0.00	0.00	0.00	0.00	0.00
18	Funding by Equity (Balancing Item)	197.29	204.59	173.12	104.84	0.00	0.00	0.00	0.00	0.00
19										
20	Notional Opening Balance - Bond	0.00	0.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
21	Bonds Issued	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	Notional Closing Balance - Bonds	0.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
23										
24	Notional Interest on Bonds During Construction	0.00	26.25	8.75	0.00	0.00	0.00	0.00	0.00	0.00
25										
26	Notional Opening Balance - Term Loan	0.00	418.80	1914.48	2281.97	2504.52	2504.52	2504.52	2504.52	2504.52
27	Additional Term Loan Availed	418.80	1495.68	367.49	222.55	0.00	0.00	0.00	0.00	0.00
28	Notional Closing Balance - Term Loan	418.80	1914.48	2281.97	2504.52	2504.52	2504.52	2504.52	2504.52	2504.52
29										
30	Notional Interest on Term Loan During Construction	6.98	116.66	34.97	0.00	0.00	0.00	0.00	0.00	0.00
31	Total Notional Interest During Construction	6.98	142.91	43.72	0.00	0.00	0.00	0.00	0.00	0.00
32										
33	Value of Notional IDC - for IDC calculation	6.98	142.91	43.72	0.00	0.00	0.00	0.00	0.00	0.00
34										

Index / A&D / C&F / Rev / Opex / Dep / Tax / P&L / BS / CFlo / Result across columns – since positive values are entered in row 99 of the "A&D" worksheet only for periods when construction is carried out, the nil values in cells H99, I99, J99, etc. on the "A&D" worksheet ensure that the calculated capital expenditure with escalation works out to nil in all periods after the end of construction.

Step	Sources	Reference	Step Result
First, take the total capital expenditure for the project excluding IDC and escalation	Cell E44, "A&D" worksheet	Absolute	'A&D'!$E$44
Second, reduce the amount of defect liability held back	E29 (base project cost) and E93 (proportion of base project cost retained as defects liability), A&D" worksheet	Absolute	'A&D'!$E$44 minus the product of 'A&D'!$E$93 and 'A&D'!$E$29; say, R1
Third, apply the proportion of capital expenditure incurred in the period to calculate the capital expenditure in each period	Cells E99, G99, H99, etc. "A&D" worksheet	Relative	Product of R1 and corresponding value in row 99 of the "A&D" worksheet; thus, product of 'A&D'!E99 and R1 for FY ending March 31st, 2007 in column E; product of 'A&D'!F99 and R1 for FY ending March 31st, 2008 in column F and so on; say, R2
Fourth, calculate the escalation factor for each period	Escalation rate in cell E192 and base year for capital cost estimate in cell E30, both on "A&D" worksheet Relevant period for which escalation factor is being calculated – values in row four (4) of the "C&F" worksheet starting from E4, i.e. E4, F4, G4, H4, etc.	Absolute Relative	One plus cell 'A&D'!$E$192 raised to the power of the corresponding cell in row four (4) of "C&F" worksheet less cell 'A&D'!$E$30;

Thus, we see that every step in the development process involves a line of reasoning that draws upon input values (assumptions and data) from the "A&D" worksheet – a mix of absolute and relative references are used in the formulae depending on the requirement. As mentioned earlier, those readers requiring a more complete understanding of specific formulae used should refer to the soft copy of the Sample Financial Model. The calculation of IDC, which is the next step on the "C&F" worksheet is also explained in detail in Chapter 6 and may be referred to.

CHAPTER 5

Essential Best Practices for Financial Models

INTRODUCTION

This Chapter is essential reading only for those readers directly involved in the development of Financial Models. Having covered the components, typical Output and the logical sequence of development of the Financial Model in the preceding Chapter, this Chapter lays down some best practices that should be generally adopted while developing the Financial model. The typical issues relating to the development of the Financial model and the implications of these are first discussed to enable the reader to understand the rationale for these best practices. The chapter concludes with a discussion on other recommended practices that go a long way in increasing the robustness of the Financial Model and make it user friendly.

Key Topics Covered in this Chapter

- Issues and implications in financial modelling
- Flexibility to adapt to changes over the project development cycle as a key objective that drives the adoption of the best practices, besides the need to ensure that the Financial Model is clear and easy to use
- Essential Best Practice 1: Always create a separate worksheet to enter all data and assumptions about the project i.e., place all input on a separate worksheet.
- Essential Best Practice 2: Always use uniform time periods across worksheets with a given column representing the same time period in every worksheet.

- Essential Best Practice 3: The formula should be the same across columns in any given row of every worksheet.
- Other recommended practices for a flexible and user friendly Financial Model.

5.1 FINANCIAL MODELLING: TYPICAL ISSUES AND IMPLICATIONS

5.1.1 The Need for a Standard Approach

The basic problem in taking an unstructured approach to financial modelling is that every individual will have differences in approach and possibly even logic used for development of the Financial Model and its components. This means that when the Financial Model is handed over by the original developer to others for use, these users typically have to spend time understanding the lay-out and logic used by the developer. The problem gets compounded because the developer typically has a clear understanding of the Financial Model in his mind but does not generally bother to label different ranges and cells to capture the source, intent and linkages. At times, the developer uses cryptic labels that do not communicate anything to subsequent users. The new users thus have to go back and forth between various cells to understand the linkages, often losing track and becoming increasingly frustrated when using large and complex Financial Models. In today's world where job responsibilities change rapidly and employee turnover is high, the risks created due to "black box" Financial Models that only the developer can use with any degree of confidence are enormous.

The problem of individual differences is only exacerbated by the fact that despite the wide-spread use of spreadsheet Financial Models for taking important business decisions across most organisations, it is rarely that an organisation lays down a standard set of practices for such Financial Models. Somehow, the development of a Financial Model is not seen as a software development process that should be subject to the same rigour in design standards and testing procedures that is normally adopted for any software development process.

A second problem arises from the range of possible projects across sectors as well as the change in data availability and detail over the course of development of any given project in the ***PPP/Project Finance Context***. The sheer range of possible PPP Project Structures and sectors within the infrastructure domain require flexibility. However, there are also common features across financial models that indicate the possibility of some standards across different financial models. To address this aspect, Chapter 4 outlined the key components that are generally part of every project and its Financial Model and suggests a standard framework for developing these components in the Financial Model.

Significant changes also arise in the course of project development in terms of the level of detail and/or accuracy of data. Starting with broad thumb rule based capital expenditure and revenue estimates at the start of the project development cycle, it is possible that a Financial Model towards the end of the project development cycle (at the bidding stage after preparation of a Detailed Project Report (DPR), for example) would incorporate detailed assumptions and data on various items of capital expenditure and aggregate revenues from various sources and categories. The Financial Model should be reasonably flexible in being able to accommodate such changes in detailing over the project development cycle. At the same time, the modeller should be able to take decisions about the appropriate level of detailing at any given point of time, keeping in mind the following:

- Whether the level of complexity incorporated into the Financial Model is in line with the accuracy of the data available – it is of little use building a very complex Financial Model that uses very broad or benchmark based assumptions and data.
- Whether the level of detail or complexity is appropriate, given the objectives and users of the Financial Model – at a time when only a broad assessment of the project viability is being undertaken to decide whether to develop the project further, it may not make sense to develop a Financial Model with very detailed financing structure (including assumptions).
- Whether the elements of the Financial Model that are leading to complexity in the Financial Model are elements that affect project outputs very significantly – it does not make sense to have detailed, complicated and accurate workings for items that are insignificant in terms of impact on the project viability.

Many modellers, especially some from a technical or engineering background, often develop complicated formulae to generate accurate estimates for items that contribute very little to the overall feasibility of the project when a rough-cut estimate would more than suffice, require much less effort and enhance clarity of the Financial Model. Similarly, replicating in the Financial Model details that are available elsewhere does not make sense. For example, where a detailed component-wise break-up of the capital cost running into a few pages has been provided in the DPR, it may not be necessary for the Financial Model to reflect this including the assumptions about unit rates and quantity underlying the cost estimate for each component. Rather, just the total capital cost estimate from the DPR or at most the sub-totals for the main categories needs to be included with a comment mentioning the source. Even if there is a subsequent change in the costs estimated for some components, the recalculation can be carried out elsewhere and only the resultant change in the capital cost reflected in the Financial Model. This is simpler than trying to ensure that the Financial Model can address changes in assumptions underlying a detailed component-wise estimate of capital cost that can be easily handled elsewhere and only the change in the total capital cost, which has a material impact, can then be incorporated in the Financial Model.

5.1.2 Key Objectives for the Modeller

While these problems cannot be eliminated entirely, with some attention to basic ground rules, most of us can create spreadsheet Financial Models that do not drive later users up the wall in trying to understand the Financial Model. In general, we can state that the Financial Model should meet the following objectives:

Flexibility: The Financial Model should be able to accommodate changes in data and assumptions including the level of detail at which the data is available over the project development cycle without requiring any re-start from a clean slate. In particular, the Financial Model should not become redundant due to delays during project development and should be flexible with regard to changes in time-line related Project Variables such as commencement date, construction period, concession period, etc.

Clarity: The Financial Model should be user friendly and users other than the modeller should be able to identify the data/assumptions used and the overall flow of the Financial Model without too much effort. This is essentially driven by mind-set – the developer has to keep in mind the fact that the Financial Model will be used by others right from the word go. With this fact in mind, the developer must question at every stage of the development, whether what is being added will be clear to any user of the Financial Model, irrespective of the user's background or level of familiarity with the project and design accordingly. At the end of the development, any user looking at the Financial Model should be in a position to identify clearly what data and assumptions are required by the Financial Model and where these are to be entered. The adoption of the standard structure in terms of worksheets described in Chapter 4 will certainly help to ensure clarity but every developer also needs to develop the right mind-set.

In order to achieve these objectives, this chapter outlines some basic practices that should be generally followed by any developer of a Financial Model, irrespective of purpose or level of complexity.

5.2 ESSENTIAL BEST PRACTICES

The essential best practices described should by and large be followed. However, it is even more essential to understand the underlying rationale since financial modelling is bound to throw up situations where one of the following best practices may have to be ignored, in which case a correct judgement requires understanding the rationale for the practice and the implications of ignoring the same.

5.2.1 Essential Best Practice 1: Separate Sheet for Assumptions and Data

Essential Best Practice 1: Always create a separate worksheet to enter all data and assumptions about the project i.e., place all input on a separate worksheet.

The simplest reason for this essential practice is ease of use. If data and assumptions are scattered throughout the Financial Model in different worksheets, these become very difficult to track and change even if the relevant cells have been labelled clearly (which is also rare given that many modellers do not consistently keep in mind the fact that others who are not conversant with the modeller's thinking and the Financial Model may need to use it). With data and assumptions entered on a single worksheet with any given item in a single cell, the development of the Financial Model will in general be such that once a given item of data or assumption is changed on the "A&D" worksheet, the relevant figures affected by this change throughout the Financial Model will change.

In general, any numeric input required for the Financial Model should be entered in the "A&D" sheet. It is permissible to include some basic workings in the "A&D" sheet, such as summing up different components of project cost to arrive at the landed project cost. However, all calculations beyond such elementary ones should be performed in other work-sheets.

A less direct implication of this essential practice is that no formula should incorporate any data or assumption entered directly, i.e., no formula in the calculation worksheets of a model should be hard coded, i.e., include a numerical value directly entered. To explain this using a simplistic example, if we expect prices to go up by 10% every year for a given project, the formula to calculate the revised price should never, ever contain a 10% or 0.1 directly. Rather, the entry should be in a cell (with appropriate label) on the “A&D” sheet, and all formulae should refer to that cell (using “$” in cell references i.e. absolute cell reference, as appropriate for a single value used across a range of cells) rather than including the value ‘hard coded’ as part of the formula. This would mean that rather than manually having to change the formula if we later decide that 8% is a more appropriate estimate of inflation in this case and copy the revised formula into other cells, we would simply change 10% on the “A&D” sheet to 8%. While this may seem obvious, it is surprising how often we tend to take certain aspects of the project as unchanging and end up hard coding. There is however an exception to the rule regarding hard coding – the use of the numbers zero (0), one (1), 12 (number of months in a year) or 365 (number of days in a year) in formulae is generally acceptable.

The entering of data into the “A&D” sheet should be accompanied by a little effort in making the “A&D” sheet user-friendly. The colour coding of cells (especially marking cells that the user may be expected to vary), use of explanatory labels and grouping of data and assumptions into discrete sets like capital expenditure, funding, construction phasing, revenue, etc., go a long way in ensuring that a user does not have to grope around a large worksheet (the “A&D” sheet is most often the largest one in the Financial Model). Moreover, the “A&D” sheet can be used just like the “Presentation” worksheet to document assumptions and data in a deliverable like a Word document where the large set of assumptions and data are best relegated to an annexure, though critical assumptions and data can be replicated in the main body of the report. A part of the documentation of the Financial Model thus gets done while developing the Financial Model. The modeller is also advised to use comments (Insert-Comment) to record further details about the basis/source of the assumption/data on the “A&D” sheet as these can become less apparent with a number of changes being made over a long period of project development.

A critical point relating to the “A&D” sheet is the treatment of time-frames and date/time related data for the Financial Model. Most people are not comfortable with date functions in Excel (not without reason as these can be cumbersome) and thus do not incorporate any flexibility with regard to dates and time periods into the Financial Model. A modeller preparing a Financial Model in June 2005 and expecting the project construction to commence in an year’s time will thus generally enter 2006 (or 2006-07 or

FY07) as the first time period covered by the Financial Model and proceed from thereon by "drag-copying" or using a formula of the type x+1 (where x is the reference to the cell where the first date value is entered) across the cells of the row showing the time period. With the result that if that progress on the project is not as expected (which, as we all know is fairly common and often beyond one's control), the revision of the Financial Model in January 2007 will become a cumbersome affair requiring some care to be taken to ensure a thorough and logical revision. It thus makes sense to create a model that is flexible enough to adapt to development cycle delays. Though this takes a little extra effort, it is generally well worth it. This also means that for items on the "A&D" sheet that have different values in different time periods should be entered into the same columns of the "A&D" sheet as the relevant columns representing those time periods on other sheets. Specific aspects related to this have been covered later in the book (Section 5.4). At this point, however, it makes sense to lay down the next essential practice as an extension of the discussion above.

5.2.2 Essential Best Practice 2: Uniform Time Periods

Essential Best Practice 2: Always use uniform time periods across worksheets with a given column representing the same time period in every worksheet.

This requires the incorporation of the assumptions on time periods (start of construction, construction period, etc.) in the "A&D" sheet and refer the first time period label in every worksheet to the appropriate cell in the "A&D" sheet, using "x+1" formula in other time period labels.

The obvious implication of the above essential practice is that on changing the date/time related cells in the "A&D" sheet, the time periods throughout the Financial Model change appropriately without having to manually change the relevant cells. It also means that formulae using the time period as a Project Variable are suitably flexible and not "hard coded". The resulting flexibility addresses the problems faced in the first and last year of operations where a concession period specified in years typically mean part-year operations. In Chapter 6, the use of time/date functions combined with entry of some key dates by the user in order to create a Financial Model that is flexible in terms of the coverage and representation of time periods has been taken up in some detail and may be referred to.

Following the above practice means that it should be easy to extend or change the time period covered by the Financial Model without much difficulty. However, this will be the case only if essential practice number three discussed below is also adhered to. In relation to essential practice 2, an absolute no-no is to have periods across columns on one worksheet and across rows on another – it is surprising how many people new to modelling end up doing this and spending time developing complicated formulae to take care of the linkages between the two sheets.

5.2.3 Essential Best Practice 3: Uniform Formulae in any Row

Essential Best Practice 3: The formula should be the same across columns in any given row of every worksheet.

Note that in line with essential practice 2, the columns on every worksheet will represent a particular time period like FY07, Q1, Apr-Sep 2008, etc. The formula entered into the first time period should be such that it can be copied (or "dragged") across different columns in the same row and result in correct figures. This makes the extension of the Financial Model to cover a longer period very easy, though it should be noted at the same time that given the nature of DCF analyses, cash flows in the years beyond say, 20 years, would have limited impact on the feasibility of the project whether measured by IRR or NPV[1]. An obvious implication of this essential practice is that the modeller cannot enter a particular value for one period and formulae in columns for the other periods – this usually takes the form of a value like zero entered in the first period and formulae for subsequent periods. This is a common practice used by many when the projected values are cumulative in nature, for example, reserves in the balance sheet for which the profit generated in any period have to be added to the reserves as on the previous period's balance sheet date, to arrive at the reserves as on the balance sheet date of the given period. For such values, many modellers enter zero in the first period column (say, column B, row 15, i.e. cell B15) and then the formula "=B15+Profit in Second Period" in C15, thereafter dragging the formula across the row. For these types of values, it is better to have a hidden column to the left of the first period column. The first period formula (now in column C) thus become "=B15+Profit in First Period", which can be copied across the columns for the subsequent time periods. With nothing entered in cell B15, its value is anyway taken as zero by excel.

As another example, we often face situations where the revenues or costs in the first and last years of the concession period will differ because these years involve operations for less than twelve months. Rather than manually

[1] For example, with a discount rate of 10% the present value of a cash flow occurring in the 21^{st} year is 13.5% of its value in the 21^{st} year. With the same discount rate, the present values of cash flows in the 30^{th} and 40^{th} years are 5.7% and 2.2% respectively.

entering values or formulae that are different in the first and last years of the concession period, which can lead to errors if assumptions about Project Time-Lines are subsequently changed, it is better to handle it such that the number of months of operation (say, m) during every year covered by the Financial Model is first calculated. This is done such that 'm' is equal to zero for years outside the concession period, less than 12 for the first and last year depending on the start of commercial operations[2] and equal to twelve for other years in the concession period. A factor 'm' divided by twelve (m/12) can then be used in all the formulae in any row containing elements such as revenue or operating cost that is affected by the number of months of operations, provided that these items are evenly distributed across the months of any given year.

Another related situation relates to the first period of the Financial Model – there may be instances where the construction of a project starts somewhere in the middle of the first period in which case the interest calculation on a loan partly drawn down to fund the construction in this first period should provide for interest for part of the year only. Using the standard formula for interest which applies the relevant interest rate (as assumed in the Financial Model) to the average of the opening and closing balance of the loan will obviously overstate the interest amount. Again, using a formula to calculate the number of months of construction for each period of the Financial Model can be used, just as in the case of months of operation outlined above. This value, say 'n', may be 5 for Period 1, 12 for Period 2 and 7 for Period 3 in case the construction is completed in 24 months and will then be equal to zero from Year 4 onwards. This value 'n' is also useful for bifurcation of the interest into IDC that is to be capitalised in the balance sheet and interest payment that is expensed on the P&L. Once 'n' is calculated, for all instances where the formula needs to be different only in the first period and in no other period of the Financial Model, using the IF function in the formula with the period label as an argument is a neat way to ensure that the formulae are common across various columns of the relevant row that calculates the interest. The IF-THEN-ELSE logic[3] is then used as follows for interest calculation:

IF Period is the First Period
THEN Interest is (n/12) times the interest calculated for the full period
ELSE Interest is equal to the interest calculated for the full period

[2] The calculation of number of months (m) is covered in Section 5.1.

[3] As such, Excel's in-built IF function does not specifically include the terms THEN and ELSE but the syntax effectively performs the IF-THEN-ELSE operation. See Section 5.1 for details.

Overall, it may require some ingenuity to devise some formulae such that these can be dragged or copied across columns in any row of the worksheet but the benefit in terms of robustness of the Financial Model is well worth discarding the lazy option of manually entering values or using different formulae in some columns of the Financial Model. In a sense, this is an extension of Best Practice 1, which forbids hard coding of formulae.

5.2.4 Essential Best Practice 4: Create a Single Financial Model

Rather than have different Financial Models for different assumptions and scenarios, it is desirable to have a single Financial Model with inter-linked worksheets that can accommodate all practical options in terms of assumptions or scenarios. A useful practice is build in some sensitivity parameters into the formulae for critical parameters such as base capital cost, revenues and operating expenses even while developing the Financial Model. Thus, while entering the data/assumptions regarding capital cost, a cell (say, C60) can be labelled as being the sensitivity parameter for capital cost which reflects increase (positive percentage) or decrease (negative percentage) in the capital cost over the base assumptions. Wherever the assumptions/data regarding capital cost is then used in the Financial Model for calculating the effective landed capital cost in a given period (which will typically include cost escalation and IDC), the factor (1+$C$60) can be incorporated in the formula used so that the sensitivity of Financial Model's Output to an increase/decrease in the base capital cost can be easily analysed without having to create a separate file in which only the data/assumptions relating to capital cost (or any other key parameter) are changed in order to carry out the sensitivity analysis. Of course it is not always possible to anticipate in advance all the parameters we may want to vary as part of the sensitivity analysis. Even then, as long as the essential best practice number 3 has been followed, adding a factor of the type (1+$C$60) is fairly easy even after the Financial Model has been developed. This approach is to be always preferred over the dubious practice of creating multiple Financial Models/files.

Even where more than two alternatives are to be analysed for a set of key parameters, say the typical "High-Medium-Low" or "Optimistic-Normal-Pessimistic" type of alternatives, Excel's ability to handle conditional calculations can be used to create switches that will determine which set of values will be used for calculations in the Financial Model. As an example, a cell in the Financial Model may be designated as the switch for traffic assumptions, where the user can enter "H" (high), "M" (medium) or "L" (low). Since these are mutually exclusive choices, the relevant values can be picked for the calculation using a formula that sums three IF functions, the logic being of the type:

IF Cell Value is H THEN use high values ELSE zero
Plus
IF Cell Value is M THEN use medium values ELSE zero
Plus
IF Cell Value is L THEN use low values ELSE zero

Since the cell will have any one of the three possible values, two of the three IF functions used will return zero and only the relevant values corresponding to the choice entered in the cell will be used for calculations.

5.3 OTHER RECOMMENDED PRACTICES FOR A USER FRIENDLY AND ROBUST FINANCIAL MODEL

Apart from the four best practices outlined in the previous section, a number of other practices that can be adopted by the modeller to enhance the ease of both development and use are discussed below.

5.3.1 Labelling Worksheets

It makes sense to use the top-left cell A1 on the "Assumptions & Data" ("A&D") worksheet or "Index" worksheet for labelling the Financial Model so that it can be uniquely identified. The label should at the minimum identify the project name and the modeller can add on other details considered important. The cell A1 in every other worksheet should refer to A1 on the relevant worksheet, i.e., having the formula:

='Assumptions & Data'! A1,

or

='Index'! A1

This will ensure that every sheet will carry a label to identify the project for which the Financial Model has been prepared when the print-out or extract of any given worksheet is used.

In line with the above, it is also desirable to use the cell A2 in every worksheet for a label to identify the contents of that worksheet. Labels such as "Assumptions & Data", "Revenue Projections", "Capital Expenditure & Funding", etc., may be used for this purpose. This is necessary as the names given to the worksheets have to be brief and may not convey the contents to someone using the Financial Model later. In all worksheets apart from the “Assumptions & Data”, it is also desirable to use cell A3 for entering the currency unit being used. Labels such as “All figures in ₹ Crore” or “All figures in US$ Mn” may be used for this purpose. The “Assumptions & Data” worksheet will typically have a wide range of values in different units including physical units (length, area), time units (months, years, dates) and unit rates (₹ per sq. ft, ₹ Crore per km, etc.), besides financial units such as ₹ Crore or US$ Mn. Hence, it does not make much sense to use A3 for the same purpose on the “Assumptions & Data” worksheet. Rather, suitable labels to indicate the units being used can be placed appropriately throughout the worksheet.

5.3.2 Checks on Data Entry

It is a good practice to include some check cells in the “A&D” sheet to ensure that the data entered is logical and consistent. For example, it is easy to use the IF function to check that the proportions of the capital expenditure incurred in the various periods over the construction phase of the project add up to 100% (or 1) and display an error alert to warn the user about any inconsistent data entered. Similar check cells can be used to ensure that the sources of funding add up to the landed project cost and especially in case of dates that the user may be required to enter. While this to an extent requires subjective assessment by the modeller, the key underlying criterion should be to provide check cells for data or assumptions that will affect the entire Financial Model if wrongly entered but may not be very evident.

For assumptions that are to be specified by the users, it is preferable to avoid the possibility of the user entering a value that is outside the range or set of values that the Financial Model requires. This is easily done by incorporating a drop-down list containing the possible values that the user can specify for that particular cell. This requires the possible or acceptable values to be entered in a range of adjacent cells that becomes the “list” for the cell where the user is required to enter the assumption. Having created the list, one is required to go to the cell where the user is required to enter the assumption and create the drop-down list by using “Data-Validation” and then choosing “List” under “Allow” on the “Settings” tab (Data-Validation-Settings) and specifying the relevant range of cells where the list is entered under “Source:” on the same tab. This is illustrated later in this chapter.

5.3.3 Treatment of Negative Values

It is always possible to use formulae that result in negative numbers for items such as operating expenses and accumulated depreciation and then simply add such items to revenues and gross block of fixed assets respectively to arrive at operating profit and net block of fixed assets. In fact, many people are more comfortable calculating such items so that these are displayed as negative numbers. However, this creates scope for confusion among users and possible lack of uniformity in the Financial Model. It is better to follow the convention that all items, even those that are to be subtracted from other items, are calculated as a positive number in the first instance and the subtraction then handled in the appropriate formula used for arriving at the resulting item such as operating profit or net block. For example, it is preferable to calculate accumulated depreciation as a positive number as shown in Alternative A below though the resulting value for net block in Alternative B is identical to Alternative A.

ILLUSTRATION 5.1

Use of Formulae Avoiding Negative Values

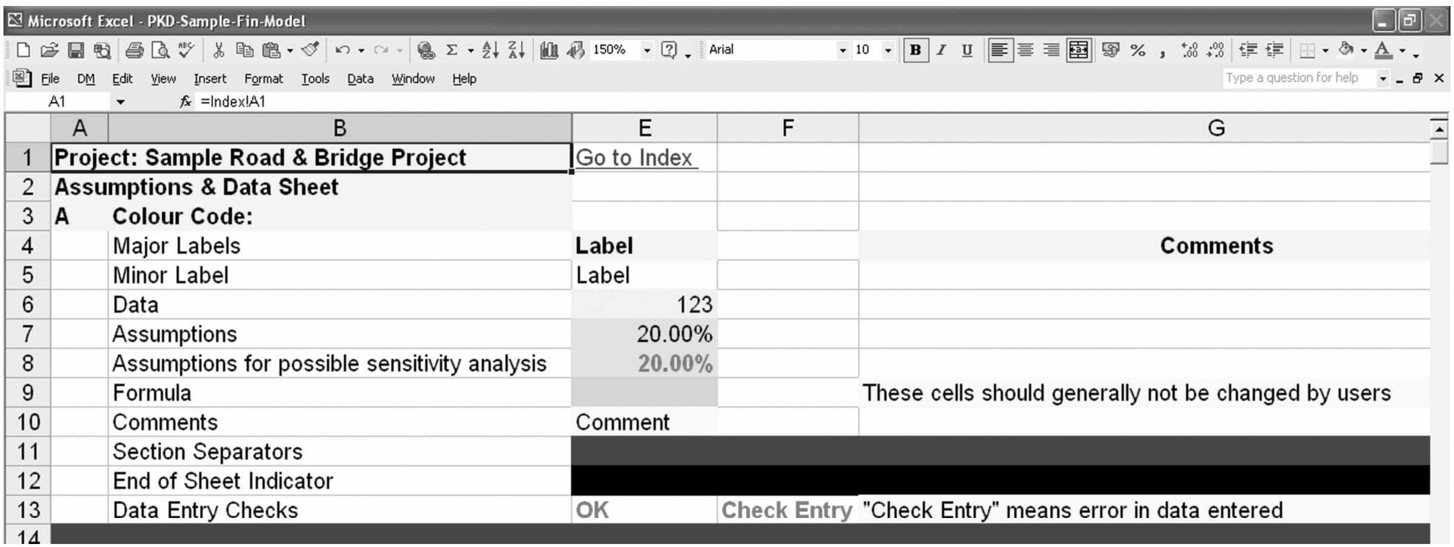
	A	B	C
1		Alternative A	Alternative B
2	Gross Block	1000	1000
3	Less: Accumulated Depreciation	250	(250)
4	Net Block	750	750
5		Formula in B4 above is "=B2-B3"	Formula in B4 above is "=B2+B3"

5.3.4 Colour Coding Cells and Ranges

We have come a long way since the days of monochrome monitors to the extent that those who have started to use computers in the last few years probably cannot even conceive a black screen that displayed text in white font or even earlier, in green! It makes sense to use to take advantage of the almost universal use of colour monitors to create colour codes for Financial Models. Different colours can be used for cells/ranges on the spreadsheet that contain major labels, data/assumptions entered by users, formulae that should generally not be changed by users, etc. While this may appear to be a cosmetic detail for those hardnosed individuals who see the Financial Model as a serious tool that should preferably remain somewhat esoteric, the impact made by colour coding extends beyond mere "looks". It makes the Financial Model much more user friendly, reduces chances of inadvertent changes in formulae by users and makes the job of validating/checking the Financial Model much easier. Apart from colour coding adopted by an individual

ILLUSTRATION 5.2

Colour Code used in the Sample Financial Model



	A	B	E	F	G
1	Project: Sample Road & Bridge Project		Go to Index		
2	Assumptions & Data Sheet				
3	A	Colour Code:			
4		Major Labels	Label		Comments
5		Minor Label	Label		
6		Data	123		
7		Assumptions	20.00%		
8		Assumptions for possible sensitivity analysis	20.00%		
9		Formula			These cells should generally not be changed by users
10		Comments	Comment		
11		Section Separators			
12		End of Sheet Indicator			
13		Data Entry Checks	OK	Check Entry	"Check Entry" means error in data entered
14					

modeller, it also makes sense for organisations that create and use Financial Models frequently to create and use a standard colour coding for Financial Models understood by all employees. The illustration below shows a typical colour code index used by the author for the Sample Financial Model used in this book. The colour code adopted for a Financial Model should be clearly set out in the "A&D" and "Index" worksheets for the benefit of users.

5.3.5 Development/Version Log

As mentioned earlier, an "Index" worksheet is essential for ensuring clarity in all but fairly simple Financial Models. Subsequent users of a Financial Model find it easier if the modeller incorporates an index sheet that lists all the other worksheets in the Financial Model. This sheet can also be used to outline the colour code used in the Financial Model and describe key elements on each sheet, assumptions, linkages, data sources, instructions for users, etc. The index sheet can also contain hyperlinks to all worksheets to make it easier for users to move to any worksheet from the "Index" worksheet. The other worksheets can also incorporate hyperlinks to allow the users to move to the "Index" worksheet from any other worksheet. To avoid confusion about different versions of the Financial Model as it evolves, it also makes sense to use the "Index" sheet to document the versions as well as the changes from version to version, starting with the first complete version of the Financial Model. A typical comprehensive "Index" sheet from a Financial Model developed by the author is shown in the illustration below, with some of the labels changed since the Financial Model in question was prepared as part of an assignment to vet the financial feasibility of a project for a client and hence subject to confidentiality requirements. Some of the rows have been omitted to save on space required to display the illustration. It should be noted that the "Index" worksheet comprises four sections:

- Version details and log for the Financial Model
- Colour code used in the Financial Model
- Worksheet index with description of all the worksheets used in the Financial Model
- Documentation of key features of the Financial Model

ILLUSTRATION 5.3

Typical Index Sheet

File DM Edit View Insert Format Tools Data Window Help

A1 Appraisal of Capex Proposal, ABC Limited Hyderabad Unit

	A	B
1	**Appraisal of Capex Proposal, ABC Limited Hyderabad Unit**	
2	**Index Sheet**	
3	**A) Version Details & Version Change Log**	
4	Version	2
5	Version Finalisation Date	19 June 2009
6	a) Change from Version 1 (25th May 2009) to Version 2 (19th June 2009) in order to reflect	
7	changes in internal working by ABC Limited, as communicated by e-mail from Mr. X	
11		
12	**B) Colour Code Used:**	
13	Major Label	**Label**
14	Minor Label	Label
15	Assumption	1234
16	Data	1234
17	Sensitivity Parameter	10%
18	Check Cell (to read "OK", check if "Error")	OK
19	Formula (Not to be changed by User)	1234
20	Section Break	
21	End of Worksheet Indication	
22		
23	**C) Worksheet Index**	
24	**Description**	**Name & Hyper-link to Worksheet/Section**
25	This worksheet - hyperlinks back to sheet in cell B1 of every worksheet for easy navigation	Index
26	All assumptions and data, with major sections being:	Assump
27	A) Capital Expenditure (Rs. Lakh) Assumptions	See Capex Assumptions
30	D) Output & Revenue Generation Assumptions	See Revenue Assumptions
33	G) Other Assumptions (Depreciation Rates, Income Tax)	See Other Assumptions (Depr/Tax rates)
34	Revenue Projections	Rev
41	Projected cash flows and IRR calculations	Cash Flows
44		
45	**D) Documentation of Key Features**	
46	a) Investment costs take into account MODVAT benefits for indigenous items and EPCG benefits for imported items.	

Index / Assump / Opex / Dep / Tax / WC / BS / P&L / Cash Flows / Sensitivity / Capex /

5.3.6 Hidden Ranges – Rule and Exception

Some people attempt to spruce up the looks of the Financial Model by hiding some rows or columns that they consider irrelevant for users. Unfortunately, this lazy practice will immediately raise questions about the credibility of the Financial Model in the mind of any user, besides making it difficult for any user to trace back and check calculations. Taking a reasonably structured approach to the development of the Financial Model, there should be no reason why any part of the Financial Model would require to be hidden. Even if the Financial Model involves some detailed and iterative calculations, there is no reason for the developer to take a decision on which of these the users would consider irrelevant and thus should be hidden. As long as the user is able to view the Output in a meaningful manner, there is no reason to hide any of the underlying calculations.

The one exception to this recommended practice is in case blank columns have to be inserted in some worksheets to ensure that the best practices with regard to uniformity of time periods across worksheets (i.e. the same time period in a given column on every worksheet) and common formulae in rows as discussed earlier are adhered to.

5.3.7 Saving and Naming the File

Saving the Financial Model at regular intervals during the development process is essential. Though this may seem obvious, it is very rare that anyone actively involved in developing Financial Models does not have a horror story about the "one that went wrong" – a Financial Model that at some point in the development cycle started displaying error messages across many cells and requiring a re-start from scratch because an earlier version was never saved. Thus, it is a good idea to periodically save intermediate versions of the Financial Model under development using different names – a date extension following the name such as "[Project-Name]-Fin-Model-230307.xls" is appropriate. This is particularly important to avoid starting from the scratch in the event that a Financial Model gets corrupted during development.

5.4 CONSISTENCY CHECKS IN MODEL DEVELOPMENT AND USAGE

It is not always apparent to the developer that an error has crept into the Financial Model – in fact, most Financial Models commonly developed and used, contain multiple errors. However, it is not essential that such errors always lead to significant error in the Output. The reason usually lies in the fact that some of these errors occur only when the associated Project Variables take on certain values or range of values where the formula throws up wrong answers. As long as this is not the case, even a Financial Model with errors may pass muster. The other possibility is that of multiple errors driving the Financial Model's Output in opposite directions and thus tending to reduce the extent of error in the Output. However, relying on such factors to take care of errors would amount to wishful thinking that most bosses and/or clients would not find acceptable.

In general, a particular formula used should be tested as and when it is introduced into the Financial Model, rather than waiting for the Financial Model to be completed before commencing the checking and debugging process. It makes sense to check whether the formula can handle all possible combinations of data/assumption entered in the cells that the formula refer to.

5.4.1 Checks on Completed Model

Incorporating checks during development does not mean that checking and debugging the completed Financial Model is not required. In fact, running consistency checks on a completed Financial Model is relatively simpler as one can check whether the results behave as expected in line with our understanding of finance theory, for example:

- Does the equity IRR increase if the assumed rate of interest paid on debt funding is reduced? Does it decline with a rise in interest rates?
- A key check on the completed model should be the equality of project IRR and equity IRR when debt financing is reduced to zero. If the project IRR differs from the equity IRR when the debt funding assumed is made nil, there is definitely an inconsistency in the Financial Model. The only caveat in this connection is the difference between pre-tax and post-tax returns should be kept in mind.
- A related point is to check whether the project IRR changes if the funding assumptions are changed. If you remember the definition of project IRR, it should be obvious that changes in funding structure should not affect it. Again, this should be checked with pre-tax project IRR as the tax effects of debt funding will show up in any post-tax measure. Also, the discussion on projects where the tariff setting is on a cost plus basis should be kept in mind – since some elements of capital structure may be normative, changes in other elements like the interest rate payable on loans may work such that the expected changes in IRR values may not result in such exceptional cases.

- Does assuming a higher cost of debt than the project IRR lead to a decline in the equity IRR as it should, due to the effect of leveraging?
- As long as the project IRR is higher than the cost of debt funding, does an increase in gearing (i.e., debt equity) lead to an increase in the equity IRR?

5.4.2 Checks during Development

A problem in using the completed Financial Model is that even when it is apparent that there is an error (or multiple errors) on the basis of testing as outlined above, it is not always easy to then identify the source of the error given that the completed Financial Model is somewhat complex and has been developed over a period of time, especially since most modellers do not document the basis or logic during the development process within the Financial Model, let alone elsewhere as a separate document that can be referred to by future users. Thus, while a competent modeller will certainly carry out checks (in a sense, play around) with the completed Financial Model, it is also essential to carry out periodic reviews during development as new components of the Financial Model are added on.

In some instances, it will become immediately apparent on adding the new component (or formula) that it is generating an error. For example, in creating the loan schedule, if we end up with a negative loan balance, it should be clear that the formulae used need to be re-checked. On the other hand, it is often possible to introduce errors that may not be apparent unless put to test using a wide range of possible values.

In creating the depreciation tables/schedules, many modellers do not include checks in the formulae used to ensure that the depreciation for a given period or the closing block of assets does not become negative. With low rates of depreciation, this may not be apparent in the first 10-15 years of the Project Time-Line that we typically see on the screen or otherwise restrict ourselves to in analysis and presentation.

Another common source of errors that are not apparent arises when dealing with periods designated in terms of financial years. In the Indian context, the financial year (FY) ending on March 31st is typically used. In a bid to keep the Financial Model flexible in terms of the actual start of construction and operations (as should be the case), we typically have to deal with situations where in the first and last financial years over which construction or operation of the project is carried out, the number of months available/used for construction or operation is typically less than the 12 months available over the complete financial year. In trying to program the flexibility to handle this aspect into the Financial Model, errors frequently creep in because of the discontinuity as one moves from December to January at the end of the calendar year. To understand this discontinuity, consider the following table:

ILLUSTRATION 5.4

Formulae to Generate Number of Months in Relation to Financial Years

Month in Which Construction Ends OR Operation Commences (Independent Variable X is the number of the month)	Nos. of months of construction during the FY (dependent Project Variable Y_1)	Nos. of months of operations during the FY (dependent Project Variable Y_2)	Y_1 as a function of X	Y_2 as a function of X
May (i.e. 5)	2 (April-May)	11 (May-March)	X-3	16-X
October (i.e., 10)	7 (April-October)	6 (October-March)	X-3	16-X
December (i.e., 12)	9 (April-December)	4 (December-March)	X-3	16-X
January (i.e., 1)	10 (April-January)	3 (January-March)	X+9	4-X
March (i.e., 3)	12 (April-March)	1 (March)	X+9	4-X

The above of course assumes that construction always ends on the last date of the month and operation commences on the first day. This is not very unrealistic since in dealing with dates in Excel (see Section 5.5 for details) with the objective of retaining flexibility with regard to time-frames generally requires that while the spreadsheet calculates a date given another (start/end) date and construction or operation period in months or years, the date actually used in the Financial Model should be the nearest month-end or beginning to be entered by the user. The key point is that in entering formulae to throw up the number of months of operation or construction during the first or last FY in question, the discontinuity in the functions as shown in the table above is often missed. The error, which may show up later as 13 months of construction in a FY or -2 months of operation in the last FY of the concession period, will not be noticed unless the modeller checks the formulae with a variety of start/end dates with at least one test value each from the sets (1, 2, 3) and (4, 5, 6, ..., 12) required for the error to show up.

5.4.3 Preventing Errors in Use

Apart from errors that may creep in during development, it is also highly probable that the users will introduce further problems during usage especially if the modeller has not bothered to document the requirements from the user or program in check cells that warn the user of wrong or inconsistent entries that will lead to errors in the Output of the Financial Model or fail to generate the required Output, leaving the user to tear his/her hair when confronted by arrays of spreadsheet cells displaying error values like "#DIV/0!" or "#VALUE!". Simple data inconsistency errors may include:

- The user entering percentages of the total capital expenditure against each period or financial year during which construction takes place that do not add up to 100%.
- The user entering assumptions that are not possible, like trying to enter a percentage of capital expenditure against a period or FY after completion of project construction.
- In case of dates that have to be entered by users to ensure that the end of construction is taken as the month end or commencement of operation at the beginning of a month in the Financial Model, the user may enter a date that is not consistent with the date calculated in Excel, based on the assumed start date and period for the activity to be completed.

Not being familiar with the Financial Model, users may be in no position to identify and correct such errors unless the modeller anticipates possible data entry errors and incorporates checks to ensure that the user is warned in case of wrong data entry. The potential for errors in usage is not restricted to data entry errors. Users may inadvertently end up altering or deleting formulae while using the Financial Model. There is also a class of users who will think nothing of fiddling around with the Financial Model making changes here and there without taking the time (or perhaps lacking the required aptitude) to first figure out the possible impact of such changes. There is of course no enduring solution for errors arising or creeping in during use of the Financial Model. However, the possibility can be minimised by colour coding the cells so that users are aware of the cells containing formulae that generally should not be changed. Some modellers also protect certain ranges in the worksheets or hide these to protect against fiddling by users or even go to the extent of giving users access to versions with the values copied into cells rather than the formulae, though some of these methods can be frustrating for the user and detract from the credibility and utility of the Financial Model.

For assumptions entered by users, one way of restricting the users to a reasonable range of values is to allow these values to be selected from a drop-down list. This can be created in Excel by using Data-Data Validation-Settings where "List" can be selected instead of the default "Any Value". A range of cells containing the values to be allowed has to be identified and entered at the same time. An example of such a drop-down list is shown in the illustration below.

ILLUSTRATION 5.5

Use of Drop-Down List for Data Entry by Users

Another useful practice is to incorporate "check cells" that return "OK" if the values entered by the user are logically consistent and "Error – Check Values Entered" if the values entered are inconsistent. The author generally uses highlighted cells with bold red font for such check cells, positioned close to the range where the user is expected to enter data or assumptions. This ensures that the check cells are visible to the user at the time of data entry. The illustration below shows the use of such check cells for users entering the percentage of capital expenditure to be incurred during each FY of the construction period of the project. Here, the check cells in row 205 immediately below each cell where a percentage is entered by the user check for inconsistencies arising out of any of the following:

(a) A positive percentage value being entered for a FY where the number of days construction during the FY is nil;
(b) A negative percentage value entered for any FY;
(c) A zero percentage value entered for any FY with a positive number of days construction;

In addition, the check cell in B206 ensures that the percentage values entered add up to 100% so that the entire capital expenditure is allocated over the construction period.

ILLUSTRATION 5.6

Use of Check Cells for Data Entry by Users

	A	B	C	D	E
200	**Phasing of Capex:**				
201	**For the FY ending March 31st,**	**2013**	**2014**	**2015**	**2016**
202	Nos. of days construction during the FY	274	365	244	0
203	Nos. of months construction during the FY	9	12	8	0
204	Enter Percentage of Capex Incurred During the FY	25.0%	40.0%	35.0%	0.0%
205	Check Cells for FY-wise % Capex Entered	OK	OK	OK	OK
206	Check Cell for Sum of % Capex Entered Adding Up to 100%	OK			

5.5 DEALING WITH UNCERTAINTY: SENSITIVITY AND SCENARIO ANALYSES

5.5.1 Addressing Uncertainty

An inherent drawback of any Financial Model is that it is an abstraction of a reality that cannot always be represented as a neat probability function that can be used to associate probabilities to a discrete set of events of interest to us. While the modern measure theoretic approach to probability attributed to Kolmogorov is cast in very general mathematical terms, its intense symbolism is beyond the reach of most people to be useful in our context – for those interested and not daunted by that, "Text Box 8: The Essence of Probability Theory" provides a very basic introduction put together by the author as background research for a paper[4]. Though classical probability theory with its mundane foundation of gambling and games of chance is more intuitive to the non-mathematician, the problem still remains that in creating an abstract representation of a project yet to unfold, one has to assume single values for a whole set of random variables (i.e., the Project Variables) that are fundamentally uncertain. Does this mean that the Financial Model to which this book is dedicated is a futile exercise? The author strongly believes that this need not be the case, as long as the following key point is borne in mind.

[4] This "Going beyond the Obvious" text box draws upon various sources from the Internet and collated over a period of time. Hence, it is difficult for the author to acknowledge all sources while remaining responsible for any errors that may be present.

Even at the cost of repetition, use of a single Output value is not a recommended practice; nor does it represent an efficient and practical use of a Financial Model – we should look at multiple outputs with different combination of values of the Project Variables, each Project Variable being assigned a "likely" range, even if this is a "guesstimate". It is only when we disregard the fundamental uncertainty of the real world and fall in love with our abstraction in the form of the Financial Model so much that we start espousing a single Output value of that Financial Model as the equivalent of the Almighty that we run into problems. As long as the Financial Models of projects are used sensibly and with healthy cynicism for single point outputs, such Financial Models are definitely better compared to a situation where nothing is known, not even a likely range of Output values that is "sensible".

Moreover, it should be borne in mind that the Output of the abstraction that is the Financial Model is driven by a number of Project Variables that are random in nature. While this obviously makes the Output random in nature, it should be borne in mind that all the Project Variables do not affect Output in the same direction and many of them are likely to be statistically independent in the sense that the value taken for one Project Variable may not affect the probability of another (random) Project Variable. As such, some of the errors we make in assuming single values of Project Variables in our Financial Model may well cancel out and reduce the degree of error in the Output using the Financial Model. While this may seem rather iffy, consider the alternative – no Financial Model to guide an investment decision where the only weapon is intuition. It is immaterial that there may be situations where intuition turns out more correct than the Financial Model in generating correct predictions of project outputs – that does not establish the futility of Financial Models just as any "exception does not prove the rule".

Text Box 5.1

Essence of Probability Theory

Going Beyond the Obvious 1: The Essence of Probability Theory

Probabilities are expressed as fractions (such as 1/3 or 4/9) or decimals between 0 and 1 (such as 0.25 or 0.8). A probability of 1 is attached to something that is certain (will always happen) while a probability of 0 is attached to something that is impossible (can never happen).

(*Contd.*)

The fundamental ingredient of probability theory is an experiment that can be repeated, at least hypothetically, under essentially identical conditions and that may lead to different outcomes on different trials. The set of all possible outcomes of an experiment is called a "sample space." The term event is used to describe one or more outcomes. An event is thus a matter of definition and of special interest in probability theory are events that are:

(a) Mutually exclusive; and
(b) Cumulatively exhaustive

The terms MECE is often applied to events that cannot occur simultaneously (mutually exclusive, hence "ME") and which taken together cover all the possible outcomes of the experiment (cumulatively exhaustive, hence "CE"). Outcomes are by definition mutually exclusive though it is possible to consider cumulatively exhaustive outcomes – i.e. all possible outcomes.

Classical probability assumes/requires all outcomes to be equally likely and defines the probability of an event A as:

P (A) = The number of outcomes where the event A occurs/Total number of possible outcomes … (1)

This notion of probability is of limited usefulness in dealing with cards/dice/coin type of orderly experiments and is in effect a priori probability – i.e. it is possible to make probability statements on the basis of logical reasoning without carrying out the experiments involving deck of cards/unbiased dice/coin, i.e._before (prior) to the experiment. In effect, the classical approach requires the ability to list all possible outcomes, as also the advance assessment of these outcomes as equally likely, in a sense bypassing a proper definition of probability. Obviously, such a priori probability is of limited relevance to real life decision problems where it is not possible to list down all outcomes or decide in advance that the outcomes are equally likely. This is understandable given the study of probability emerged from French nobleman Antoine Gombault's question to Blaise Pascal about the odds of "at least two sixes in twenty four rolls of a pair of dice" and correspondence between Gombault, Pascal and Pierre de Fermat represent the first academic discussion of probability.

However, along with concept of mutually exclusive events, several symbols, concepts and probability rules that emerge even from classical a priori probability theory are of use in real life applications. In particular, the following concepts may be noted.

Marginal/Unconditional Probability

Denoted by P(A) for event A, this is simply the probability of the event A happening, also known as unconditional probability to indicate that P(A) is not affected by the occurrence of another event. The concept is thus closely linked to that of independence of events (below). It makes sense to speak of the marginal probability of the event of getting a head on any toss of a coin since this is not affected by the number of tosses already made and the outcomes of those tosses. In contrast, for an

(*Contd.*)

event such as "drawing a red card out of a standard deck of cards as the second card to be drawn with the cards drawn not being replaced in the deck" or the event "sum of first two throws of a dice adding up to eight" are such that the probability of the event is obviously affected by the outcome of the first draw or toss. It does not make sense to speak about the marginal probability of such events.

Union (or) and Intersection (and) of Events; Joint Probability

In real life situations, we are often concerned with situations where (1) Either event A OR event B will occur; and (2) both events A AND B will occur.

(1) is denoted by P(A+B)
(2) is denoted by P(AB)

P(AB) is known as the joint probability of the two events A and B, which can be interpreted as two events both occurring at (a) the same time; or (b) in succession where the order of occurrence is not relevant.

Addition Rule for Mutually Exclusive Events; Complement of Events

Where A and B are two mutually exclusive events,

$$P(A+B)=P(A)+P(B)$$

A special case of the addition rule for mutually exclusive events is the event "not A" denoted by P(A'), where:

$$P(A)+P(A')=1; \text{ or } P(A')=1-P(A)$$

Addition Rule for Events that are Not Mutually Exclusive

Where A and B are two events that are not mutually exclusive,

$$P(A+B)=P(A)+P(B)-P(AB)$$

Statistical Dependence and Independence; Multiplication Rule for Joint Probability of Independent Events

Two events are statistically independent when the probability of one is not affected by the outcome of the other. One way of defining independence of two events A and B is to say that the joint probability of the two events is given by:

$$P(AB)=P(A)*P(B)$$

Conditional Probability

Conditional probability is relevant if the probability of an event A is affected by the outcome of another event B and is denoted by P(A|B) read as the probability of event A given event B (has occurred).

Rule for Conditional Pobability Under Statistical Independence

The concept of statistical independence can be stated in terms of conditional probability as follows:

For two statistically independent events A and B,

$$P(A|B)=P(A) \text{ and } P(B|A)=P(B)$$

(*Contd.*)

Rule for Conditional Pobability Under Statistical Dependence (Bayes' Theorem)

In case two events A and B are statistically dependent,

$$P(B|A)=P(BA)/P(A) \text{ and } P(A|B)=P(AB)/P(B)$$

This can be re-stated as a rule for joint probability of statistically dependent events, i.e.

$$P(BA)=P(A)*P(B|A)$$

Driven by the requirements of the insurance industry, an alternative approach to probability using available statistical data emerged in the 19th century – the relative frequency of occurrence approach. This defines probability as either of:

(a) The observed relative frequency of an event in a very large number of observations

OR

(b) The proportion of times that an event occurs in the long run when conditions are stable

.... (2)

Obviously, the relative frequency of occurrence approach can be applied when the relevant data is available and there is some over-lap here with sampling in Statistics. In effect, this approach uses the relative frequencies of past occurrence as the probability of an event. Using the relative frequency of occurrence approach without sufficient data can lead to incorrect results. An overlooked aspect is the application of the relative frequency approach to the staple of classical probability, i.e. orderly events involving cards, coins or dice. If an unbiased coin is tossed a number of times, the relative frequency of "heads" will tend to stabilize and approach 0.5 as the number of tosses is increased. Thus, the relative frequency of occurrence approach is compatible with classical probability, at least when a "very large number of observations" or "observations of the outcome of the event in question over a long run with stable conditions" are possible. Where this is not the case, use of the relative frequency of occurrence is not possible. Even with the simple coin toss experiment, there is a cost (subsuming time and effort) involved in repeatedly carrying out the experiment to generate more and more accurate estimates of the probability of heads (or tails). Where documenting observations (at least at regular intervals) have been considered worthwhile in the past, as in case of demographic data relating to population, age, birth rates, mortality rates, etc. the relative frequency of occurrence approach can be applied effectively and profitably. As a prime example, one can consider the actuarial assessments underlying the insurance industry.

Thus, both the classical and relative frequency of occurrence approaches to probability can be considered useful but not based on very rigorous mathematical frameworks. Indeed, a third approach to probability named subjective probability also emerged out of this lacuna but did not quite address it. Subjective probability

(*Contd.*)

is based on premises that few would find fault with – subjective probabilities are based on the beliefs of the person making the assessment of probability. The basis of such assessment may or may not be based on the relative frequency of occurrence applied to past experience. In fact, the subjective probability approach is the only one possible where the events in question occur only once or at most a few times.

While subjective probability is the most flexible of the three approaches, it is also the least amenable to application in the sense that though one may accept that many real life decisions are indeed based on subjective assessment of probability, the decision maker would not be able to logically AND quantitatively document the process such that it would be universally accepted. As a result, nor can mathematical rigor be considered to be of a very high order, though the concept was introduced by Frank Ramsey in his book The Foundations of Mathematics and Other Logical Essays (1926). The concept was further developed others like Bernard Koopman, Richard Good and Leonard Savage.

MODERN MEASURE THEORETIC APPROACH

During the two decades following 1909, measure theory was used in many concrete problems of probability theory, notably in the American mathematician Norbert Wiener's treatment (1923) of the mathematical theory of Brownian motion, but the notion that all problems of probability theory could be formulated in terms of measure is customarily attributed to the Soviet mathematician Andrey Nikolayevich Kolmogorov in 1933.

The fundamental starting point of the measure-theoretic foundation of probability theory is the sample space, which as before is just the set of all possible outcomes of an experiment, and a sigma-algebra over the set U (used in preference to the Greek letter Ω, which is widely used in the literature) denoted by E (in preference to Σ), the elements of E being subsets of U called events. In general, a sigma-algebra need not contain all subsets of the sample space U. Unlike in the case of finite U, in general not every subset of U is an event in this approach, allowing us to deal with infinite sample spaces. Each event is assigned a probability, which means mathematically that a probability is a function p mapping E into the set of real numbers that satisfies certain conditions derived from one's physical ideas about probability. Also, a random variable x may be considered as a function that maps U to the set of real numbers (or real number line).

In general terms, a sigma-algebra over a set X is a non-empty collection of subsets of X (including X itself) denoted by E, which is closed under complementation and countable union of its members.

Note 1: A set is defined as closed under an operation if the performance of that operation on any member of the set always produces a member of the same set.

Note 2: The power set of a set X is the set of all sub-sets of the set X. It follows that the sigma-algebra E is a sub-set of the power set of X.

(*Contd.*)

Formally, a subset E of the power set of a set X is a sigma-algebra if it has the following properties:

1. E is not empty,
2. E is closed under complements: If an event e is in set E then so is the complement of that event (i.e. the event "not e" denoted by (X|e) part of E, and
3. E is closed under countable unions: The union of countably many sets in E is also in E.

From these axioms, it follows that X and the empty set or null set (denoted by O) are both elements of E, and that the σ-algebra is also closed under countable intersections.

For a set X= (a, b, c, d), one possible sigma-algebra is {O, (a, b, c, d), (a, b), (c, d)}. Thus, a sigma-algebra need not contain all possible sub-sets of X.

Let X be any set, then the following are σ-algebras over X:

- The family consisting only of the empty set and X (the minimal or trivial σ-algebra over X).
- The full power set of X.
- The collection of subsets of X which are countable or whose complements are countable (which is distinct from the power set of X if and only if X is uncountable.). This is the σ-algebra generated by the singletons of X.
- If $\{E_i\}$ is a family of σ-algebras over X indexed by i, then the intersection of all E_i is a σ-algebra over X.

Note 3: The pair (X, E) is called a field of sets, or a measurable space (also "σ-field", though some authors also use "σ-field" for σ-algebra). A measure in the context of this measurable space (X, E) is a function p that satisfies:

- Non-negativity: $p(e) \geq 0$ for all $e \in E$ (i.e. for every e that is an element of E)
- Null empty set: p (O) = 0.
- Countable additivity (or sigma-additivity): For all countable collections $\{E_i\}$ of pair-wise disjoint sets in E: $p(U(E_i) =$ "$p(E_i)$

A measure on a set is a systematic way to assign to each suitable sub-set a number, intuitively interpreted as the size of the sub-set. A probability measure is a measure with total measure one (i.e., p(X) = 1); a probability space is a measure space with a probability measure, i.e. (X, E, p) where p where p(X) = 1.

The concepts of sigma algebras are used in measure theory and probability. The measure theoretic treatment of probability unifies the treatment of discrete as well as continuous random variables. To qualify as a measure, a function that assigns a non-negative real number or infinity to a set's sub-sets must satisfy a few conditions. One important condition is countable additivity. This condition states that the size of the union of a sequence of disjoint sub-sets is equal to the sum of the sizes of the sub-sets. However, it is in general impossible to consistently associate a size to each sub-set of a given set and also satisfy the other axioms of a measure. This problem was resolved by defining measure only on a sub-collection of all sub-sets; the sub-sets

(*Contd.*)

on which the measure is to be defined are called measurable and they are required to form a sigma-algebra, meaning that unions, intersections and complements of sequences of measurable sub-sets are measurable. Thus, the pair (X, E) is called a measurable space, the members of E are called measurable sets, and the triple (X, U, p) is called a measure space. The corollary to this concept in probability theory should be understood. In elementary probability theory, a sample space (typically denoted by S, U or Ω) is defined as the set of all possible outcomes of an experiment or random trial. In such a formulation, any sub-set of the sample space S is an event. However, this gives rise to a problem where the sample space is infinite. In such instances, a more formal definition of event is provided by a sigma-algebra of U, which has as its elements the relevant events. With this approach if (U, E, p) be a measure space with p (U) =1, then (U, E, p) is a probability space, with sample space U, event space E and probability measure p.

5.5.2 Assessing Sensitivity

It is also a fact that we do not necessarily have to accept uncertainty as being beyond the scope of the Financial Model. Once the Financial Model is in place, it is a simple matter to identify those Project Variables that affect Output significantly. While a Financial Model may involve a host of Project Variables, only a few are likely to be significant in terms of their effect on Output. To identify such Project Variables, an elasticity relationship of the following type can be used:

$$\frac{\text{\% Change in Output Value}}{\text{\% Change in Project Variable}}$$

However, it is generally intuitive that some parameters are likely to have higher elasticity compared to others, though counter-intuitive results are possible given the sheer range of projects in the PPP/Project Finance Context. Project cost, operating expenses, various parameters representing operating efficiency and interest costs are the usual suspects. Similarly, physical Project Variables such as the base level of traffic and growth in traffic in case of transport infrastructure projects are likely to have a significant impact on Output, with the first (i.e., base level of traffic) likely to have a more significant impact as compared to growth given the lesser impact of cash flows occurring in the more distant future in any DCF model. However, for a project with a long Project Time-Line, even small differences in growth rate may have significant impact in the long run, though this gets balanced to an extent by the fact that cash flows occurring well into the future impact Output less as compared to up-front cash flows like capital expenditure. In any case, it is best to approach this aspect of the Financial Model without too much mental baggage given the wide range of such projects.

What should emerge from the above discussion is that there are two elements to the proper use of a Financial Model to incorporate realism by way of probability – firstly, sensitivity analysis to identify the Project Variables that have significant impact and secondly using combinations of these "sensitive" Project Variables to generate a range of Output, i.e., scenario analysis.

5.5.3 Creating Scenarios

As such, it is always preferable to present the Output of the Financial Model in the form of a matrix that shows the Output for different combinations of values of two Project Variables that affect the Output significantly. This is reasonably easy to generate if the Financial Model is flexible and is in fact one of the reasons why the Financial Model should be kept flexible. It is often a good idea to present the Output for three levels of each Project Variable corresponding to optimistic, most likely and pessimistic views on these Project Variables. As an example, consider the illustration below showing such a matrix based on our Sample Financial Model is shown below. This indicates a Pre-Tax Project IRR in the range of 12.8% to 15.6% and Post-Tax Equity IRR in the range of 15.1% to 21.7%, which is more realistic than considering a single value of the Output.

ILLUSTRATION 5.7

Matrix of Output from the Sample Financial Model

	Capex Less by 10%	Base Case Capex	Capex Higher by 10%
Traffic Growth Rates Higher by 10%	Project IRR (Pre-Tax)= 15.6% Equity IRR (Post-Tax)= 21.7%	Project IRR (Pre-Tax)= 14.6% Equity IRR (Post-Tax)= 18.9%	Project IRR (Pre-Tax)= 13.7% Equity IRR (Post-Tax)= 16.6%
Base Case Traffic Growth	Project IRR (Pre-Tax)= 15.1% Equity IRR (Post-Tax)= 20.6%	Project IRR (Pre-Tax)= 14.1% Equity IRR (Post-Tax)= 17.9%	Project IRR (Pre-Tax)= 13.3% Equity IRR (Post-Tax)= 15.8%
Traffic Growth Rates Lower by 10%	Project IRR (Pre-Tax)= 14.5% Equity IRR (Post-Tax)= 19.4%	Project IRR (Pre-Tax)=13.6% Equity IRR (Post-Tax)= 16.9%	Project IRR (Pre-Tax)= 12.8% Equity IRR (Post-Tax)= 15.1%

Creating useful scenarios is all about identifying combinations of Project Variables to which output is sensitive. At the same time, one should not make the mistake of regarding the probabilities associated with each cell of the scenario matrix as being equal. This should be apparent even using fundamental concepts of probability like statistical independence and the point can be emphasised using the matrix from the illustration above.

As a start, let us recognise that that the outcome with regard to the actual capital expenditure on the project is in no way affected by the outcome with regard to traffic growth. In other words, the outcome of the random variable "actual capital expenditure incurred" does not in any way affect the probability of the outcome of the random variable "actual traffic growth witnessed". This is referred to as statistical independence of the two events. When two events A and B are statistically independent, the probability of both these events occurring together (or in succession) is known as the joint probability. This is denoted by P(AB) and is simply the product of the probabilities of the two statistically independent events. Thus, under conditions of statistical independence:

$$P(AB)=P(A)*P(B)$$

Now, let us assume that the probabilities associated with each possible outcome of the two random variables "actual capital expenditure incurred" and "actual traffic growth witnessed" are as follows:

Random Variable: Actual Capital Expenditure Incurred (Capex)	**Random Variable: Actual Traffic Growth Incurred**
P(Capex is less than estimate by 10%) = 0.15 P(Capex is equal to estimate) = 0.60 P(Capex is higher than estimate by 10%) = 0.25	P(Traffic Growth is higher by 10%) = 0.30 P(Traffic Growth is equal to estimate) = 0.50 P(Traffic Growth is lower by 10%) = 0.20

It may be noted that the probabilities in each case adds up to one (0.15+0.60+0.25=1.00; 0.30+0.50+0.20=1.00). In other words, we are assuming that there exist only three possible outcomes for each variable, one of which must occur. While this is unrealistic, that fact does not detract from the concept being explained in any manner. In fact, the reader may well question how the probability for each of the outcomes is arrived at? One possibility is that this is based on past experience – it has been seen that the capital expenditure actually incurred is as per estimate in 60% of past projects, 10% lower than estimate in 15% of past projects and 10% higher than the estimate in 25% of past projects. For that matter, these may well be subjective probabilities, which would not affect the following analysis.

We note that each cell of the scenario matrix corresponds to the simultaneous occurrence of two events – one event being associated with the variable "actual capital expenditure incurred" and the other event being associated with the variable "actual traffic growth witnessed". Since the events are statistically independent, the joint probability associated with each cell of the scenario matrix is simply the product of the probabilities associated with the two underlying events. This is shown in the illustration below.

ILLUSTRATION 5.8

Joint Probabilities Associated With Scenario Matrix

	Capex Less by 10%P=0.15	**Base Case Capex P=0.60**	**Capex Higher by 10%P=0.25**
Traffic Growth Rates Higher by 10%P=0.30	0.045(0.15*0.30)	0.180(0.60*0.30)	0.075(0.25*0.30)
Base Case Traffic Growth P=0.50	0.075(0.15*0.50)	0.300(0.60*0.50)	0.125(0.25*0.50)
Traffic Growth Rates Lower by 10% P=0.20	0.030(0.15*0.20)	0.120(0.60*0.20)	0.050(0.25*0.20)

It is thus apparent that the probability of occurrence associated with each cell of the scenario matrix is different. Moreover, the sum of the probabilities associated with the nine cells adds up to one, as must be the case since the events represented by the nine cells are together MECE, i.e. only one of the nine events must occur. While this may not be apparent from the illustration, it is also possible to use the probabilities associated with each cell of the scenario matrix to derive a single value of the expected return on equity represented by the matrix. For this, we need to recall the definition of expected return in Chapter 3 (Section 3.5.3)—by multiplying the probability shown in each of the nine cells with the corresponding post-tax equity IRR shown in the earlier illustration and summing the same, we can thus state that the expected post-tax equity IRR based on the scenario matrix is 17.9%.

CHAPTER 6

Miscellaneous Aspects

INTRODUCTION

This chapter covers the finer issues related to financial modelling for those readers directly responsible for development of the Financial Model in a PPP/Project Finance Context.

Key Topics Covered in this Chapter

- Conditional Calculations
- Managing Conditional/Logical Calculations – IF, AND & OR functions
- Interest during Construction (IDC) and Circular Reference
- Depreciation and Taxation
- Debt Structuring and Re-financing
- Real Versus Nominal Financial Projections
- Incorporating Time-Lines in Financial Models
- Projecting Balance Sheets

6.1 CONDITIONAL CALCULATIONS

6.1.1 Need for Conditional Calculations

Some Project Variables that have to be calculated in developing a Financial Model vary depending on the value of another Project Variable or a set of Project Variables. The most common independent Project Variable that drives the conditional values of another (dependent) Project Variable in most Financial Models is the time period. Depending on the PPP Project Structure and the time-lines for construction and concession/operation period (i.e., the Project Time-Line), besides aspects such as the moratorium period on repayment of loans, tenure for loan repayment, time limits imposed by Income Tax rules, etc., we may expect the period or FY in any column to drive the values of Project Variables such as:

- The number of months the project is operational during the period or FY or conversely the number of months of construction during the period or FY, which in turn drives depreciation calculation, the bifurcation of interest payments into Interest during Construction (IDC) that is capitalised in the balance sheet and interest expense charged to the profit and loss statement, proportion of revenue or expense projected on an yearly basis that should be reflected in the Financial Model, etc.
- Loan repayment, which in turn drives the closing balance of loan and interest payment.
- Income tax related aspects such as the amount of carry forward loss available for setting off against the profit generated in a given period/FY or certain time limited tax benefits that can be availed only within a specified period.

Apart from conditional values linked to the period or FY, it may also be necessary to ensure that abnormal values such as negative values of loans outstanding or assets do not arise, which is possible if depreciation continues to be charged after the net asset value has fallen to nil or loan repayments projected to continue after the loan has been entirely paid off. Such issues are also typically best addressed using the IF function in the formulae. Based on the objective of creating a Financial Model that is flexible and the consequent best practices outlined earlier, it is clear that one should not address such conditional values using different formulae in different columns representing different periods/FYs for calculating the value of a given Project Variable in a particular row of the spreadsheet Financial Model. However, ensuring this flexibility can get somewhat involved if there are several conditions that have to be considered in calculating the value for a given Project Variable and it is easy even for modellers with some experience to make errors in developing formulae for such conditional calculations. It is thus worthwhile to devote some attention to conditional/logical calculations.

6.1.2 Handling Complex Conditional Calculations

A good technique to use for returning the correct conditional/logical result is to divide up the entire range of results into discrete and mutually exclusive condition ranges that in total cover all possible conditions i.e., are cumulatively exhaustive. As an example, consider the common problem of generating the number of months of operation in a given period or FY. The conditions that will drive this result can be usefully broken up into four discrete ranges:

- Periods/FYs prior to completion of construction, when the number of months of operation is obviously zero.
- The period/FY during which construction is completed and the concession period or operations commence, where the number of months of operation during the period/FY will be driven by the month in which commercial operations commence. (Note: The approach to calculating the number of months of operation in a given period/FY is discussed in detail in Sections 4.4 and 5.5).
- The periods/FYs lying between the first and last period/FY of the concession/operation period, in all of which the number of months of operation is twelve.
- The last FY/period of the concession/operation period, when the number of months of operation will be determined by the number of months operation in the first period/FY – if the number of months operation in the first FY/period is x, then the number of months operation in the last FY/period will be 12-x.[1]

Say, construction of a BOT project starts in FY08 and is completed in FY10 (say, in the month of December 2009). Operations commence from January 2010 and the concession period is 15 years, ending in FY26 (January

[1] This is based on the type of concession agreements most commonly used. However, a different definition of the concession period may be provided for in the concession agreement and in developing a Financial Model for a real life project reference must be made to the concession agreement (draft agreement generally provided as part of Request for Proposal if the agreement is yet to be signed)or more generally, the PPP Project Contract.

2026). Thus, the Financial Model for the project will run from FY08 to FY26 and the value for months of operation over these FYs will be as follows:

FYs	Months of Operations
FY08, FY09	0
FY10	3
FY11 to FY25	12
FY26	9

Now given that the four sets of conditions (i.e., FYs) are MECE, the logic for calculating the number of months of operation (say, m) during a given FY can be as follows:

(If FY is greater than FY10 and less than FY26 then m=12, else m=0) plus (If FY=FY10 then m=3 else m=0) plus (If FY=FY26 then m=9 else m=0)

Note that a specific If-Then-Else construct is not required for FY08 and FY09 before commencement of operations when 'm' equals zero, since the logic is such that the value zero is returned by "Else" in all three If-Then-Else components. Moreover, since the condition ranges are MECE, only one of the If-Then-Else components will return a non-zero value of 'm' for any given FY (for FY08 and FY09, none of the three will return a non-zero value of 'm' and the value of 'm' will be calculated as zero), the components can be added up in the formula that is entered in each cell of the output range that shows the number of months of operation in a given FY.

6.1.3 Multiple Conditions Handled using AND and OR Functions

Before considering a few examples of conditional calculations, it should be noted that it is possible to have multiple conditions that have to be evaluated in order to return a value. For such situations, use of the AND function and the OR function along with the IF function is commonly required. The general syntax of the IF function has three arguments – the condition to be met, the value to be returned if the condition is met and the value to be returned if the condition is not met. The condition used can be any logical test that will return a value of TRUE if the condition is met and FALSE if the condition is not met. Typically the logical test will involve references to the cells that are to be evaluated along with any one or more of arithmetic operators such as addition (+), division (/), multiplication (*), exponential (^), etc. or comparison operators such as equal to (=), greater than (>), less than (<), not equal to (<>), greater than or equal to (>=), etc. The syntax of the IF function is as follows:

IF (condition to be met, value if condition is met, value if condition is not met)

Of the three arguments, the first is a logical test combining cell references, operators, etc. The second argument specifies the value to be returned if the logical test returns TRUE (i.e. the condition specified is met) while the third argument specifies the value to be returned is the logical test returns FALSE, i.e. the condition is not met.

When both of two conditions must be met, the AND function is typically used in the form:

IF (AND (condition 1, condition 2), value if both conditions met, value if both conditions or any one condition not met)

It may be noted that the AND function in Excel is not restricted to two conditions or logical tests – up to 255 logical tests can be used with the AND function, with the function returning TRUE only when all conditions are met and FALSE if one or more condition is not met. In situations where a particular value is to be returned if either one of two conditions is satisfied, the OR function can be used in the form:

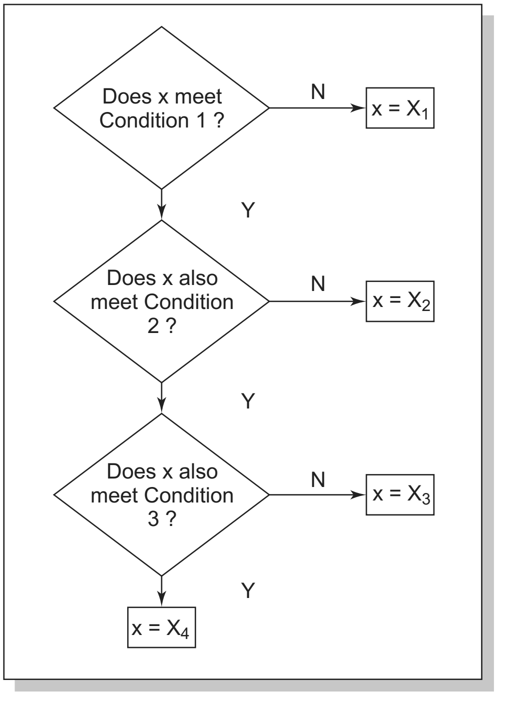
IF (OR (condition 1, condition 2), value if either condition met[2], value if both conditions not met)

As in case of the AND function, the OR function is not restricted to two logical tests and up to 255 such tests can be used, though that would be a fairly theoretical limit for Financial Models, where a maximum of 2-3 logical tests are generally required. It should be noted that just as the AND function and OR function can be combined with the IF function (i.e., nested functions, where one or more argument is a function), it is also possible to combine multiple IF functions to address multiple conditions that apply to a given Project Variable, say x, as shown in ***Illustration 6.1***.

[2] It is assumed here that both conditions cannot be met simultaneously, which is not essential as long as the value to be returned if either condition or both conditions are met is the same.

ILLUSTRATION 6.1

Situation Requiring Nested IF functions



This situation of multiple conditions can be addressed using nested IF functions of the type:

=IF (Condition 1, IF (Condition 2, IF (Condition 3, X_4, X_3), X_2), X_1)

While nesting of conditional functions such as the IF function, AND function and OR function is convenient, excessive use leading to long and complicated formulae can and should be avoided as it becomes difficult for an user to follow the logic underlying the formulae while also increasing the chances of errors creeping in. A good way of avoiding complicated formulae is to break up the calculation using "flags" in intermediate rows. These flags are binary dummy variables that take on a value of either 0 or 1 depending on a specified condition, which can then be referred to by formula in subsequent rows that add on further conditions that refer to the value of the flag. For examples of such flags, readers may refer to the illustrations covered under income tax calculations later in this chapter (Section 6.3).

6.2 IDC AND CIRCULAR REFERENCE

6.2.1 IDC as a Typical Example of Circular Reference

An Excel spreadsheet will usually display an error message if a formula with a circular reference is entered – i.e., if the formula in question refers in some way to the cell in which it is entered. This need not be a direct or obvious reference – it is more likely that the arguments of the formula in question include a cell that in turn calculates a value using the content of the formula cell. Usually, Excel displays a circular reference toolbar when a formula with a circular reference is entered which allows us to identify the cell containing the formula with circular reference and trace the precedents/dependents to correct. However, the circular reference toolbar may not be automatically displayed in which case the following menu path has to be followed:

Tools – Customize – Toolbars and the box next to Circular Reference checked.

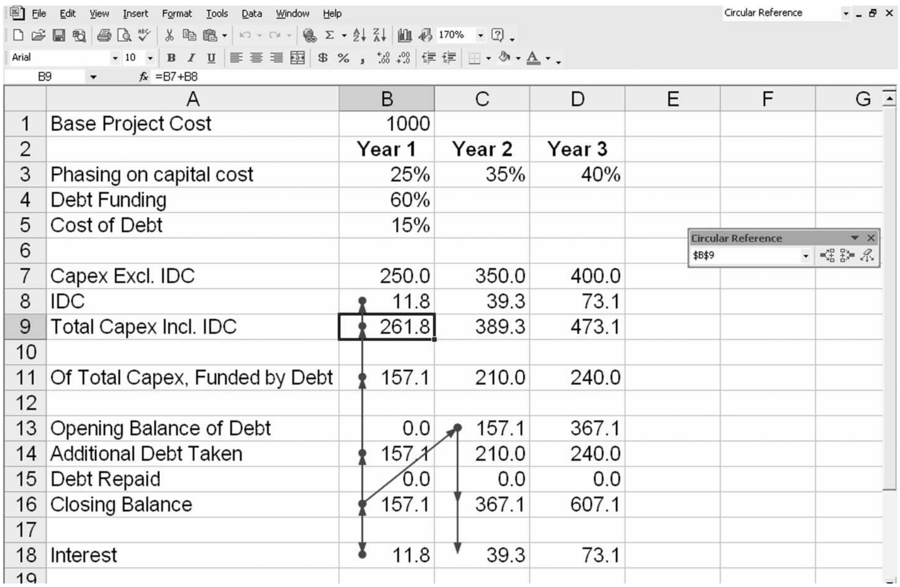
One aspect of a Financial Model that typically results in a circular reference is the calculation of interest during construction (IDC). As per standard practice, the interest on loans during the construction period is capitalised to the asset being created, along with other pre-operative expenses incurred before the start of commercial operations. Generally, we start with a base cost for the project excluding IDC and then make assumptions about the funding of this cost. Depending on the capital cost incurred during each year of the construction period, we then calculate the amount of loan drawn down in the year, followed by a calculation of the interest on the loan drawn down. During the construction period, this interest has to be included in the capital cost and the revised capital cost including IDC then has to be funded. This will typically create a circular reference as shown in ***Illustration 6.2***.

6.2.2 Enabling Iterative Calculations

It should be noted that the cell with the circular reference (B8 in above example) will be displayed in the status bar at the bottom of the screen only if the cell is on the active worksheet. The simplest way to tackle the circular reference problem is to use the menu path Tools-Options (the Windows button in Excel 2007) and check the box next to Iteration on the Calculation tab (shown below in ***Illustration 6.3***). This turns iteration on and effectively instructs Excel to stop after a certain number of iterations (default 100, can be set by user) or when the change from one iteration to the next is less that a certain value (default 0.001, can be also set by user to different value). This generally does away with the problem.

ILLUSTRATION 6.2

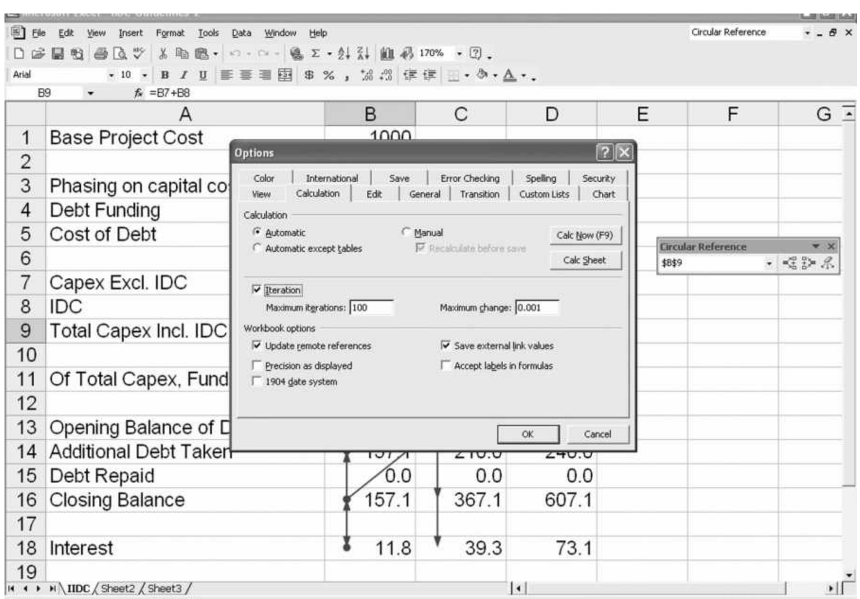
Circular Reference



	A	B	C	D
1	Base Project Cost	1000		
2		Year 1	Year 2	Year 3
3	Phasing on capital cost	25%	35%	40%
4	Debt Funding	60%		
5	Cost of Debt	15%		
6				
7	Capex Excl. IDC	250.0	350.0	400.0
8	IDC	11.8	39.3	73.1
9	Total Capex Incl. IDC	261.8	389.3	473.1
10				
11	Of Total Capex, Funded by Debt	157.1	210.0	240.0
12				
13	Opening Balance of Debt	0.0	157.1	367.1
14	Additional Debt Taken	157.1	210.0	240.0
15	Debt Repaid	0.0	0.0	0.0
16	Closing Balance	157.1	367.1	607.1
17				
18	Interest	11.8	39.3	73.1

ILLUSTRATION 6.3

Enabling Iterative Calculation in Excel



For example, the illustration of circular reference arising out of IDC shown on the previous page would display the following with iteration turned on.

ILLUSTRATION 6.4

Result after Enabling Iterative Calculations

	A	B	C	D	E	F	G	H	I
1	Base Project Cost	1000							
2		Year 1	Year 2	Year 3					
3	Phasing on capital cost	25%	35%	40%					
4	Debt Funding	60%							
5	Cost of Debt	15%							
6									
7	Capex Excl. IDC	250.0	350.0	400.0					
8	IDC	11.8	39.3	73.1					
9	Total Capex Incl. IDC	261.8	389.3	473.1					
10									
11	Of Total Capex, Funded by Debt	157.1	210.0	240.0					
12									
13	Opening Balance of Debt	0.0	157.1	367.1					
14	Additional Debt Taken	157.1	210.0	240.0					
15	Debt Repaid	0.0	0.0	0.0					
16	Closing Balance	157.1	367.1	607.1					
17									
18	Interest	11.8	39.3	73.1					
19									
20	Capex Excl. IDC	1000.0							
21	IDC	124.2							
22	Total Capex Incl. IDC	1124.2							
23									

However, taking this easy way out has repercussions. For one, in case other circular references are created by mistake in the Financial Model during development, this will not be pointed out by Excel. It is, however, possible to tackle this issue by developing the model completely with iteration on, and then switching it off to check if there are other circular references apart from the IDC calculation where iteration is deliberately used. It should be noted, moreover, that though the status of iteration (off/on) is saved as a setting of the workbook, in any given session Excel will use as the status of iteration according to the first workbook opened during that session. It is thus entirely possible that someone else using the workbook or even the same user in a different session will end up with error messages showing circular reference. The author has faced such an embarrassing situation while formally presenting financial projections for an entity to potential investors, at which point it was difficult to understand why a Financial Model that was working perfectly well suddenly showed errors.

6.2.3 Avoiding Circular References through Form of Assumptions

It is also possible to avoid circular references in calculation of IDC by changing the form of assumption about funding. The circular reference problem typically arises when using a debt-equity ratio such as 3:2 or 2:1 as the assumption for funding. Thus, the total capital expenditure in any period is used along with the ratio to calculate what amounts of debt and equity will be required for funding. Depending on the amount of debt calculated in the first iteration, the IDC is calculated and added back to the capital expenditure, starting off a second iteration where the new capital expenditure figure is used with the debt-equity ratio to calculate the new values of debt and equity, thereby changing the IDC figure and leading to the need for the third and subsequent iterations in the same manner. Instead of using a debt-equity ratio, it is possible to build the Financial Model by using an amount of debt that is fixed in absolute terms. With such an assumption, the amount of debt in any given period is calculated as the same proportion of the total (fixed) debt amount as the proportion of capital expenditure incurred in that period. The IDC is then calculated and added back to the initial figure of capital expenditure and the equity calculated simply as the balancing amount required for meeting the increased capital expenditure given that the debt figure remains fixed, i.e., equity funding during the period is calculated simply as the difference between the capital expenditure incurred (including IDC) and the debt accessed during the period. This is in no way very different conceptually from using the debt-equity ratio basis and has the advantage that the Financial Model can be built using any assumed value of debt and once the Financial Model is complete, the amount of debt can be easily changed by trial and error till the desired debt-equity ratio is reached. An example using this approach is shown in ***Illustration 6.5***.

ILLUSTRATION 6.5

IDC Managed Using Fixed Amount of Debt - Adjusted by Trial and Error (1/2)

	A	C	D	E	F
1	Base Capital Cost of Project - Year 0	100			
2	Years:	1	2	3	
3	Phasing of Capital Cost	20.0%	45.0%	35.0%	
4					
5	Debt Funding Assumed	60			

6	Total Equity Funding (Calculated; =F26)	63.28			
7	Resulting Debt Equity Ratio (i.e. C5/C6)	0.95			
8					
9	Cost Escalation Assumed per annum	5.0%			
10	Interest Cost of Debt Funding	15.0%			
11					
12	Years:	1	2	3	Totals (C+D+E)
13	Base Capital Cost Incurred During the Year	20.00	45.00	35.00	100.00
14	Base Capital Cost Plus Cost Escalation	21.00	49.61	40.52	111.13
15					
16	Debt Funding	12.00	27.00	21.00	60.00
17					
18	Loan – Opening Balance	0.00	12.00	39.00	
19	Loan Taken During the Year	12.00	27.00	21.00	
20	Loan - Closing Balance	12.00	39.00	60.00	
21					
22	Interest during Construction (IDC)	0.90	3.83	7.43	12.15
23					
24	Landed Capital Cost Incl. Escalation & IDC	21.90	53.44	47.94	123.28
25					
26	Equity Funding (Balancing Item, Row 24 Less Row 16)	9.90	26.44	26.94	63.28

In the above example, we know that the base capital cost for the project is 100. The actual landed project cost will include cost escalation due to inflation and the IDC, which would normally involve circular references while calculating. To get around this problem, we can simply assume a fixed amount of debt funding (60 in this case) that will be disbursed in line with the project construction schedule, i.e., 20% of 60 or 12 in Year 1, 45% of 60 (i.e. 27) in Year 2, and so on. We then go ahead and calculate the cost escalation and the implied interest cost, with the amount of equity getting calculated as the balancing amount required to fund the total landed cost including escalation and IDC, given that the amount of debt funding is fixed. As a result of this approach, no circular reference or iterations are involved and we arrive at a solution whereby the landed project cost of 123.28 gets funded by debt amounting to 60 and equity funding of 63.28, implying a debt-equity ratio of 0.95. Now, supposing we want to actually fund the project with debt-equity ratio of 1.50, it is a simple matter to change the amount of debt funding assumed by trial and error to arrive at the solution, again without getting caught up in the problem of circular reference. This is shown below, where with debt funding of 76, the landed project cost of 126.62 gets funded by 50.52 of equity, leading to a debt-equity ratio of exactly 1.50.

ILLUSTRATION 6.6

IDC Managed Using Fixed Amount of Debt - Adjusted by Trial and Error (2/2)

	A	C	D	E	F
1	Base Capital Cost of Project - Year 0	100			
2	Years:	1	2	3	
3	Phasing of Capital Cost	20.0%	45.0%	35.0%	
4					
5	Debt Funding Assumed	76			
6	Total Equity Funding (Calculated; =F26)	50.52			
7	Resulting Debt Equity Ratio (i.e. C5/C6)	1.50			
8					
9	Cost Escalation Assumed per annum	5.0%			
10	Interest Cost on Debt Funding	15.0%			
11					
12	Years:	1	2	3	Totals (C+D+E)
13	Base Capital Cost Incurred During the Year	20.00	45.00	35.00	100.00
14	Base Capital Cost Plus Cost Escalation	21.00	49.61	40.52	111.13
15					
16	Debt Funding	15.20	34.20	26.60	76.00
17					
18	Loan - Opening Balance	0.00	15.20	49.40	
19	Loan Taken During the Year	15.20	34.20	26.60	
20	Loan - Closing Balance	15.20	49.40	76.00	
21					
22	Interest during Construction (IDC)	1.14	4.85	9.41	15.39
23					
24	Landed Capital Cost Incl. Escalation & IDC	22.14	54.46	49.92	126.52
25					
26	Equity Funding (Balancing Item, Row 24 Less Row 16)	6.94	20.26	23.32	50.52

6.2.4 Macro for IDC

The problem with IDC can be also addressed using a simple macro. The circular reference in IDC arises due to the fact that the calculated interest changes the total project cost, which then changes the amount of debt funding, leading to further change in the calculated interest and so on. However if the interest calculated using a formula in every iteration is not fed back directly into this circular loop but first converted into a value that is then added back to the base capital cost, the circularity can be broken. This involves some understanding of macros, which in Excel use Visual Basic programming and can be used to automate repeated steps. This is something that many people are not comfortable with though one can actually record macros in Excel just by carrying out the necessary actions using the menu option "Tools-Macro-Record New Macro" even without being an expert at Visual Basic. However, simple recording procedures are not adequate for tackling the iterations involved in IDC calculations using a macro. Though there are different options available for this purpose, a simple macro for calculating IDC is illustrated below with assumptions about the base capital cost incurred in each of four years, proportion of debt funding and interest cost used to create a loan schedule and interest calculation as shown. However, note that the amount of loan taken in any given year is calculated on the values generated in row 6 which in turn sums the values in row 4 (assumed base capital cost) and row 14 (Interest Value), which is initially blank as shown.

ILLUSTRATION 6.7

Set-up for IDC Macro (1/4)

	A	C	D	E	F	G
1		% of Debt Funding	60%			
2		Interest Cost	16%			
3	Year	1	2	3	4	Totals
4	Base Capital Cost	100.00	150.00	200.00	250.00	700.00
5						
6	Base Capital Cost + IDC (Row 4 Plus Row 14)	100.00	150.00	200.00	250.00	700.00
7						
8	Opening Balance – Loan	0.00	60.00	150.00	270.00	
9	Loan Taken	60.00	90.00	120.00	150.00	
10	Closing Balance – Loan	60.00	150.00	270.00	420.00	
11						
12	Interest Calculated	4.80	16.80	33.60	55.20	110.40
13						
14	Interest Value					0.00

Now, range C12:F12 can be copied and pasted as values (using "Paste Special) in the range C14:F14. As a result of this first iteration, the values in row 6 change, leading to changes in other rows (8, 9, 10 and 12) that contain formulae linked to row 6 as well. This is shown below in ***Illustration 6.8***.

ILLUSTRATION 6.8

Set-up for IDC Macro (2/4)

	A	C	D	E	F	G
1		% of Debt Funding	60%			
2		Interest Cost	16%			
3	Year	1	2	3	4	Totals
4	Base Capital Cost	100.00	150.00	200.00	250.00	700.00
5						
6	Base Capital Cost + IDC (Row 4 Plus Row 14)	104.80	166.80	233.60	305.20	810.40
7						
8	Opening Balance – Loan	0.00	62.88	162.96	303.12	
9	Loan Taken	62.88	100.08	140.16	183.12	
10	Closing Balance – Loan	62.88	162.96	303.12	486.24	
11						
12	Interest Calculated	5.03	18.07	37.29	63.15	123.53
13						
14	Interest Value	4.80	16.80	33.60	55.20	110.40

The step of copying the range C12:F12 and pasting in C14:F14 as values can be repeated again, which will lead to ***Illustration 6.9*** shown below.

ILLUSTRATION 6.9

Set-up for IDC Macro (3/4)

	A	C	D	E	F	G
1		% of Debt Funding	60%			
2		Interest Cost	16%			
3	Year	1	2	3	4	Totals
4	Base Capital Cost	100.00	150.00	200.00	250.00	700.00
5						
6	Base Capital Cost + IDC (Row 4 Plus Row 14)	105.03	168.07	237.29	313.15	823.53
7						
8	Opening Balance – Loan	0.00	63.02	163.86	306.23	
9	Loan Taken	63.02	100.84	142.37	187.89	

10	Closing Balance – Loan	63.02	163.86	306.23	494.12	
11						
12	Interest Calculated	5.04	18.15	37.61	64.03	124.83
13						
14	Interest Value	5.03	18.07	37.29	63.15	123.53

Clearly, iterations as shown above can be used to calculate IDC. As such, any repetitive action of this type can be easily automated using a macro. In fact, the core of the required macro can be easily generated using "Tools-Macro-Record New Macro" and recording the action of copying the range C12:F12 followed by the pasting of this in the range C14:F14 as values using "Paste Special". The required Visual Basic program gets automatically created in Excel. This can be viewed using the menu commands "Tools-Macro-Visual Basic Editor" or "Tools-Macro-Macros" followed by choice of name given to the macro (say, "IDC") and the "Edit" button. The underlying program then looks like this:

```
Sub IDC()
'
' IDC Macro
'Macro recorded 21/01/2009 by Prabuddha
'
 Range("C12:F12").Select
 Selection.Copy
 Range("C14:F14").Select
     Selection.PasteSpecial     Paste:=xlPasteValues,
Operation:=xlNone, SkipBlanks _
 :=False, Transpose:=False
End Sub
```

Modifying the above macro to repeatedly carry out the "Copy" and "Paste Special" (paste as values) actions does require some programming that cannot be recorded. Essentially, this involves the introduction of a loop and a counter so that the actions are repeated till the counter reaches the values specified by the programmer. The complete program with a counter "num" (for number) and repetitions of the loop till the counter reaches the value of ten (10), ensuring that ten iterations of the "Copy" and "Paste Special" actions are carried out appears as shown in the text box below.

```
Sub IDC()
'
' IDC Macro
```

```
 ` Macro recorded 21/01/2009 by Prabuddha
 `
 ` Keyboard Shortcut: Ctrl+i
 `
  num = 0
  Do Until num = 10
  Range("C12:F12").Select
  Selection.Copy
  Range("C14:F14").Select
      Selection.PasteSpecial     Paste:=xlPasteValues,
 Operation:=xlNone, SkipBlanks _
  :=False, Transpose:=False
  num = num + 1
  Loop
 End Sub
```

Using the "IDC" macro, ten iterations are carried out every time "Ctrl-I" is pressed, which provides the IDC for any set of inputs. Using different assumptions for the proportion of debt funding and interest cost, the results yielded by the "IDC" macro are as follows:

ILLUSTRATION 6.10

Set-up for IDC Macro (4/4, Result)

	A	C	D	E	F	G
1		% of Debt Funding	70%			
2		Interest Cost	14%			
3	Year	1	2	3	4	Totals
4	Base Capital Cost	100.00	150.00	200.00	250.00	700.00
5						
6	Base Capital Cost + IDC (Row 4 Plus Row 14)	105.15	168.56	238.51	315.67	827.89
7						
8	Opening Balance – Loan	0.00	73.61	191.60	358.56	
9	Loan Taken	73.61	118.00	166.96	220.97	
10	Closing Balance – Loan	73.61	191.60	358.56	579.53	
11						
12	Interest Calculated	5.15	18.56	38.51	65.67	127.89
13						
14	Interest Value	5.15	18.56	38.51	65.67	127.89

Lastly, it may be noted that the iterative solution of circular references works only if the values in the cell(s) with circular reference converge, i.e., tend towards a limiting value which can then be considered the correct value. In case circular references produce diverging values, turning iteration on will not solve the problem. Though circular references that produce such diverging values are in most cases due to a mistake in the logic or entry of the formula and rather unlikely to otherwise appear in Financial Models, the possibility cannot be entirely discounted given the wide range of potential Financial Models in terms of sector, technology, PPP Project Structure, financing structure, etc in the PPP/Project Finance Context.

6.3 DEPRECIATION AND TAXATION

The calculation and treatment of depreciation and income tax is one area that typically causes some difficulty and apprehension, especially among those taking on financial modelling with limited formal training in accounting. Taxation, in particular, can be a little disconcerting given the multiplicity of tax related provisions and the fact that these provisions change from time to time, sometimes with every year's budget. Thankfully, there is now an established trend towards simplification of income tax rules though some special provisions for infrastructure projects are likely to remain in the years to come[3]. Of course, these observations are by no means specific to PPP or Project Finance transactions and some of the discussion in this Section would apply in general to any corporate entity operating in the Indian context.

To treat this aspect as simply as possible without excluding any, the following concepts need to be understood by the readers:

- Difference between accounting/book/reported profits and taxable profits of a company, based on two books of account;
- The rationale and alternate methods for calculating depreciation on fixed assets;
- The concept of deferred tax arising out of timing difference or permanent difference, and the accounting treatment of such deferred tax;
- Carry forward loss;
- Minimum Alternate Tax (MAT);

[3] Taxation practice is to an extent country-specific and this Section deals largely with taxation and company law as prevalent in the Indian context, though some of the discussion would apply in other tax jurisdictions as well.

- Income Tax holiday for infrastructure projects under Section 80IA of the Income Tax Act, 1963;
- The nature of assets created under a service concession agreement and the equivalence of amortisation and depreciation from the point of view of cash flows in a Financial Model;

6.3.1 Difference between Accounting Income and Tax Income

In effect, two sets of P&L Account are prepared by an entity, one each for accounting/reporting purpose and calculation of taxes on income. There is thus a figure of accounting income or book profit and another for tax income/profit, and in most cases these differ from each other. The terms accounting/book income (profit)[4] and tax income (profit) can be used to distinguish the two. Though the calculation of tax on income follows the matching principle in that such tax is accrued in the same period as the revenue and expenses to which it relates, the difference arises because all the items of revenue and expenditure that determine the accounting income/profit may not be recognised partly or fully for taxation purpose as per the tax laws and vice versa. The resulting difference in accounting income and tax income in any given period is known as timing difference (if such difference is capable of reversal in subsequent periods) or permanent difference (in case subsequent reversal is not possible). The tax effect of these differences is known as deferred tax. As an example of permanent difference, consider the case where tax laws allow only part of an item of expenditure for calculation of tax income. In such a case, the item of expenditure will be fully deducted from revenue in order to arrive at accounting income/profit whereas the tax income/profit will be higher to the extent of the disallowed part of the item of expenditure. This difference will occur only in that period where the relevant item of expenditure is incurred and the difference will not get reversed in the subsequent periods.

On the other hand, if the amount of depreciation allowed under income tax rules in a given period is higher than depreciation as per the company's accounts, the tax income (profit) in that period will be lower than the accounting income (profit). The income tax payable for the period (known as "current tax") will thus be lower than the amount that would be calculated based on the accounting income, i.e. the accounting income (profit) multiplied by the income tax rate – this difference is the deferred tax. The

[4] The term "book profit" is also used to denote the same concept.

effect of this deferred tax is to reduce the outgo on account of income tax in the given period. In later periods, the depreciation allowed under income tax rules would become less than the depreciation as per the company's accounts since over a period of time the cumulative depreciation must be equal, being equivalent to the cost of the asset in question that has to be written off over the asset's life. In such later periods, the income tax payable (i.e. current tax) would be higher than that arrived at by multiplying the accounting income (profit) by the effective tax rate. The deferred tax in the given period is thus in the nature of a liability that has to be met in future periods on account of higher tax payable in those periods – a deferred tax liability is thus created.

In the situation where certain expenses incurred in a given period are charged to the profit and loss but not allowed to be fully charged in the same period under income tax rules, the tax income (profit) will be higher than the accounting income (profit). As a result, the current tax in that period will thus be higher than that based on the accounting income (profit) for the period. In later periods, when part of the expense incurred and charged off in the earlier period is allowed to be charged under the income tax rules, this will result in a reduction in the tax income (profit) and therefore in the outgo on account of income tax. The deferred tax in the initial period is thus in the nature of an asset that will yield benefits to the company in future periods on account of lower tax payable in those periods - a deferred tax asset is thus created.

6.3.2 Depreciation

Different treatment of depreciation is one of the major reasons for timing differences. Depreciation is simply a reflection of the fact that in addition to the expenditure on raw materials, salaries & wages, marketing, etc., any revenue generating activity that uses fixed assets has a hidden cost in that these fixed assets wear out with usage and/or obsolescence and have to be periodically replaced. Accordingly, accountants calculate depreciation on the fixed assets and treat this as an expense in every year of operation in order to arrive at the net income/profit earned by any given operation or firm. It should be noted that depreciation is a non-cash expense – while other expenses have to be paid for sooner or later, depreciation is simply an accounting construct used to reflect correctly the profits earned using assets that are subject to wear and tear and need to be replaced from time to time. The fact that depreciation is being charged does not mean that an equivalent amount is set aside in order to fund the periodic replacement of fixed assets. The rate of depreciation allowed under tax laws for a particular type of fixed asset will generally not match the rate used for accounting[5]. Moreover, in the Indian context, depreciation for tax purposes is calculated on the basis of Written Down Value (WDV) where the depreciation rate is applied to the net value of the asset in any period after deducting the accumulated depreciation of all previous periods. The amount of depreciation allowed for income tax purpose thus keeps reducing as time goes by. In contrast, the Companies Act allows every company to choose between WDV and the Straight Line Method (SLM) where the rate is applied to the initial cost of the asset and the amount of depreciation remains constant from year to year. Two sets of rates are provided for this purpose in a schedule to the Act and any company is free to choose one of the two systems and therefore the relevant rates of depreciation.

Where depreciation is being calculated using SLM for arriving at the accounting income/profit, the depreciation calculated on WDV basis for arriving at the tax income/profit shall be higher than the SLM depreciation in the initial years and the tax income/profit will, as a consequence, be lower than accounting income/profit. In later years, the income tax depreciation on WDV basis will be lower than the SLM depreciation amount and as a result the tax income/profit will be higher than the accounting income/profit. The effect of the timing difference is thus to reduce the income tax outgo in the initial years and increase it in the later years – in effect, the outgo on account of income tax is deferred to later years though over the life span of the asset the total accumulated depreciation charged under both WDV and SLM will be the same.

Keeping in mind the fact that DCF analysis should ignore all non-cash transactions, it is thus essential to add back the amount of depreciation charged in any given year to the profit figure in order to get the correct cash flows that are to be discounted. Better still, as described earlier in Chapter 4, the OPBDIT should be the starting point for calculating project IRRs as this represents the amount of net cash available to the investors in the project (both debt and equity) after meeting all expenses, but before income taxes are paid. In order to calculate a post-tax project IRR, the amount of tax should be deducted from OPBDIT.

In calculating depreciation in the Financial Model, it is essential to include checks so that one does not end up with negative values of net assets in any period. This is similar to the case of loan schedules where a check should be

[5] For exact rates, it is necessary to refer to the Companies Act (for accounting purpose) and the current Income Tax Ready Reckoner.

applied to the repayment of loans to ensure that the closing balance of the loan does not become negative.

Another relevant point that arises in case of PPP Project Contracts is whether the project assets can be considered as property, plant and machinery of the SPV in the first place. This aspect is dealt with in more detail in a subsequent Sub-section 6.3.7 but it may be noted that there is no conceptual difference if the assets created under a PPP Project Contract along with the SPV's rights to certain revenues arising out of the PPP Project Contract are treated as an intangible asset that is amortised rather than being treated as fixed assets that are depreciated — the non-cash nature of depreciation applies to amortisation as well and the only real difference may be in terms of the rates applied, both under the Companies Act and the Income Tax Act.

6.3.3 Treatment of Deferred Tax

In the Indian context, the recognition of timing differences and the accounting treatment of deferred tax is governed by Accounting Standard (AS) 22 on "Accounting for Taxes on Income" issued by the Institute of Chartered Accountants of India. However, with the increasing alignment of accounting standards across the world, the basic principles are likely to be similar in other countries as well. These basic principles are as follows:

- Both current tax (i.e. the amount of income tax actually payable as determined on the basis of the tax income in the income tax accounts) and deferred tax (i.e. the tax impact of timing differences) in any given period should be recognised as tax expense in that period itself in order to arrive at the net (i.e. post-tax) profit or loss in the entity's profit and loss accounts for the period. This is based on the principle that the financial statements for a given period should recognise the tax effect of all transactions occurring in that period.
- While both current tax and deferred tax are included under tax expenses in the profit and loss accounts for the relevant period, it should be noted that the actual outgo of cash is only on account of current tax. For the deferred tax component, an asset or liability is created in the balance sheet and carried forward to the future periods when these can be reversed. In case of a deferred tax asset, such reversal occurs in future periods when the asset is realised in the form of lower current tax in those periods. For a deferred tax liability, the reversal occurs when the higher current tax in future periods extinguishes the liability created in the initial period due to postponement of the income tax payout because of the timing difference. In some

instances, the terms "origination" and "reversal" are also used in the context of deferred tax in a slightly different manner. Deferred tax (liability) is said to originate in any period where the tax profit is lower than the accounting/book profit, or for that matter when tax loss is a greater amount than the accounting/book loss. When the reverse occurs, the deferred tax is said to reverse.

- All timing differences should be recognised in the form of deferred tax assets or liabilities as the case may be. However, for deferred tax assets, the continued recognition is subject to considerations of prudence – that is, there has to reasonable certainty that the deferred tax assets will get realised in the future, which essentially amounts to taking a view that the entity will generate tax profits in the future that allow the deferred tax assets to be realised. In case of subsequent changes in the rate of income tax, deferred tax assets and liabilities are adjusted to reflect the impact of such changes.
- No deferred tax assets or liabilities arise in case of permanent differences that do not get reversed in subsequent periods. A good example of this in the PPP/Project Finance Context is the income tax holiday provided for infrastructure projects under Section 80IA of the Income Tax Act, discussed in detail in a subsequent section.

From the point of view of the Financial Model, the important consideration that has to be borne in mind is that in arriving at the returns generated by the project, we are interested only in the cash flows associated with all items including income tax. Thus, even where current tax and deferred tax are projected in the profit and loss accounts, only the figure of current tax should be reflected in the projected cash flows on the "CFlo" worksheet. A reasonably good test for the correctness of the projected deferred tax amounts in the P&L Account is that these should sum up to zero over the Project Time-Line – in other words, the amounts of deferred tax assets or liabilities created should only impact the timing of the cash outflows on account of current tax and not the actual cumulative amount of income tax projected to be paid by the SPV over the life of the PPP Project Contract. In some cases, one finds on summing up the projected amounts of deferred tax that it differs from zero by a small amount – this is typically due to the fact that under the WDV method of depreciation under the Income Tax Act, the project assets are not fully written off and a small value remains on the books even at the end of the Project Time-Line. As long as the sum of deferred tax amounts differs from zero only to the extent of the residual value of assets in the income tax accounts multiplied by the income tax rate, this should not be a cause for concern.

Projecting timing differences and deferred tax in the Financial Model also gives rise to several issues. Firstly, since the SPV has operations limited to the Project Time-Line, any deferred tax recognised in the later periods may not be realisable as the operations of the SPV will cease in line with the provisions of the PPP Project Contract. Secondly, a more serious issue arises because of the income tax holiday under Section 80IA. Since the SPV is in any case allowed to set off its entire tax profit during ten consecutive periods, any deferred tax reversing during this period is actually meaningless and should not be recognised – to that extent there is no need to recognise the origination of the deferred tax prior to the tax holiday period. Deferred tax originating during the tax holiday period should be recognised only to the extent that these reverse after the tax holiday period. Thus, in order to project deferred tax properly, one would have to consider the net extent of origination or reversal during the period prior to the tax holiday, the tax holiday period and the period after the tax holiday and then adjust accordingly. This can be a cumbersome exercise that in turn adds little value to the output of the Financial Model that is affected only by cash flows. Effectively, there is little impact on the output of the Financial Model if deferred tax liabilities/assets arising out of timing difference are not projected.

6.3.4 Carry Forward Loss

Where a company records a loss in its income tax accounts in any given period, most tax authorities allow this loss to be carried forward and set off against tax profits generated in subsequent periods. However, such tax loss cannot be carried forward indefinitely – under current Indian laws, a tax loss can be carried forward for a maximum of eight periods from the period when it is recorded. If tax profits are not generated within eight periods, the carry forward loss effectively lapse. This aspect is important for most Financial Models as projects undertaken in the PPP/Project Finance Context typically generate tax loss in the initial periods of operation because usage of the project assets and therefore revenues from user charges in initial periods are often low as project assets are designed for projected demand in the long term[6]. This, coupled with high interest costs in the initial periods after completion of construction when loans are yet to be paid off to any

[6] For example, a highway may be designed based on the projected traffic over a period of fifteen to twenty years. Typically, this projected traffic is translated into the load to be borne by the project road over this period, expressed in terms of million standard axles. The design specifications for the project road are then developed in order to minimize the total cost (comprising initial capital expenditure as well as maintenance) over the entire life cycle.

significant extent, means that most SPVs report accounting as well as tax loss during the initial periods. The high level of income tax depreciation also contributes to the tax loss, which are then carried forward and become available for setting off against tax profits generated in subsequent periods, effectively reducing the tax outgo of the SPV in later years. In effect, the large amount of depreciation charged in the initial years to arrive at the tax income often cannot be absorbed by the level of revenues generated during initial periods and the unabsorbed depreciation becomes available in later periods for setting off against tax income and thus reduces the outgo on account of tax, provided of course that such tax profits are generated within the period that the tax loss can be carried forward.

The treatment of carry forward loss is not conceptually different from that of deferred tax discussed earlier. Thus, carry forward loss is essentially similar to a deferred tax asset that can be realised in later periods when there are tax profits in the form of lower outgo on account of income tax in those periods. The only consideration that has to be kept in mind is whether such carry forward loss can be realised or utilised within the time-frame of eight periods allowed under Indian tax laws at present. If adequate taxable income is not generated within this time-frame, the carry forward loss will have no value and cannot be realised. This aspect is again similar to the requirement of prudence while recognising deferred tax assets as discussed earlier.

To effectively deal with carry forward loss in the Financial Model, it is best to incorporate a matrix with the relevant periods corresponding to the Project Time-Line along both axes in the "Tax" worksheet. The availability of carry forward loss generated in any period shown in rows of the first column can be depicted against periods shown in columns of the first row, using the logic that the carry forward loss generated in any period will be available for utilisation only over the next eight periods. An example of this type of matrix is shown in the illustration overleaf. Using this type of matrix, it is possible to generate the amount of carry forward loss that is notionally available in each period by summing each column of the matrix. This availability of carry forward loss for setting off is notional in the sense that the actual utilisation of the carry forward loss is not reflected in the column sums. As and when taxable profit is generated, a part of the available carry forward loss can be set off against such profit. This setting off follows the "first in first out" (FIFO) principle in the sense that the earliest carry forward loss generated and available in the period when tax profit is generated is set off first.

ILLUSTRATION 6.11

Matrix for Carry Forward Losses (₹ Mn)

	A	D	E	F	G	H	I	J	K	L	M	N	O	P
49														
50	Schedule of Carry Forward (CF) Losses													
51		CF Loss Available During the FY's in columns												
52	CF Loss Generated During the FY's in rows below	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
53	2013	0	0	0	0	0	0	0	0	0	0	0	0	0
54	2014	0	0	0	0	0	0	0	0	0	0	0	0	0
55	2015	0	0	0	1,708	1,708	1,708	1,708	1,708	1,708	1,708	1,708	0	0
56	2016	0	0	0	0	3,108	3,108	3,108	3,108	3,108	3,108	3,108	3,108	0
57	2017	0	0	0	0	0	2,113	2,113	2,113	2,113	2,113	2,113	2,113	2,113
58	2018	0	0	0	0	0	0	1,381	1,381	1,381	1,381	1,381	1,381	1,381
59	2019	0	0	0	0	0	0	0	797	797	797	797	797	797
60	2020	0	0	0	0	0	0	0	0	294	294	294	294	294
61	2021	0	0	0	0	0	0	0	0	0	0	0	0	0
62	2022	0	0	0	0	0	0	0	0	0	0	764	764	764
63	2023	0	0	0	0	0	0	0	0	0	0	0	460	460
64	2024	0	0	0	0	0	0	0	0	0	0	0	0	0
65	2025	0	0	0	0	0	0	0	0	0	0	0	0	0
66	2026	0	0	0	0	0	0	0	0	0	0	0	0	0
67	2027	0	0	0	0	0	0	0	0	0	0	0	0	0
68	2028	0	0	0	0	0	0	0	0	0	0	0	0	0
69	2029	0	0	0	0	0	0	0	0	0	0	0	0	0
70	2030	0	0	0	0	0	0	0	0	0	0	0	0	0
71	2031	0	0	0	0	0	0	0	0	0	0	0	0	0

88	Financial Year ending March 31st,	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
89	Total CF Loss (Notional) Available for setting off during the FY	0	0	0	1,708	4,816	6,929	8,311	9,108	9,402	9,402	10,166	8,918	5,810

To the extent of the setting off of carry forward losses in any period, the effective availability of carry forward losses in any subsequent period may be lower than the notional amount shown at the bottom of the matrix. This would be driven by the extent of tax profits available for setting off the carry forward loss as well as the actual pattern of the availability of carry forward loss. To understand this point, consider alternate scenarios with respect to the amount of tax profit available in the financial year 2024 in the illustration. If such tax profits generated in FY2024 is 2000[7], this will get set off against the earliest carry forward loss that is available, i.e. against 3108 generated in FY2016. In effect, only a part of the available 3108 gets utilised for setting off against the tax profit of FY2024 and the balance amount of 1108 (3108 less 2000) lapses at the end of FY2024. Thus, the amount of carry forward loss available in the next period (FY2025) would be the same as the total shown at the bottom of the column P corresponding to FY2025, i.e. the notional carry forward loss available will be equal to 5810.

Now, consider an alternative scenario where the tax profit generated in FY2024 is 3500. In this case, the setting off in FY2024 will not only consume the entire amount of carry forward loss generated in FY2016 (3108) but also a part (392, i.e. 3500 less 3108) of the carry forward loss generated in FY2017 (2113). In this case, the effective amount of carry forward loss available for setting off in FY2025 will be less than 5810 shown as the notional carry forward loss available at the bottom of column P corresponding to FY2025. This is due to the fact that a part (392) of the carry forward loss of 2113 generated in FY2017 and reflected in its entirety in the notional available carry forward loss figure for FY2025 has already been used up for setting off against the tax profits of FY2024. The effective carry forward loss available for setting off against tax profits generated in FY2025 will thus be 5418 (5810 less 392) since 392 out of the carry forward loss generated in FY2017 has already been used up in setting off against the tax profit of FY2024 even through the entire amount of the carry forward loss generated in FY2017 (i.e. 2113) is reflected in the column total of 5810, which is the notional available carry forward loss for setting off against tax profits generated in FY2025.

Extending this logic forward, it is possible that though the notional available carry forward loss in a subsequent period is positive, the carry

[7] The monetary unit in the Financial Model from which the illustration is drawn is Rupees Million. However, there is no harm in ignoring this for the purpose for this illustration and the reader should just bear in mind that the numbers mentioned have associated monetary units.

forward loss that is effectively available for setting off against tax profit of that period is nil since setting off against tax profits in earlier periods has consumed all the carry forward loss. Thus, to deal in a proper manner with carry forward loss, the matrix of carry forward loss providing the notional available carry forward loss has to be supplemented with logic that covers the following aspects:

(a) For setting off against tax profit of any period, the effective available carry forward loss for that period should be considered rather than the notional available carry forward loss derived simply by summing the column of the carry forward loss matrix corresponding to that period. Subject to this, the carry forward loss set off against tax profit in any period will obviously be the minimum of the two amounts – i.e. the effective available carry forward loss and the tax profit generated during that period.

(b) If the carry forward loss set off in any period is equal to the effective available carry forward loss for that period, this means that the effective available carry forward loss in subsequent periods is nil unless fresh tax loss is generated during subsequent periods.

The type of logic required to cover the points above is shown in the illustration below. The first row shown (Row 91) is simply the sum of columns of the carry forward loss matrix shown in the earlier illustration (***Illustration 6.11***), with some of the columns corresponding to the initial FY's deleted for clarity. As discussed, this row represents the amount of carry forward loss that is notionally available without considering the set-offs in the past. The next relevant row (Row 93) shows the amount of tax profits available to utilise the carry forward loss – this simply replicates the value from a previous row on the "Tax" worksheet if that value is positive and returns zero if there is a tax loss in the given period. The rows 95, 97 and 99 contain flags that take on the values 0 or 1 using the IF function. The first of these in row 95 returns (1) in all periods after the period when tax profits first become available for setting off (FY ending March 31st 2021 in the illustration).

ILLUSTRATION 6.12

Format for Calculating Carry Forward Loss Set Off

	A	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Financial Year ending March 31st,	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
91	Total CF Loss (Notional) Available for setting off during the FY (₹ Mn)	1,708	4,816	6,929	8,311	9,108	9,402	9,402	10,166	8,918	5,810	3,697	2,316	1,519	1,224
92															
93	Profit Available for Setting Off CF Loss (₹ Mn)	0	0	0	0	0	150	0	0	1,296	1,660	2,039	2,423	2,793	1,271
94															
95	Flag for FY's after Profits for Setting Off CF Loss Available for the First Time (=1)	0	0	0	0	0	0	1	1	1	1	1	1	1	1
96															
97	Flag for Exhaustion of CF Loss in any given FY, i.e. CF Loss Set Off equals Effective CF Loss Available (=1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0
98															
99	Flag for All Periods After Complete Exhaustion of CF Loss (=1)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
100															
101	Effective CF Loss Available (₹ Mn)	1,708	4,816	6,929	8,311	9,108	9,402	9,252	10,016	8,918	5,810	3,697	1,658	0	0
102															
103	CF Loss Set Off (₹ Mn)	0	0	0	0	0	150	0	0	1,296	1,660	2,039	1,658	0	0

Effectively, the values of tax profit available for set off as shown in row 93 are summed up to the previous period (column) and once this sum exceeds zero indicating that tax profits have become available in the past, the flag in row 95 returns one (1). The values in row 95 are referred to by the formula in row 101 that returns the amount of carry forward loss notionally available. As long as the value in row 95 is zero (0), the carry forward loss effectively available is the same as the carry forward loss notionally available. Once the flag is row 95 shows one (1), the formula in row 1 calculates the carry forward loss effectively available as different from the figure of carry forward loss notionally available in row 91.

If there is no increase in the carry forward loss notionally available in any given period over the corresponding figure of the previous period (column), this means that no fresh carry forward loss has been generated in that period. In such cases, the formula in row 101 sets the carry forward loss effectively available as the minimum of the two values:

(a) The carry forward loss notionally available in row 93; and
(b) The carry forward loss effectively available in row 101 of the previous period (column) less the carry forward loss set off during the previous period (column) as shown in row 103

In some cases, fresh carry forward loss may be generated even after tax profit becomes available for set off for the first time. In the illustration, this happens in the FY ending March 31st 2022 as indicated by the increase in the amount of carry forward loss notionally available from ₹ 9,402 million in the FY ending March 31st 2022 to ₹ 10,166 million in the FY ending March 31st, 2023. In such cases, the formula in row 101 cannot be the same as that used when there is no fresh carry forward loss generated. For example, the carry forward loss effectively available in the FY ending March 31st 2023 in the illustration is not ₹ 9,252 million (the carry forward loss effectively available in the FY ending March 31st 2022) less zero (carry forward loss set off in the FY ending March 31st 2022, when fresh carry forward loss is generated and hence no set off is possible). In such cases, the formula is row 101 returns the value of the carry forward loss effectively available for setting off as the value of the carry forward loss notionally available (value in row 91) less the sum of the carry forward loss set off till the previous period, i.e. the sum of values in row 103 from the first period covered till the immediately preceding period. In the illustration, the carry forward loss effectively available in the FY ending March 31st 2023 is thus ₹ 10,166 million (value in cell N91) less ₹ 150 million, the value of carry forward loss set off against tax profit in the past as obtained by summing up values in row 103 up to column M.

Once the value of the carry forward loss effectively available is calculated in row 101, the carry forward loss in row 103 is simply the minimum of the two values, i.e. the amount of tax profit available for setting off carry forward loss (row 93) and the carry forward loss effectively available (row 101). This logic yields the check utilised by the flag in row 97. When the carry forward loss set off (row 103) is equal to the carry forward loss effectively available (row 101), this means that all the carry forward loss has been set off and no further setting off is possible. The flag is row 97 returns one (1) when the values in row 101 and row 103 are equal and zero (0) otherwise – in the illustration, this happens in the FY ending March 31st 2027. In this FY, though ₹ 2,423 million is available as tax profit for setting off carry forward loss, the carry forward loss effectively available is lower at ₹ 1,658 million. The carry forward loss set off in that FY is thus limited by the carry forward loss effectively available, i.e. ₹ 1,658 million. The flag is row 99 is simply set up to return a value of one (1) in all periods after that when the carry forward loss set off is equal to the carry forward loss effectively available. This is made possible by summing up the values of the flag in row 97 from the first period covered till the immediately preceding period – as long as this sum is zero (0), the flag in row 99 returns zero (0) and one (1) when the sum is not equal to zero (0). The formula for calculating the carry forward loss effectively available in row 101 thus first refers to the value of the flag in row 99 and returns zero (0) as the carry forward loss effectively available for setting off when the value of the flag in row 99 is one (1). Where the value of the flag is row 99 is zero, the formula in row 101 calculates the carry forward loss depending on whether fresh carry forward loss has been generated or not, as discussed earlier.

6.3.5 Minimum Alternate Tax (MAT)

Due to the difference in accounting/book income (profit) and tax income (profit) as per Income Tax Act, it was earlier possible for a company to declare book profits and pay out dividends without having to pay out any income tax. Indeed, a situation had arisen where many companies, especially those making heavy investments and thus having access to tax shields arising out of the depreciation on the assets created through such investment programmes, would report decent book profits but not be liable to pay income tax as the tax income was negative or nil due to the high levels of depreciation allowed as per the provisions of the Income Tax Act.

It is to deal with such situations that the concept of Minimum Alternate Tax (MAT) was introduced in the late nineties. Section 115JA was inserted in the Income Tax Act by the Finance Act, 1996 with effect from assessment year 1997-98 (i.e., for income tax on income generated in financial year 1996-97) and remained effective till assessment year 2000-01, i.e., covering a period of four financial years. This Section provided that where the tax income of a company as computed under provisions of the Income Tax Act was less that 30% of the book profit, the income of the company subject to income tax, i.e. the tax income would be deemed to be 30% of the book profits. Coupled with an average income tax rate of 30%-35% for corporate bodies, this meant that every company would have to pay a minimum of approximately 10% of its accounting or book profits as income tax, even if the income tax calculated in line with the Income Tax Act was lower than this amount. Where the tax income of a company as per its income tax accounts was greater than 30% of the book profits for the same period, the income tax payable would naturally be higher than that calculated under Section 115JA of the Income Tax Act, 1961.

Subsequently, Section 115JAA was inserted in the Income Tax Act to provide for a tax credit against MAT paid by a company as per the provisions of Section 115JA. The provisions in relation to MAT have been revised from time to time, starting with the insertion of Section 115JB in the Finance Act, 2000 that provided that in case the income tax payable by a company as per its income tax accounts was lower than 7.5% of the book profits, the company would liable to pay MAT at 7.5% of its book profits. MAT credit in respect of MAT under Section 115JB was subsequently allowed. Without going into the details of the changes in the MAT provisions in the intervening period, the current situation following the enactment of the Finance Act, 2011 may be noted. These are as follows:

- From the assessment year 2011-12 onwards, in case the income tax payable by a company as computed under the Income Tax Act is lower than 18% of the book profits, the company would be liable to pay MAT at 18% of the book profits. Effectively, this translates into a rate of 19.9305% at present, considering the surcharge of 7.5% and the education cess of 3% applicable to corporate income tax assesses.
- MAT credit would be allowed within ten financial years (assessment years as per the Income Tax Act) immediately following the financial/assessment year in which MAT is paid. The amount of MAT credit generated in any financial/assessment year is equal to the excess of MAT as paid over the "normal" income tax as calculated in line with the Income Tax Act, 1961. Thus, if a company is not liable to pay any income tax as per its income tax accounts, the entire amount of

MAT paid would be available as a tax credit for setting off within the specified period. In order to claim MAT credit during any financial/assessment year within the specified period of ten years, the company has to be liable in that financial/assessment year to pay income tax as per the normal provisions of the Income Tax Act, which amount is in excess of the MAT calculated for that financial/assessment year. Only in such a situation can the company avail a tax credit equivalent to the amount by which the income tax payable as per the normal provisions exceeds MAT. Thus, in such a financial/assessment year the company can claim tax credit to the extent that the income tax payable as per its income tax accounts exceeds MAT calculated for the financial/assessment year, provided of course that the amount of MAT credit available (carried forward) from earlier financial/assessment years is adequate. In such a situation, the company would thus end up paying income tax equivalent to MAT even though its tax liability based on taxable income is higher.

- For the purpose of accounting, MAT credit is not considered as a deferred tax asset. The reasoning behind this is simply that MAT does not arise on account of any timing difference as discussed earlier.
- MAT is payable even when there is an income tax holiday, such as that under Section 80IA of the Income Tax Act discussed in the next sub-section (6.3.6). Thus, even though benefit under Section 80IA is being availed in a given financial year, this does not mean that the income tax payable becomes nil in that financial year. This is primarily due to the fact that the wording of Section 115JB includes the non obstante clause "notwithstanding anything contained in any other provision of this Act" and to that extent the provisions relating to MAT in Section 115JB shall prevail over benefits and exemptions under other sections of the Income Tax Act.

In calculating MAT in the Financial Model, the following points should be kept in mind:

- The starting figure for book profit should be the projected Profit Before Tax (PBT). Though the wording of the relevant section of the Income Tax Act[8] provides that the calculation of book profit should commence with the figure of net profit (after tax) from the books of account, the effect of the procedure outlined is served if one starts with the figure of projected PBT. For instance, the procedure

[8] The wording in the proposed Direct Tax Code, 2010 is similar.

outlined calls for the amount of income tax paid or payable, including any provision for income tax and deferred tax to be added back to the net profit. Similarly, depreciation charged to the P&L Account is to be added and then subtracted.

- An adjustment that has to be made to the PBT figure is to add back any provision that has been made and charged to the P&L Account. Similarly, any transfer to a reserve has to be added back and any amount credited to the P&L Account from any reserve has to be subtracted. While such items are generally not projected in the Financial Model, an exception that can occur is the creation of a provision or reserve for periodic maintenance, which is a common practice in case of road projects. In such projects, there is usually significant expenditure required every six to eight years for relaying the road in order to maintain service quality at the level specified in the PPP Project Contract. To avoid the resultant hit on profits in the year when such periodic (or major) maintenance is undertaken, it is a common practice to create a "major maintenance reserve" (MMR) or provision for periodic maintenance and transfer from the revenues of each year during the relevant period of six to eight years an amount by way of a charge to the P&L Account of every year[9]. However, such transfers are generally not recognised as tax deductible expenses from the income tax perspective – rather, the expense on periodic maintenance is allowed to be charged in the tax accounts as and when the expense is actually incurred. Thus, both for determining the tax profit for calculation of Income Tax at normal rates as well as determining the amount of book profit for the purpose of MAT, the transfer to the major maintenance reserve (by whatever name this is called) has to be added back. Of course, in the period when the expense on periodic maintenance is actually incurred that amount has to be subtracted in order to arrive at the figure of tax profit as well as for book profit on which MAT is then calculated.

[9] In the year when the periodic maintenance is actually incurred, the amount is adjusted against the major maintenance reserve created over the periodic maintenance cycle, thus avoiding a hit on the reported profit for that year. In terms of cash flows, there is obviously no outflow corresponding to the transfers to the major maintenance reserve every year while there will be cash outflows in the periods when the expenditure is incurred, irrespective of the accounting treatment. Thus, even if the P&L Account in the Financial Model is projected on the basis of transfers to a major maintenance reserve and charges to that reserve when the expense is incurred, care should be taken to ensure that these are fully adjusted in the cash flows that are used to calculate IRRs or other cash flow based measures such as DSCR.

- Following the adjustment for provisions and reserves as discussed, there is a final adjustment to be made for carry forward loss. It is a common mistake in calculating MAT to omit this adjustment based on the understanding that the adjustment for carry forward loss is limited to the calculation of the tax profit for arriving at the "normal" income tax payable in the Financial Model. This is not the case as the provisions relating to MAT in the Income Tax Act as well as the proposed Direct Tax Code 2010 clearly provide for the adjustment of carry forward loss in order to arrive at the figure of book profit on which MAT is to be calculated. Thus, where the figure arrived at after adjusting the projected PBT for provisions and reserves is negative (i.e. there is a accounting/book loss) this amount should be added to the balance of carry forward loss. In subsequent periods, when the adjustment of projected PBT for provisions and reserves yield a positive figure, the available balance of carry forward loss should be adjusted till the carry forward loss is fully exhausted. Only then should one project MAT as being payable. The illustration below shows the typical adjustments required to arrive at the book profit for calculation of MAT in the Financial Model for a highway project.

ILLUSTRATION 6.13

Adjustment to Projected PBT for Calculation of MAT

Book Profit for MAT Calculation (₹ Mn)								
Financial Year ending March 31st,	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Profit Before Tax (from Row 29, P&L Sheet)	- 248	-803	- 887	- 674	- 478	- 267	- 41	203
Add: Provision for Periodic Maintenance (from P&L Sheet)	0	0	388	388	388	388	388	388
Subtract: Expense on Periodic Maintenance (from Opex Sheet)	0	0	0	0	0	0	0	1,322
Book Profit Before Carry Forward Loss	- 248	- 803	- 499	- 286	- 90	121	346	- 732
Carry Forward Loss Set Off	0	0	0	0	0	121	346	0
Book Profit for MAT Calculation (used on Tax Sheet)	- 248	- 803	- 499	- 286	- 90	0	0	- 732
Carry Forward Loss								
Opening Balance	0	248	1,052	1,551	1,837	1,927	1,806	1,460
Addition	248	803	499	286	90	0	0	732
Carry Forward Loss Set Off	0	0	0	0	0	121	346	0
Closing Balance	248	1,052	1,551	1,837	1,927	1,806	1,460	2,192

Once the figure of MAT is calculated, a matrix for MAT credit generated in any period and available during subsequent periods for setting off is constructed in the same manner as discussed in the case of carry forward loss. The effective amount of MAT credit available for setting off and MAT credit availed is also calculated in exactly the same manner as discussed for carry forward loss. In case of carry forward loss, setting off is possible whenever tax profit is positive and carry forward loss effectively available. In case of MAT credit, the utilisation of MAT credit is possible only when the tax payable at normal income tax rates (after adjustment of carry forward losses and Section 80IA benefits if available to arrive at the figure of tax profit to which the normal income tax rate is applied) exceeds MAT on accounting/book profit, provided of course that MAT credit is effectively available. Also the MAT credit cannot be set off to the full extent of the tax payable at normal income tax rates but only to the extent that such tax payable at normal income tax rates exceeds MAT.

6.3.6 Income Tax Holiday for Infrastructure Projects

In order to encourage private sector investment in infrastructure projects taken up in the PPP/Project Finance Context in India, Section 80IA was added to the Income Tax Act. This section provides income tax benefits to entities engaged in the business of (a) developing, or (b) operating and maintaining, or (c) developing, operating and maintaining any infrastructure facility commissioned on or after 1st April, 1995. An essential condition for availing this benefit is that the entity should have "entered into an agreement with the Central Government or a State Government or a local authority or any other statutory body for (i) developing or (ii) operating and maintaining or (iii) developing, operating and maintaining a new infrastructure facility;" – this in fact reflects the fundamental definition of the PPP/Project Finance Context covered in Chapter 1.

The tax benefits under Section 80IA essentially allows the entire tax income of the entity operating the infrastructure facility to be deducted for ten consecutive financial/assessment years during the first fifteen or twenty[10] financial/assessment years after commencement of operations. Effectively, the entity would have nil tax income during these ten financial/assessment

[10] The extended period of twenty financial/assessment years during which the Section 80IA benefits can be availed is available only for projects in roads/highways, ports, airports, inland waterways, water supply and sewerage including water treatment and irrigation. For other infrastructure projects in power, telecommunication, industrial parks and Special Economic Zones, the period during which the benefit can be claimed is fifteen years.

years. The infrastructure sectors covered by Section 80IA include roads/highways (along with housing or other activities clubbed together with the road/highway as an "integral part" of the project), ports, airports, inland waterways, rail systems, water supply and sewerage, irrigation, solid waste management, industrial parks, Special Economic Zones, power generation, transmission and distribution as well as telecommunication services. However, the availability of the benefit in case of sectors like power, telecommunication, industrial parks and Special Economic Zones have been progressively limited to projects set up before cut-off dates incorporated in the Income Tax Act in successive budgets and for all practical purposes the benefit of Section 80IA is not available for new projects in these sectors. Even for other infrastructure sectors that continue to be eligible for the benefits, it is always advisable to check the latest amended version of the Income Tax Act before incorporating such benefits into the financial model.

In case of projects where Section 80IA benefits have to be incorporated into the Financial Model there exist some related issues that have to be addressed. The first issue is the choice of the ten successive financial/assessment years during which the benefits are to be availed. This obviously has to be built into the Financial Model in order to project the income tax pay-outs over the Project Time-Line. In general, the tax profits of the SPV rise over time – this is because the higher amounts of (income tax) depreciation and interest payments tend to reduce tax profits or lead to tax losses that in turn can be carried forward during the initial years of operation. Thus, it may seem obvious that where the Section 80IA benefits have to be availed within fifteen financial/assessment years after the commencement of operations, the benefit should be availed of during years 6 to 15, with year 1 being the first year of operations. Similarly, years 11 through 20 may appear to be the obvious choice in case the twenty year window of opportunity is available. However, this may not always be the case. To understand why, it is necessary to recall the concept of time value of money as reflected in the present value of any future cash flow, discussed earlier in Chapter 3.

In choosing the period of ten consecutive financial/assessment years during which the benefit under Section 80IA is to be availed, the rational objective has to be maximising the present value of the income tax savings. The present value of income tax savings obtained from Section 80IA benefits is driven by:

(a) The value of income tax that would have to be paid in a given period without the Section 80IA benefit; and
(b) How far out into the future the relevant period occurs;

Though the amount of income tax payable without the Section 80IA benefit (and hence the amount of income tax saved by availing of Section 80IA benefit) will typically increase from one period to another the further into the future one goes, there is a trade-off involved as the present value of this saving will tend to decrease the more in the future one avails the benefit as the discount factors keep increasing the further into the future the relevant cash flow occurs. This is shown in the illustration below.

ILLUSTRATION 6.14

Present Value of S80IA Income Tax Savings Availed During Different 10-Year Periods

Year	Income Tax Payable Without S80IA (₹ Mn)	Discount Factors @		Years When S80IA Benefits Availed	PV of Income Tax Savings with Discount Rate = 10%
		10%	15%		
1	0.0	1.0000	1.0000	5 to 14	₹ 181.0
2	0.0	0.9091	0.8696	6 to 15	₹ 199.4
3	0.0	0.8264	0.7561	7 to 16	₹ 215.8
4	0.0	0.7513	0.6575	8 to 17	₹ 229.7
5	12.0	0.6830	0.5718	9 to 18	₹ 228.0
6	14.4	0.6209	0.4972	**10 to 19**	₹ **236.6**
7	17.3	0.5645	0.4323	11 to 20	₹ 234.1
8	36.0	0.5132	0.3759		
9	24.0	0.4665	0.3269	**Years When S80IA Benefits Availed**	**PV of Income Tax Savings with Discount Rate = 15%**
10	48.6	0.4241	0.2843		
11	58.3	0.3855	0.2472		
12	72.9	0.3505	0.2149	5 to 14	₹ 118.8
13	87.5	0.3186	0.1869	6 to 15	₹ 126.2
14	96.2	0.2897	0.1625	7 to 16	₹ 132.1
15	101.0	0.2633	0.1413	**8 to 17**	₹ **136.2**
16	106.1	0.2394	0.1229	9 to 18	₹ 130.5
17	108.7	0.2176	0.1069	10 to 19	₹ 131.6
18	84.6	0.1978	0.0929	11 to 20	₹ 125.5
19	109.8	0.1799	0.0808		
20	110.9	0.1635	0.0703		

The income tax payable without the Section 80IA benefits in the illustration shows an increasing trend year on year after being nil during the first four years of operations. The trend of year on year increase in the income tax liability is broken in the years 9 and 18, which may be attributed to expense on major maintenance that has to be incurred periodically. The periodicity in this case is nine years – i.e. major maintenance follows a nine year cycle. As such, though hypothetical, the pattern of income tax payable shown in the illustration is fairly typical of many projects in the PPP/Project Finance Context. Further, it is assumed that the Section 80IA benefits may be availed during any block of ten consecutive years within twenty years from the start of operations.

Barring years 1 to 4 when no income tax is payable, the ten year period for availing the Section 80IA benefits can then be chosen as any of the available options starting from Year 5, i.e. Year 5 to Year 14, Year 6 to Year 15 and so on till the period from Year 11 to Year 20, which is the most into the future that the tax holiday can be availed. As mentioned, this choice of the ten year period for the tax holiday should be made so as to maximise the present value of the income tax savings. The illustration shows this present value of income tax savings calculated for various ten year periods, using two alternative discount rates of 10% and 15% and assuming that the "present" corresponds to Year 1 of operations[11]. The trade-off between higher income tax payable (and therefore, savings) in the later years and the lowering of present value due to increasing discount factors is clearly demonstrated – despite that fact that the income tax payable in the illustration has a trend of year on year increase barring breaks in the trend in Year 9 and Year 18, the present value of income tax savings is not maximised by choosing the tax holiday period as Year 11 to Year 20, which is the maximum that the tax holiday period can be pushed into the future. This is despite the fact that the simple summing up of the income tax payable for the various periods (without discounting) shows that the maximum amount of income tax payable corresponds to the period Year 11 to Year 20[12]. Instead, we find that with a discount rate of 10%, the present value of income tax savings due to section 80IA is maximised when the tax holiday is availed from Year 10 to

[11] In a Financial Model the "present" is normally taken as corresponding to that period when the first project related cash flows occur. For a project involving construction of the project asset, this would normally be that period when construction starts. This aspect is ignored in the illustration to avoid confusion in explaining the concept – readers should simply bear in mind that is applying the concept in a Financial Model for selecting the optimum ten-year period of tax holiday under section 80IA, the appropriate "present" would correspond to the period when construction starts.

[12] Though not shown in the illustration, the total income tax payable during the period Year 11 to Year 20 is ₹ 936.2 million, which is higher than the corresponding amount for any other period – this amount is ₹ 873.9 million for the period Year 10 to Year 19, ₹ 788.0 million for Year 9 to Year 18, etc.

Year 19. With a discount rate of 15%, this happens when the tax holiday is availed from Year 8 to Year 17. Thus, we see that it is not necessary that Section 80IA benefits should be availed as late as possible. Moreover, the choice of the tax holiday period depends not only on the pattern of income tax payable before availing of Section 80IA benefits, but also on the discount rate used to calculate the present value. In the illustration, a higher discount rate of 15% shifts the optimum tax holiday period closer to the present. This is of course expected given that a higher discount rate increases the impact of discounting future values to present value.

The illustration thus suggests that the choice of the tax holiday period in a Financial Model should be based on a similar logic. The only question that remains to be addressed in this regard is the appropriate discount rate to be used for discounting the projected income tax payable before availing of Section 80IA benefits to present value terms. As we have already seen in the illustration discussed above, the choice of the discount rate can affect the choice of the tax holiday period to be selected. There are two different points of view in this regard. There exists one school of thought that argues that since payment of income tax as well as debt servicing are obligatory in nature, any saving in cash outflows on account of tax such as those provided by Section 80IA essentially accrue to the equity investors. This is in line with the fact that equity cash flows are essentially residual in nature as discussed earlier. Thus, the lower outflow on account of income tax translates directly into higher cash inflows for equity investors and improves the return earned on equity. Accordingly, it is argued that the choice of the period for availing the Section 80IA benefits should use the cost of equity as the discount rate. This will obviously be higher than the WACC or cost of debt for the project and tend to move the optimum period during which the tax benefits should be claimed closer to the present.

A slightly different perspective is offered by the other school of thought that focuses on the question of what would happen if the tax savings accruing due to Section 80IA were not available. This approach thus looks at the opportunity cost of these tax benefits. To the extent that the cash inflows (net of the higher tax outflow) from the project fell short of the amount required to meet operating expenses and debt servicing in the absence of the income tax benefits, the deficit would have to be funded. The relevant question, according to this school of thought, is whether such deficit would be funded wholly by equity infusion? Keeping in mind that we are considering a period in the future when the project has been operating for a few years, it may be said that the SPV would have an established track record and would have in all probability paid off some of the initial debt. Thus, it is difficult to state with certainty that funding of any deficit solely through equity infusion would be the case – it is probable that the SPV could raise some additional debt to meet the deficit or at least fund the deficits resulting from the absence of the Section 80IA benefits through a mix of equity infusion and additional debt. Thus, the opportunity cost of the tax benefits available under Section 80IA would be more in line with the weighted average cost of capital for the project. Accordingly, it is argued that the appropriate discount rate used to determine the optimum period for availing of the Section 80IA benefits should be weighted average cost of capital (WACC) for the project.

While both arguments possess some logic, it is the author's experience that the choice of the period for availing of the section 80IA benefits in case of Financial Models for most real-life projects is not affected whether the cost of equity or WACC is used as the discount rate. However, the argument in favour of using WACC gets somewhat vitiated for two reasons. Firstly, as noted earlier, the WACC in case of a project in the PPP/Project Finance Context in any case varies over the Project Time-Line. It is thus difficult to select a single value of WACC for use as the discount rate. Secondly, in case of projects involving financing of a part of the capital expenditure through a Government grant, the lower WACC due to such zero cost financing no doubt improves viability of the project but it cannot be claimed that this value of WACC can be taken as a good proxy for the cost of capital when it comes to funding of cash deficits during the period of operation. Accordingly, it is best that a discount rate close to the cost of equity or at least an average of the cost of equity and debt for the project be used as a discount rate for determining the optimum period for availing of the Section 80IA benefits. The illustration below shows the set-up used in a Financial Model for choice of the optimum period for availing Section 80IA benefits based on maximising the present value of the tax savings with a discount rate of 18% representing the cost of equity. It should be noted that some columns (periods) have been deleted in the illustration for clarity.

The tax payable before availing of Section 80IA benefit in row 39 is linked to a row on the "Tax" worksheet where the overall calculation of income tax (covered in Section 6.3.8) is carried out. The discount factors in row 40 are based on the discount rate entered in cell A41 (18% in this case). Row 42 simply converts the tax payable amount shown in row 38 to present value terms by multiplying that amount with the discount factor in row 40. The formula in row 44 calculates the present value of tax payable over a period of ten financial years starting from the period indicated in the column, returning zero (0) for all financial years that lie before the start of commercial operations (FY ending March 31st 2015 in the illustration) or beyond ten financial years counted from the start of commercial operations, taking into account the effective limit for availing of the section 80IA benefits.

ILLUSTRATION 6.15

Calculation of Optimum Period for Availing Section 80IA Benefit

	A	D	E	J	K	L	M	N	O	P	Q	R	Y	Z	AA
36	Calculation of Optimum Period for Availing of S80IA Benefit														
37	Financial Year ending March 31st,	2013	2014	2019	2020	2021	2022	2023	2024	2025	2026	2027	2034	2035	2036
38															
39	Tax Payable without S80IA benefit (From Row 18)	0	0	0	0	0	0	0	0	0	0	254	1,840	2,052	1,383
40	Discount Factors at discount rate of	1.000	0.847	0.370	0.314	0.266	0.225	0.191	0.162	0.137	0.116	0.099	0.031	0.026	0.022
41	18.0%														
42	PV of Tax Payable without S80IA benefit	0	0	0	0	0	0	0	0	0	0	25	57	54	31
43															
44	Total PV of Tax Payable without S80IA benefits with S80IA benefits started from the FY	0	0	103	132	164	231	295	355	412	0	0	0	0	0
45		2013	2014	2019	2020	2021	2022	2023	2024	2025	2026	2027	2034	2035	2036
46	Maximum Present Value of Tax Payable Obtained	412													
47															
48	First FY when S 80IA benefits availed	2025													
49															
50	S80IA benefit indicator (1=availed, 0=not availed)	0	0	0	0	0	0	0	0	1	1	1	1	0	0

The present value of tax payable shown in row 44 thus effectively indicates the total present value of tax savings under Section 80IA if the benefits are claimed starting in the relevant financial year corresponding to that column (values in row 37). Our objective is to select the financial year from which to claim the Section 80IA benefits so as to maximise the present value of tax savings over the period of ten consecutive financial years allowed under section 80IA. This is achieved simply by calculating the maximum present value out of the values in row 44, using the MAX function in cell D46. The relevant financial year corresponding to the maximum present value of the tax savings is then obtained in cell D48 using the HLOOKUP function. The replication of the financial year indicators of row 37 in row 45 is incorporated to allow the HLOOKUP function to be applied over the range D44:AK45, referenced to cell D46 as the value to be looked up in that range of cells and two (2) as the row reference[13].

6.3.7 Ownership and Nature of Project Assets

Another issue relating to the calculation of income tax for projects in the PPP/Project Finance Context has to do with the nature of the assets created by the SPV through investment in a PPP project. While these assets are generally in the nature of fixed assets, a relevant question that has been raised is whether the SPV can be considered to be the owner of these assets? In responding to this question, the following points are considered important:

- In most PPP projects of the concession type, the SPV is required to hand over the assets to the Government/public grantor of the concession at the end of the concession period specified in the PPP Project Contract. Such transfer generally does not involve any payment by the grantor.
- In most cases, the project assets are created on land owned by the Government/public sector grantor. Since the ownership of the land is generally not transferred to the SPV, it is doubtful whether the SPV can claim title to the assets created on such land.
- The rights of the SPV over the project assets are limited by the PPP Project Contract. In particular, the SPV generally does not have any right to control the access of the public to the services delivered using the project assets. By and large, these services are in the nature of public services that must be made available to any member of

[13] Readers unsure about the HLOOKUP function may refer to the appendix on commonly used Excel functions at the end of this book.

the public willing to pay the user charges. This public nature of the service is also reflected in the fact that user charges or tariffs remain subject to control, either directly by the grantor of the concession or an independent statutory regulator. In some instances, the revision of user charges is subject to provisions of the PPP Project Contract, which may in turn draw upon legislation enacted in this regard. The basic point is that the SPV does not have the right to control access to the services provided by the project assets; nor does the SPV have the power to set user charges or tariffs freely and use that power to control such access of members of the public. Under these circumstances, it is difficult to conclude that the SPV owns the project assets.

Based on the above considerations, the Exposure Draft of a "Guidance Note on Accounting for Service Concession Arrangements" issued by The Institute of Chartered Accountants of India (ICAI) in 2008 recommended that the project assets should not be considered as property of the SPV and to that extent depreciation on these assets should not be reflected in the SPV's accounts. This then raises a question about how the SPV is to provide for the recovery of its investment in creating the project assets. As we have seen, depreciation is allowed as a tax deductible expense while determining the tax profits of a company. In fact, we have also noted that in the initial years of operation, the higher amounts of income tax depreciation as compared to the depreciation charged to arrive at the accounting profit is one of the major causes of timing difference, in turn giving rise to deferred tax liability during the initial years of operation.

To address this issue, the Guidance Note issued by the ICAI recommended that:

(a) Where the operator (SPV) receives a right to recover cash or any other financial asset from the grantor in lieu of constructing, operating and maintaining the project assets as per the provisions of the PPP Project Contract and this right is legally enforceable and unconditional in the sense that the grantor has no discretion in making the payments as long as the project assets are created, operated and maintained in line with the provisions of the PPP Project Contract, the operator (SPV) should recognise on its books of account a financial asset. A common PPP Project Structure to which this would apply is the annuity based arrangement whereby the private entity invests in creating the project asset and maintains it over a specified period of time during which it receives periodic (generally, annual or semi-annual) and pre-determined payments from the Government or public sector grantor.

(b) Where the SPV receives a right to charge members of the public for use of the project assets for a specific period of time, the Guidance Note recommended that it recognise an intangible asset in its books of account. The basic distinction made between the two types of assets is that in case of unconditional, pre-determined payments due from the grantor and recognised as a financial asset, such payments are not linked to usage of the project assets and the private operator does not bear any market or demand risk. In case of a right to collect user charges to be recognised as an intangible asset, the operator bears market or demand risk since revenues from user charges obviously depend on the level of usage and is to that extent not unconditional. Where the arrangement involves a mix of the two, for example, where the SPV receives the right to collect and appropriate user charges (recognising an intangible asset) but the grantor is obliged to make good any shortfall in the revenues from user charges as compared to a specified amount (or level of return), the SPV may recognise and account for each component of the consideration to be received separately, valuing each asset initially at fair value.

(c) For both financial assets and intangible assets, the Guidance Note referred to existing Accounting Standards – AS-30 on "Financial Instruments: Recognition and Measurement" and AS-26 on "Intangible Assets".

However, the situation as it stands currently is not wholly clear because the exposure draft of the ICAI Guidance Note has subsequently not been issued formally though there are instances of companies adopting the recommendations of the Guidance Note. Insofar that the treatment of the SPV's investment as an intangible asset is concerned, there is no significant difference as far as the Financial Model is concerned. Instead of depreciation, an equivalent non-cash expense in the form of amortisation gets charged to the profit and loss accounts in every period of the concession. The ICAI Guidance Note provides that the interest on funds borrowed to fund the creation of the project assets can be capitalised as part of the intangible asset representing the SPV's right to collect and appropriate user charges at the beginning of the operations period. This is the same as the treatment of IDC discussed earlier.

The only significant difference that arises is the difference in the rates applied for amortisation of the intangible asset as compared to the depreciation rates for fixed assets, both as per the Companies Act (for accounting profits) and the Income Tax Act (for tax profits). As per the Companies Act, the intangible asset of value equal to the expenditure incurred on creating the asset (including interest payment during construction) is written off (amortised) equally over the life of the intangible asset using the Straight Line Method. For all effective purpose, the life of the intangible asset should be considered as equal to the period when the SPV operates the project assets before handing the asset back to the grantor at the end of the period specified in the PPP Project Contract. Thus, if the concession period is twenty seven years including two years allowed for construction, the intangible asset would be amortised or written off at 4% of the initial value every year (100% spread equally over 25 years of operation). This is in contrast to the depreciation rate, which is determined by the category of fixed assets and may involve different rates for different categories comprising the project assets. For example, different rates would be applied to the category "buildings and civil structures" and the category "plant and machinery" if both categories form part of the project assets. In contrast, the rate allowed under the Income Tax Act for amortisation of intangible assets is currently 25% using the Written Down Value (WDV) method. Recognising the investment in the project as an intangible asset thus leads to higher tax deductible expenses in the form of amortisation, at least during the initial years of operation. As discussed earlier, this would in turn lead to timing difference and deferred tax liability getting recognised during such years. In effect, the cash outflow on account of income tax would be lower in the initial years if an intangible asset is recognised and amortised as compared to treating the project assets as fixed assets and applying depreciation rates applicable to the relevant categories of fixed assets under the Income Tax Act. Of course, the actual benefit in terms of a lower cash outflow on account of income tax in present value terms over the duration of the PPP Project Contract will also be driven by the project's ability to generate adequate tax profits for setting off the higher carry forward loss generated due to amortisation of higher amounts in the initial years (as compared to depreciation) before these lapse, as well as the impact of the tax holiday under Section 80IA of the Income Tax Act.

6.3.8 Format for Calculation of Income Tax

Based on the discussion in the preceding sub-sections, it should be clear that the calculation and projection of income tax in the Financial Model involves several aspects that have to be addressed. As such, given that all of these were not in force at the time the Sample Financial Model was developed, a soft copy of the "Tax" worksheet for a more recent project is provided in the CD for the reader's reference. This will help readers to study in greater detail the logic and formulae used in a typical "Tax" worksheet, including most of the illustrations used in the preceding sub-sections. However, to

ILLUSTRATION 6.16

Format for Income Tax Calculation

	Financial Year ending March 31st,	2014	2015	2016	2017	2018	2024	2025	2026	2027	2028	2033	2034	2035	2036	2037
7	PBDT (From "P&L")	0	-128	-344	-428	-214	1,017	1,311	1,639	1,984	2,325	4,202	4,757	5,391	6,094	6,894
8	Add: Provision for Periodic Maintenance Expense (Not Tax Deductible) (From "P&L")	0	0	0	388	388	556	556	556	556	556	797	797	797	797	797
9	Less: Periodic Maintenance Expense Incurred (Tax Deductible) (From "Opex")	0	0	0	0	0	0	0	0	0	0	0	0	0	2,718	2,862
10	Less: Income Tax Depreciation (From "Dep")	0	1,580	2,764	2,073	1,555	277	208	156	117	88	21	16	12	9	7
12	PBT for Income Tax Before Setting Off Carry Forward Loss (= Row 7+Row 8-Row 9-Row 10)	0	-1,708	-3,108	-2,113	-1,381	1,296	1,660	2,039	2,423	2,793	4,979	5,538	6,176	4,164	4,822
14	Carry Forward Loss Set Off (From Row 103) – Refer Illustrations 59 and 60	0	0	0	0	0	1,296	1,660	2,039	1,658	0	0	0	0	0	0
16	Taxable Income as per IT Act after Setting Off Carry Forward Tax Loss	0	-1,708	-3,108	-2,113	-1,381	0	0	0	765	2,793	4,979	5,538	6,176	4,164	4,822
18	Tax Payable Without S80IA	0	0	0	0	0	0	0	0	254	928	1,654	1,840	2,052	1,383	1,602
20	S80IA Exemption Availed - Deduction from Taxable Income in Row 16 Refer Illustrations 62 and 63	0	0	0	0	0	0	0	0	765	2,793	4,979	5,538	0	0	0
22	Taxable Income After S80IA Benefit	0	-1,708	-3,108	-2,113	-1,381	0	0	0	0	0	0	0	6,176	4,164	4,822
24	Tax Payable After S80IA Benefit	0	0	0	0	0	0	0	0	0	0	0	0	2,052	1,383	1,602
26	MAT Payable on Accounting Profit Refer Illustration 61	0	0	0	0	0	0	0	302	415	483	905	1,015	1,142	740	871
28	Income Tax Payable (Before MAT Credit)	0	0	0	0	0	0	0	302	415	483	905	1,015	2,052	1,383	1,602
30	MAT Credit Generated for the Period	0	0	0	0	0	0	0	302	415	483	905	1,015	0	0	0
32	MAT Credit Utilised (from Row 156) Similar to Carry Forward Loss	0	0	0	0	0	0	0	0	0	0	0	0	910	643	731
34	Income Tax Paid After MAT Credit	0	0	0	0	0	0	0	302	415	483	905	1,015	1,142	740	871

cover in the main text the broad modalities of income tax calculation and establish a suitable format for the same, the illustration below is extracted from the sample "Tax" worksheet It may be noted that some periods (columns) have been removed in the illustration for the sake of clarity and coverage.

6.4 DEBT STRUCTURING AND RE-FINANCING

Many transactions in the PPP/Project Finance Context involve long gestation periods where the construction/commissioning of projects and the build-up of revenues take several years. In such situations, the cash inflows of the project SPV in the first few years of operation are often inadequate (or just adequate) to meet debt servicing requirements, especially with plain vanilla debt structures involving equal repayment of the principal amount in each period starting from the first period after commencement of operations, while interest is payable at a uniform rate. In such cases, structuring the debt may become a significant tool for ensuring a better match between the projected cash inflows of the SPV and debt servicing, especially in the initial years. Essentially, such debt structuring involves any one or more of the following:

- Moratorium on repayment of principal
- Differential interest rates across periods
- Varying repayment of principal, with repayments in initial years kept low (so called 'baloon repayment')

A specific possibility in the PPP/Project Finance Context[14] is re-financing of the debt component of the project financing by the SPV once the project has been implemented and starts generating revenues. The risks are obviously lower at this stage as compared to the stage of financial closure when the debt component of the project financing was contracted. It is essential to appreciate the nature of this type of transaction, understanding clearly that value cannot be created by financing and therefore, re-financing. Rather, the project's intrinsic value remains constant before and after re-financing of debt, ceteris paribus. It is only that the relative shares of that constant project value accruing to shareholders vis-a-vis lenders change, thereby making shareholders better off.

To understand the above fully, it is necessary to appreciate that what is relevant is the present value of the cash flows accruing to shareholders vis-

[14] Though it may also be said with some justification that the potential for debt re-financing exists for every Project where risks decline over time. As a matter of fact, debt refinancing/ restructuring is also possible and indeed often resorted to even at the level of the corporate entity.

a-vis lenders. At the same time, the present value of the cash flows accruing to the lenders to the project in the future, i.e., the balance repayment of principal and interest, when discounted at the effective cost of the debt is always equal to the unpaid principal amount of the debt. This should be clear from the discussions in Chapter 3 but given the critical nature of this aspect, we can take a re-look from scratch. Indeed, even those who fully appreciate that by definition the effective cost of the debt is the discount rate using which the present value of future cash flows accruing to the lenders is equal to the outstanding principal (i.e., NPV is zero) may be left wondering about the rationale for debt re-financing. After all, such transactions only involve the replacement of the existing debt from Lender A with a fresh loan of the same amount with different terms from Lender B. All said and done, the present value of both loans when discounted at the respective effective costs will remain equal to the outstanding principal. How then is any value getting transferred to shareholders?

This apparent dilemma arises only when we do not consider the fact that the relevant discount rate is not the effective cost(s) of the debt and what matters is not the absolute cash flows associated with debt but the difference between the two sets of cash flows, i.e., those associated with the debt from the original lender A and the new loan from lender B. To appreciate this, consider a simplified example where the SPV at the time of re-financing (Year 0 in the illustration below) has outstanding debt of ₹ 490 million from Lender A. The balance tenure (repayment period) of the existing debt is 7 years and it carries an effective cost (interest rate) of 14% p.a. The debt service schedule is thus as shown in the illustration below.

ILLUSTRATION 6.17

Debt Service Schedule - Existing Debt from Lender A (₹ Mn)

	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr10
Opening Balance	490.0	490.0	420.0	350.0	280.0	210.0	140.0	70.0	0.0	0.0	0.0
Loan Taken	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repayment	0.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	0.0	0.0	0.0
Closing Balance	490.0	420.0	350.0	280.0	210.0	140.0	70.0	0.0	0.0	0.0	0.0
Interest Payment	0.0	68.6	58.8	49.0	39.2	29.4	19.6	9.8	0.0	0.0	0.0
Total Cash Outflow for Debt Servicing	0.0	138.6	128.8	119.0	109.2	99.4	89.6	79.8	0.0	0.0	0.0
PV of Total Cash Outflows for Debt Servicing - Existing Debt (discount rate=interest rate)	490.0										

Now, let us assume that the Chief Financial Officer (CFO) of the SPV gets a proposal from Lender B to re-finance this debt with cheaper debt at a cost of 11% and repayable over ten years. The debt service schedule for this new debt would be as shown in the ***Illustration 6.18*** below.

ILLUSTRATION 6.18

Debt Service Schedule for New Debt from Lender B (₹ Mn)

Description	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Opening Balance	0.0	490.0	441.0	392.0	343.0	294.0	245.0	196.0	147.0	98.0	49.0
Loan Taken	490.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Repayment	0.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0
Closing Balance	490.0	441.0	392.0	343.0	294.0	245.0	196.0	147.0	98.0	49.0	0.0
Interest Payment	0.0	53.9	48.5	43.1	37.7	32.3	27.0	21.6	16.2	10.8	5.4
Total Cash Outflow for Debt Servicing of New Debt	0.0	102.9	97.5	92.1	86.7	81.3	76.0	70.6	65.2	59.8	54.4
PV of Total Cash Outflows for Debt Servicing - New Debt (discount rate=interest rate)	490.0										

It is interesting to note that the PV of the cash flows for debt servicing for the existing as well as new debt works out to ₹ 490 million, when discounted at the respective interest rates of 14% p.a. and 11% p.a. Does this imply that there is no benefit to be gained from debt re-financing? To appreciate the benefits, it is necessary to look at the cash flows from the shareholder's (i.e., sponsor/promoter's) point of view. Remember that the cash flows accruing to the shareholders are residual in nature. Assuming that the cash flows from operation of the SPV's project assets remain same, as required by the ceteris paribus condition, what is relevant to the shareholders is the difference in cash flows associated with the existing debt and new debt over the relevant period (ten years in the illustrations above). If the cash outflow associated with the new debt is lower than that associated with the existing debt in any period, the shareholders receive more cash in that period. Similarly, in periods where the cash flow associated with the new debt is higher than that associated with the existing debt, the shareholders receive less cash. Thus, we should look at the difference in cash flows between the existing debt and new debt. Since these cash flows are spread over a number of periods (ten years in the illustrations), these have to be discounted to Present Value. What is the appropriate discount rate? Obviously, it is the cost of equity or expected return of the shareholders (i.e., equity investors). To make the example more realistic, we should take into account that pre-payment of the existing debt will generally involve a pre-payment penalty. Let us assume that this is 1% of the outstanding debt, i.e., ₹ 4.9 million. The differential cash flows are shown in ***Illustration 6.19*** below.

ILLUSTRATION 6.19

Differential Cash Flows for Debt Servicing and Pre-Payment Penalty (₹ Mn)

Description	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Cash Outflow for Debt Servicing - Existing Debt	0.0	138.6	128.8	119.0	109.2	99.4	89.6	79.8	0.0	0.0	0.0
Cash Outflow for Debt Servicing - New Debt	0.0	102.9	97.5	92.1	86.7	81.3	76.0	70.6	65.2	59.8	54.4
Difference in Cash Outflows for Debt Servicing	0.0	35.7	31.3	26.9	22.5	18.1	13.7	9.2	-65.2	-59.8	-54.4
Cash Outflows on Account of Pre-payment Penalty	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Difference in Cash Outflows (New Debt vis-à-vis Existing Debt)	-4.9	35.7	31.3	26.9	22.5	18.1	13.7	9.2	-65.2	-59.8	-54.4

As expected, the re-financing of the existing debt with cheaper debt of longer tenure means that apart from the outflow of account of the pre-payment penalty, the shareholders of the SPV have net inflows in initial years as the debt servicing of the new debt is lower, translating into higher residual cash flows for these shareholders. In later years, the situation is reversed because of the longer tenure of the new debt. The question naturally is what quantum of benefit accrues to the shareholders on account of the differences in cash flows because of refinancing. Drawing on the concept of Time Value of Money, we obviously have to look at the PV of the relevant cash flows, i.e., the differential cash flows shown in the last row of the illustration above. The illustration below shows the PV of the cash flows for a range of discount rates. It may be noted that if the expected return on equity is 16%, the transfer of value or benefit accruing to the shareholders from the debt re-financing is close to 10% of the outstanding debt, which is significant.

ILLUSTRATION 6.20

Value of Debt Re-financing to the SPV's Shareholders for a Range of Discount Rates (₹ Mn)

Discount Rate	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
Benefit from Debt Re-financing, i.e. PV of difference in cash outflows	28.8	32.6	35.9	38.8	41.3	43.5	45.3	46.9	48.3	49.5	50.4	51.2	51.9

It should be noted that similar benefits arising from differential cash flows associated with debt servicing of the re-financed loan as compared to the original loan exist even if there is no extension of the repayment tenure. This is important because extending the tenure of existing loans through re-financing is difficult in the Indian context because such extension is generally treated as restructuring of the loan and requires the lender to lower the credit quality of the asset (loan) and make consequently make higher provisions against losses. Thus, re-financing opportunities will typically provide loans at a lower interest rate compared to existing debt rather than with extended repayment tenure. Such lowering of interest cost is especially relevant where the original loan was obtained at the construction stage and the SPV has subsequently implemented the project and established a track record of operations for a few years. The lower risk associated with the project will then typically allow loan re-financing to be obtained at lower interest rate as compared to the existing loan contracted at the construction stage when the risks associated with the project were higher.

With reference to the previous example, we can consider a scenario where the existing loan with residual tenure of repayment of 7 years carrying an interest cost of 14% is replaced with re-financing carrying a lower interest cost of 11% and repayable over the same tenure of 7 years. The differential cash flows in this case would be as shown in the illustration below.

ILLUSTRATION 6.21

Differential Cash Flows on Debt Re-financing at Lower Interest Cost (₹ Mn)

Description	**Yr 0**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**	**Yr 6**	**Yr 7**	**Yr 8**
Total Cash Outflow for Debt Servicing - Existing Debt	0.0	138.6	128.8	119.0	109.2	99.4	89.6	79.8	0.0
Total Cash Outflow for Debt Servicing - New Debt	0.0	123.9	116.2	108.5	100.8	93.1	85.4	77.7	0.0
Difference in Cash Outflows for Debt Servicing	0.0	14.7	12.6	10.5	8.4	6.3	4.2	2.1	0.0

Cash Outflows on Account of Pre-payment Penalty	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Difference in Cash Outflows (New Debt vis-à-vis Existing Debt)	-4.9	14.7	12.6	10.5	8.4	6.3	4.2	2.1	0.0

Even on account of difference in the interest cost alone, we find that there are positive cash flows (savings) from re-financing of the existing debt as shown below. Obviously, the benefit from re-financing is lower—as compared to ₹48.3 mn in the earlier illustration using a discount rate of 16%, the benefit in present value terms declines to ₹34.0 mn.

ILLUSTRATION 6.22

Benefit from Re-financing at Lower Interest Rate Only (₹ Mn)

Discount Rate	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
Benefit from Debt Re-financing, i.e. PV of difference in cash outflows	42.2	41.0	39.9	38.8	37.7	36.7	35.8	34.9	34.0	33.1	32.3	31.5	30.8

6.5 REAL VERSUS NOMINAL FINANCIAL PROJECTIONS

6.5.1 The Role of Inflation

In creating and using a Financial Model, it is essential to remain conscious of the difference between real and nominal figures. Just as in case of interest rates discussed in Chapter 3, it is possible to look at project returns in real terms or nominal terms. Though some sources encourage the calculation of both in a Financial Model, this can be a source of confusion and lead to conceptually unsound results (generally IRRs) that are based on a mix of real and nominal figures (cash flows).

In general, it is best to build the Financial Model using only nominal figures. It is necessary, therefore, to address clearly the basis for increase in prices (e.g., power tariffs, toll rates, etc.) obtained for the project output and costs incurred to produce this output (e.g., fuel costs). Moreover, the modeller should be clear about the cash flows that are not affected by inflation. For example, with a loan contracted at the time of commencement of construction with interest rates specified in nominal terms, the interest paid on the loan and its repayment (i.e., debt service) will not be affected by inflation. To an extent, the expected increase in prices (that is, inflation) is already factored into the nominal rate of interest charged on debt funding –

with the nominal interest being higher than the expected inflation rate, lenders expect to get back more in terms of future purchasing power than the purchasing power they give up at the time of disbursing the loan.

It is only if the actual increase in prices (inflation) is higher than the expected rate of inflation based on which the nominal interest rate is set that the lender actually receives less in terms of purchasing power than that transferred at the time of loan disbursement.[15] This risk is borne by the lenders and they may prefer to pass back to the borrower a part of the risk by providing for periodic re-setting of the nominal interest, especially in case of a long tenure loan. However, where the nominal interest rate is fixed up-front with no provision for re-setting, the project itself becomes immune to the risk of higher than expected inflation rate as far as debt service is concerned. Of course, there is a trade-off involved insofar as the project remains exposed to the risk that actual inflation turns out to be lower than that expected at the time of executing the loan agreement. Moreover, the interest charged on a fixed interest loan may be higher that one where the interest rate is floating as the lenders will tend to price in the higher risk borne in case of a fixed interest loan.

Note that the fact that a given project is immune to the risk of inflation for debt servicing in case of a fixed interest loan does not imply that the project becomes free of all risks arising out of inflation – remember that other figures like depreciation are also in nominal terms as are the balance cash flows accruing to the equity investor(s) or project promoter(s). A project that involves replacement or extensive renovation of plant and machinery during the project period may find that the cost of such replacement is much higher than that initially projected due to inflation and that the purchasing power of the cash accruing to the equity investors is much lower than expected – inflation at rates higher than that expected will thus also affect equity returns adversely.

6.5.2 Providing for Inflation in the Financial Model

In general, it is recommended that the Financial Model specifically incorporates an assumption about the expected inflation rate in the "A&D" sheet and use the same to project all future amounts in nominal terms wherever applicable (i.e., not applying inflation to figures of debt servicing or depreciation calculation). If different rates are used for different items of revenue and cost, the modeller should have a sound reasoning for this.

[15] See Chapter 3 for an explanation of lending as a trade in purchasing power between two parties who both gain from this trade.

If such reasoning exists, it is permissible to use multiple item specific rates for projecting the nominal values for different items in future years. For example, when there is firm commitment from an EPC contractor on the total payment to be made for design, construction and commissioning of the project assets including cost escalation as estimated by the contractor, there is no need to apply escalation factors to capital expenditure in the Financial Model though assumptions about expected inflation rate would still be required for projecting operating expenses in nominal terms as well as for revision of prices to be paid by users for the output of the project assets, power tariff or toll rates being examples of such prices.

Apart from assumptions about the expected inflation rate in the future, the "A&D" sheet should also include data on the base period the prices of which have been used to arrive at estimates of the capital expenditure as well as estimated expenditure on operation and maintenance (O&M). For each element that has to be adjusted for inflation in the Financial Model, the escalation factor should be calculated with reference to the appropriate base period used for estimating that cost element. For example, given typical cycles for the development and bidding out of PPP projects, it is fairly common at the bidding stage for the estimated capital expenditure to be based on prices prevailing 2-3 periods earlier when the feasibility report of the project was prepared. However, the bidder may estimate the required O&M expenses in current prices prevailing at the time of the bidding. The Financial Model used for bidding should thus apply different escalation factors to items of capital expenditure and O&M expenditure with reference to the appropriate base period for each item, besides using the time period label of the period to which the escalation factor applies. Moreover, incorporating data regarding base periods in the Financial Model ensures that it remains flexible enough to handle changes in the implementation/construction schedule over the life cycle of the project.

In a similar manner, the tariff increase to be factored into the Financial Model may be based on a different base period as compared to cost elements, given that this often depends on the tariff regulation framework specified by the regulator for the sector or legislative provisions in this regard. For example, the rules applied to National Highway projects in India for determining the toll rates use FY2008-09 as the base period. In many cases, the provisions for tariff revision may not allow for the entire increase in prices (inflation) to be reflected in the revised tariff, based on the understanding that there should be an incentive for the operator to bring down costs of operation through efficiency gains, something that is difficult to ensure if the entire increase in prices can be passed on to the users. Care has to be taken to appropriately reflect such requirements in designing the formula for escalation factors that are to be applied to project the tariff in future periods.

An aspect that has to be carefully treated in projecting nominal figures is the practical consideration of revised values that can actually be applied. For example, the application of an inflation rate may yield a figure of ₹6.37 as the toll rate for a given category of vehicles in a given year; but it should be recognised that in practical terms the revised toll rates have to be in round figures either to the nearest rupee or fifty paise. To address such considerations, it is essential to use the ROUND type of function (including ROUNDUP and ROUNDOWN functions if appropriate) to arrive at the toll rate revised for inflation that is then used to project revenues. This should not be confused with the formatting of the cells where the calculated value is displayed; as such formatting in Excel affects only the display of the number but not the value used by Excel for calculations. In the example above, even if the revised toll rate is shown as 6 in a cell formatted to show values to zero places of decimal, the value 6.37 will be used for calculations.

Another aspect related to revision of figures to capture the impact of inflation is the periodicity of allowed revisions. With regard to periodicity, it is again possible that items like toll rates can be revised only once every x periods rather than in every period covered by the Financial Model. To that extent, the revision of toll rates will take place at discrete intervals of time and the Financial Model has to cater to this. It may be noted that though toll rates have been used as an example, such considerations may be applicable to other items like rentals and such items have to be dealt with accordingly.

6.6 INCORPORATION OF TIME-LINES IN FINANCIAL MODELS

6.6.1 Need for Flexibility in Project Time-line

Based on our understanding of finance theory, it is clear that the timing of cash flows is as fundamental a parameter as the nature (inflow or outflow) and quantum of these flows for any Financial Model. Also, it is fairly clear that the development of infrastructure projects especially in the PPP framework is often a lengthy process with many changes likely over the project life-cycle. Thus, the general objective of flexibility in the development and usage of Financial Models should most definitely extend to the in-built ability of the Financial Model to deal with changes in time-lines. If a Financial Model requires to be recast because the award of the concession turns out to be later than the date used in the Financial Model or it is established that the construction period can be shortened using a different technology, the value of the Financial Model diminishes drastically. Ideally the Financial Model should be able to adjust for changes in time-lines associated with the project with no more effort than is required to enter different values in a few cells of the “A&D” worksheet. As mentioned earlier, a Financial Model can be made flexible enough to meet this requirement by using the (assumed/estimated) time period required for construction as entered on the “A&D” worksheet to calculate the construction end date from the construction start date which is also entered on the same worksheet. Of course, other entries related to the project implementation and funding time-lines such as concession period and tenure of loans are also required on the “A&D” worksheet.

Moreover, the time-lines represented by the columns on every worksheet should be kept flexible by linking the cell that serves as the label for the first time period (generally financial year) to the cell in the “A&D” worksheet that contains the (entered) construction start date. Also, to the extent that the capital cost estimates used in the Financial Model may have been prepared at a certain point of time, the Financial Model should be able to adjust the same for cost escalation due to the actual construction or implementation getting pushed back in time for whatever reason (and in India, there is no dearth of such reasons!). All this requires some manipulation of dates in Excel, which requires a little care in developing the Financial Model but yields significant benefits in terms of flexibility.

6.6.2 Interpretation and Manipulation of Dates in Excel

In order to successfully deal with dates, it is essential to understand how dates are interpreted and stored in Excel. Excel stores dates as sequential numerical values with two date systems, 1900 and 1904, being used. The default date system for Windows is 1900 while for Macintosh it is the 1904 system. In the 1900 system, 1st January 1900 is serial number 1 and the system extends up to December 31st 9999, which has the serial number 2958465, being day number 2958465 when 1st January 1900 is day number 1. Given this background, it is easy to appreciate that dates entered on a spreadsheet can be used in calculations and manipulated in a manner that is similar to any other numerical value. In fact, most date related functions in Excel automatically convert date values entered in the spreadsheet to the equivalent serial number. In case of any problem, it is also possible to convert the date entered in a given cell to the equivalent serial number and vice versa using the DATEVALUE and TEXT functions in Excel. It should be noted that the DATEVALUE function has as the argument a date text string, which can be a cell reference. As a result, if the argument is a cell reference to a cell formatted to display the entry as a particular date format, the DATEVALUE function may generate an error message “#VALUE”. To get around this it may be necessary to first convert the entered value into date text using the TEXT function. This is shown below in ***Illustration 6.23***.

ILLUSTRATION 6.23

Manipulation using DATEVALUE and TEXT Functions

	A	B
1		
2	Cell B2 is formatted to display date in the format “dd/mm/yyyy”	14/03/2001
3		
4	Formula in cell B4 is “=DATEVALUE(B2)”	#VALUE!
5		
6	Formula in cell B6 is “=TEXT(B2,”dd-mmm-yyyy”)”	14-Mar-2001
7		
8	Formula in cell B8 is “=DATEVALUE(B6)”	36964

Obviously, the serial number generated using the sequential use of the TEXT and DATEVALUE functions applied to a cell where the date is entered can then be used for further calculations. However, complications may still arise due to differences in the date settings across computers and such problems cannot be addressed using the DATEVALUE and TEXT functions. The computer’s setting should not be confused with the formatting of cells in a spreadsheet to display dates according to the user’s choice (i.e., using “Format Cells” and then selecting an option from the category “Date” under the “Number” tab). This formatting of cells in Excel applies only to the manner in which the dates are displayed in those cells and does not affect the manner in which such dates are to be entered and how these entries are interpreted by Excel for calculations. The default format for entering dates especially with regard to the order in which the day and month is entered (i.e., “mm/dd/yy” or “dd/mm/yy”) in a spreadsheet (as well as other applications) is governed by the setting for the computer’s operating system using the “Regional and Language Options” icon on the Control Panel. For example, with the “Standards and formats” under the “Regional Options” tab set to “English (United Kingdom)” by selecting it from the pull down menu options, dates have to be entered with the day preceding the month, i.e., “dd-mm-yy” or similar format in terms of the order of the day and month.

With the format of dates to be entered by users specified in the Financial Model, the possibility of conflict with the computer settings exists. This will generally not happen simply when an Excel file is opened on a computer with a different "Standards and formats" setting because the dates already entered get automatically changed to reflect the setting on the computer where the file is opened. However, if new dates are entered, problems typically arise if the format specified for entering such dates differs from the "Standards and formats" setting on the computer. Depending on the display format of the cell where a date is entered by the user, the user may not find any apparent error on entering the date as the cell may well display the date as entered – however, Excel will interpret this entered date as per the "Standards and formats" setting on the computer. For example, the Financial Model may require the user to enter a date in the "dd-mm-yyyy" format whereas the system setting is "mm-dd-yyyy". If the user enters "01-10-2006" to represent the first day of October 2006, the spreadsheet may display this as entered but Excel will interpret the entered date as the 10th day of January 2006. On the other hand, if the user enters a value like "15-07-2001", Excel will be unable to interpret this as a date and calculations using the entered date will display an error message (#VALUE!).

To get around this problem, it is best to have the entry of any date by the user in a Financial Model broken down into three separate entries for day, month and year. This also ensures that checks can be placed to meet certain requirements of the Financial Model or to avoid errors in data entry. For example, we may wish for convenience to ensure that construction starts on the first day of any month and hence create a check cell next to the cell where the day is entered that results in an errors message if any number other than 1 is entered. Similarly, a check cell may be used to ensure that the value entered for month is within the possible range of 1 to 12.

Once the user has entered valid values for day, month and year in the three designated cells (say E67, E68 and E69), it is easy to generate the equivalent serial number for that date using the DATE function. This has the syntax DATE (year, month, day) where the arguments can be cell references. The cell where the DATE function is used to generate the date serial number using inputs provided by the user should be formatted as a number. Moreover, all further calculations using the entered date should in the first instance use this date serial number to generate another serial number representing the date that is the result of the calculation. With dates entered in three parts and all the calculations being carried out using the serial numbers representing the dates, the chances of problems arising due to a particular format being specified for entry of dates that conflicts with the computer setting will get largely eliminated.

Once the serial number representing a date has been generated, the corresponding day, month and year can be generated by providing the cell reference as an argument in the DAY, MONTH and YEAR function or the date displayed in a particular format by the same means.

6.7 PROJECTING BALANCE SHEETS

While a projected balance sheet is not essential for assessing the profitability or financial viability of a project or even for generating ratios like DSCR that lenders are typically interested in, projecting the balance sheet is a good test of the Financial Model's consistency and to an extent, the modeller's grasp of basic accounting principles. Both are necessary to ensure that the projected assets equal liabilities at the end of every period over which projections are prepared. However, a balance sheet that "balances" cannot be taken as an indication that there are no errors in the Financial Model – a "balancing" balance sheet is thus a necessary condition but not sufficient to conclude that the Financial Model is free from errors.

In some instances where the working capital requirements are significant or where lenders require certain provisions to be made in the form of debt redemption reserves or some form of sinking fund, projecting the balance sheet may be an essential component of the Financial Model. In all cases however, the balance sheets projected provide a link between the cash flow projections and the projected P&L accounts, with projected cash balances acting as the balancing item that should ideally ensure that both sides of the projected balance sheets match. While it is typically only the cash flows that are important from the point of view of return as defined in finance theory, and the simplification required in assuming that cash remains in its native form (i.e., highly liquid but not remunerative to hold) is unrealistic, even the exercise of projecting simplified balance sheets ensure a final consistency check for the Financial Model as a whole upon its completion. In such a simplified balance sheet, there are two primary linkages to the other sheets that serve as "balancing" items:

- On the assets side, the amount of cash (including bank balances) is derived by adding to the figure of cash as per the balance sheet at the end of the previous period, the difference between the total sources and uses of cash as calculated on the "CFlo" sheet. Using the standard structure of the "CFlo" sheet, equity inflows are calculated as the residual amount of cash required for meeting the total projected use of cash after all non-equity sources of cash (essentially, debt financing and cash from operations) have been taken into account in each period. Thus, it is only when the non-equity sources of cash exceed the total projected use of cash (i.e., no equity inflow is required) that the figure of cash on the projected balance sheet starts increasing.

- On the liabilities side, the amount of reserves is the corresponding balancing figure. This is projected by adding to the corresponding figure in balance sheet at the end of the previous period, the amount of PAT from the current period's profit and loss account.

As explained earlier, this simple approach does not consider distribution of profits as dividend, which is also not necessary for calculating equity IRR. As such, this is not a binding constraint and the amount of dividend paid out can always be added on the "P&L" sheet (a row below PAT) and the "CFlo" sheet. On the "CFlo" sheet, rather than disturbing the standard structure explained earlier by adding dividend pay-out as an use of cash, which can lead to confusion in calculating equity IRR, it is better to address dividend in a separate section at the bottom of the "CFlo" sheet as follows:

- Row 1: Total use of cash – this just links to the row showing the total projected use of cash in the standard "CFlo" format on the same sheet. It should be noted that dividend pay-out does not form part of the standard "CFlo" format and the projected use of cash is thus without considering any dividend pay-out.
- Row 2: Total sources of cash including equity infusion - this just links to the row showing the total sources of cash excluding equity in the standard "CFlo" format and adds to this the figure of projected post-tax equity inflow if such inflow occurs, i.e. if the post-tax equity cash flow value is negative in the standard "CFlo" format. Keeping in mind that the equity cash flows are residual in nature in the standard "CFlo" format, equity inflows will occur whenever the projected use of cash exceeds the cash available from all other sources excluding equity. As long as equity inflows are required, there is obviously no cash available for paying out dividends and there is no change in the projected cash balance in the balance sheet.
- Row 3: Total change in cash without considering dividend – this is simply Row 2 minus Row 1. Once the total sources of cash in a period exceed the total use, dividend pay-out can be considered. In other words, dividend pay-out is possible when there is a positive value in Row 3.

The maximum that can be paid out as dividend is limited by (a) the value in Row 3, and (b) statutory transfer to reserves from PAT. Under Indian law, ten per cent (10%) of the book profit has to be transferred to statutory reserve before dividend can be paid. Thus, Row 4 is added to show the maximum amount that can be paid out by way of dividend by picking up the value of PAT from the "P&L" sheet when it is positive and subtracting from this the transfer to statutory reserves.

Finally, only the increase in cash after taking into account the dividend paid out is carried to the balance sheet and added to the projected cash balance at the end of the previous period. Similarly, instead of adding PAT directly to the projected reserves at the end of the previous period, the value of PAT less dividend paid out is carried to the liabilities side of the balance sheet. Making such an explicit provision for dividend paid out without altering the standard forms of the "CFlo" and "P&L" worksheets also address the problem of distortion of WACC in later periods discussed in Chapter 4.

CHAPTER 7

Financial Models Across Infrastructure Sectors

INTRODUCTION

This chapter covers some sector-specific aspects in the development of Financial Models. Since a comprehensive coverage of such Financial Models is difficult given the constraints of space, the focus is on extracts of such Financial Models drawn from the author's past experience. The essential point is that all these models are based on the same structure and development process for Financial Models covered in this book. It should also be noted that sector-specific aspects of Financial Models are covered at a fairly high level, i.e., conceptually, rather than getting into detailed explanation of the sector-specific processes in the Model Core.

Key Topics Covered in this Chapter

Since the sample financial models is drawn from the roads/highways sector, this chapter covers some sector-specific features for Financial Models from other infrastructure sectors, supplemented by extracts from relevant Financial Models covering the following sectors:

- Real Estate Projects
- Port Projects
- Airport Projects
- Power Generation Projects

7.1 REAL ESTATE PROJECTS

Real estate projects can be considered as forming special category for the purpose of developing Financial Models. Such projects are being increasingly taken up within a PPP framework as Governments, especially urban local bodies, strive to generate revenues from vacant land available, while avoiding the risks involved in real estate development that they are not equipped to manage. A critical aspect of such transactions is the value obtained by the Government in the form of lease premium or other consideration for land. Given that transactions involving the transfer of Government owned land to private developers are generally subject to increased public and media scrutiny, a typical question posed by the client to the transaction advisor is regarding the "fair value" or "reserve price" that should be considered before accepting the winning bid. While it is theoretically possible to apply DCF as a valuation tool to real estate projects and arrive at a value of the land to be communicated to the Government client, it should be appreciated that such analysis often involves assumptions that may not reflect the actual situation and can lead to misleading Output. Also, it should be kept in mind that the value of land is very closely linked to its usage and benchmarking as a tool may not be appropriate to that extent, even without considering the fact that reported values are often lower than the actual in the Indian context to save on stamp duty for registration of the change in ownership of land or real estate. This section outlines some specific aspects of real estate projects that can create problems for a Financial Model.

In typical real estate transactions, the cash flows in the initial years up to completion of construction and first sale are higher than any subsequent cash flows by an order of magnitude. As such, complicating the Financial Model of a real estate project to account for nominal annual lease rentals or maintenance expenditure over a long period of time after completion of construction and sale does not add much value. Even apart from the fact that these cash flows are very insignificant compared to the cash flows arising out of payment for land, construction expenditure and sale of the real estate by the developer, the very nature of the discounted cash flow (DCF) type of analysis means that the net impact of any cash flow occurring in the future is very limited. As an example, with a discount rate of 10%, the discount factors for cash flows occurring 10, 15 and 20 years from the present are 0.39, 0.24 and 0.15 respectively. When such discount factors are applied to the typical cash flows associated with a real estate project after completion of construction and sale like nominal annual lease rentals or annual maintenance expenditures, which are less than 5% of the project cost, the impact is virtually negligible. For example, assuming that the annual cash flows in these later years are 5% of the project cost, the equivalent impact in present value terms for such cash flows occurring after 10, 15 and 20 years are 1.9%, 1.2% and 0.7%. In other words, ignoring such annual lease rentals occurring after 10 years is equivalent to making an error of less than 2% in estimating the project cost for the real estate project to be incurred today. Given the number of assumptions typically required even for near-term cash flows, such effort at preparing a Financial Model complete with all possible cash flows over a 20-30 year time frame makes very little sense in case of a real estate project. This observation is based on the "order of magnitude" difference between cash flows up to completion of construction and sale and subsequent cash flows in case of real estate projects and may not necessarily apply to all types of projects.

The primary problem in creating a Financial Model for a real estate project lies in the assumptions about financing of the project, an aspect illustrated later in this Section. Another issue that should be borne in mind is the recognition of income by real estate developers. In most sale transactions, the income (and expense) pertaining to the sale is recognised in the period when the legal title is transferred to the buyer. However, in case of real estate projects, while the transfer of legal title may take place only on registration of the property in the buyer's name and the buyer is given possession of the property only after completion of construction, it is possible that the sale agreement itself transfers all significant risks and rewards of ownership to the buyer. A judgement in this regard thus needs to be made, checking whether the sale agreement meets the following requirements:

All significant risks and rewards related to the real estate have been passed to the buyer. In case of real estate, price risk is one of the more significant risks and in effect the price payable for the real estate should be firm – i.e., there should be no uncertainty about the sale consideration to be received by the real estate developer.

As an extension of the above, the buyer should have a legal right to sell/transfer his interest in the property either without any conditionality attached or subject to conditions that do not materially affect his right to the benefits in the property. This is a reflection of the fact that capital gain is the most significant form of return likely to arise from real estate and as long as the buyer can legally capture this return without material constraints, the entering into a sale agreement by the seller and buyer can be considered as adequate for the purpose of revenue recognition.

In addition to the above, the aspects that are generally covered by the Accounting Standard on "Revenue Recognition" (AS 9) need to be considered. For example, it should not be unreasonable to expect ultimate collection. In case the buyers have paid only a small proportion of the sale consideration and the project itself has been subject to delays or other factors that have affected it adversely, there may be uncertainty regarding the ultimate collection from buyers and it may be prudent not to recognise income on the project. Similarly, sale agreements incorporating put or call options or requiring occupancy of the property for minimum specified period by the buyer would not meet the conditions outlined above.

In many real estate projects, buyers typically enter into a sale agreement with the seller/developer and make a down payment, following which the buyers pay instalments linked to the progress of construction. If the sale agreement meets the requirements discussed earlier, revenue can be recognised following the execution of the sale agreement even if the seller/developer still has substantial acts to perform. In this case, the relationship between the buyer and the seller after the transfer of all significant risks and rewards to the buyer may be considered as analogous to that between a client and a contractor. In this case, the revenue should be recognised on a proportionate basis in line with the Accounting Standard on "Construction Contracts" (AS 7).

Having outlined that revenue recognition may be complicated in case of real estate projects; it is nevertheless true that this should affect the cash flows forming part of a DCF Financial Model only to the extent that the recognition of revenue and expenses affect taxes levied on income. Otherwise, the cash outflows and inflows associated with the real estate project in question remain unchanged and there is no impact on the Financial Model's Output such as project IRR or equity IRR. However, there is a genuine issue in that the cash from operations typically taken as the OPBDIT in other projects will not hold good for real estate projects.

It is the other aspect of real estate project mentioned earlier in this Section, i.e., the financing of the project that has a significant impact on the equity IRR. The reason for this is the typical instalment payments made by buyers. For a real estate project with good demand, the developer's outlay may be restricted to the payment made for land. Once the project is launched, the developer can register buyers and execute sale agreements requiring the buyers to pay in instalments linked to progress of construction. This effectively means that the developer's own investment in a project can be fairly small in relation to the project size and this can affect equity IRR drastically. To appreciate this aspect, some simplified cash flows associated with a real estate project are presented below.

In all four cases shown, the costs (land and construction) and the total sales realisation are identical, with the total sales realisation being 20% higher than the total cost with the project getting completed over a period of three years. The differences in the four cases lie in the amounts assumed to be collected from buyers. This aspect is obviously driven by (i) the demand for the project, and (ii) the discount on price offered to those paying up-front. In Case A, it is assumed that the entire sales realisation of 320 flows in only during Year 3 when the developer has already incurred most of the project cost out of his own funds. In cases B to D, the amount received by the developer from advance sales is assumed at progressively higher levels. In Case B, the cash inflows from the advance sales (in other words, the instalment payments by buyers) in years 0 to 3 are assumed at 0%, 11%, 28% and 61%. In Case C, the corresponding percentages are 6%, 17%, 33% and 44% while in Case D these are 8.3%, 22.2%, 33.3% and 36.1%. As may be expected, the equity return earned by the real estate developer (no debt funding of the developer is assumed in this case) increases from 13.2% in Case A to 20.8% in Case B and further to 34.6% and 55.2% in Cases C and D respectively.

The relevant lesson from this simplified example of a real estate project is that the returns earned by the developer will be driven to a great extent on the willingness of the buyers to make advance payments, which is a reflection of demand for the real estate being developed. The more the buyers are willing to pay up, the less is the actual investment of the developer's own fund and hence the higher is the return earned by the developer. In the typical project development context, the focus of such analysis of a real estate project would generally be on the amount the developer would be willing to pay for land. Obviously, this will also be affected by the kind of advance sales assumed in the Financial Model. For example, using the Cases A to D, one might carry out an analysis using the "Goal Seek" function by changing the payment for land made by the developer so as to earn 25% return. The resultant payments for land that the developer would be willing to make are as follows:

Case A: 18.18

Case B: 42.34

Case C: 60.52

Case D: 71.20

ILLUSTRATION 7.1

Impact of Advance Sales on Returns from Real Estate Projects

	A	B	C	D	E
1	Case A: No Advance Sales	Year 0	Year 1	Year 2	Year 3
2	Payment for Land	-50			
3	Construction Expenses	-10	-80	-80	-80
4	Advance Sales/payment from Buyers	0	0	0	360
5	Cash Flows for Developer	-60	-80	-80	280
6					
7	Equity IRR (Calculated on "Cash Flows for Developer" row)	13.2%			
8					
9	Case B: Advance Sales (Conservative Assumption)	Year 0	Year 1	Year 2	Year 3
10	Payment for Land	-50			
11	Construction Expenses	-10	-80	-80	-80
12	Advance Sales/payment from Buyers	0	40	100	220
13	Cash Flows for Developer	-60	-40	20	140
14					
15	Equity IRR ("Cash Flows for Developer" row)	20.8%			
16					
17	Case C: Advance Sales (Reasonable Assumption)	Year 0	Year 1	Year 2	Year 3
18	Payment for Land	-50			
19	Construction Expenses	-10	-80	-80	-80
20	Advance Sales/payment from Buyers	20	60	120	160
21	Cash Flows for Developer	-40	-20	40	80
22					
23	Equity IRR ("Cash Flows for Developer" row)	34.6%			
24					
25	Case D: Advance Sales (Aggressive Assumption)	Year 0	Year 1	Year 2	Year 3
26	Payment for Land	-50			
27	Construction Expenses	-10	-80	-80	-80
28	Advance Sales/payment from Buyers	30	80	120	130
29	Cash Flows for Developer	-30	0	40	50
30					
31	Equity IRR ("Cash Flows for Developer" row)	55.2%			

Thus, depending on the assumption about advance sales, a Financial Model for a real estate project may yield estimates of land value that vary widely – the highest estimate in the above example is almost four times that of the lowest. In such a context, it also does not help much to make conservative assumptions about advance sales (as in Case A) because the credibility of the Financial Model would suffer just as much if the value for the land arrived at through competitive bidding is much higher than the estimate derived from the Financial Model as when the estimate is much higher than the value reached through bidding. Since it is almost impossible to accurately predict advance sales, there is really no solution to this problem. The key point is that in modelling real estate projects, a reasonably wide range of assumptions regarding advance sales should be made to arrive at the possible range of values likely to be derived by the client from the land and use benchmarks of recent land transactions in the vicinity if available to identify the likely continuum within the range derived from the Financial Model where the actual value paid by the winning bidder is likely to fall, though even this may not be fool-proof. Essentially, the modeller should not only be aware of the typical problems associated with real estate projects but also educate clients to the extent possible in order to manage client expectations. Trying to sell the idea of a single sacrosanct value of land derived using a Financial Model to the client/stakeholder should be avoided at all costs.

However, having discussed aspects that are specific to real estate projects, the fact remains that the overall structure and development process for Financial Models as discussed in earlier chapters, all hold for such projects developed in the PPP/Project Finance Context. Several such projects have been implemented in India, covering mixed commercial use, residential complexes[1], slum re-development and several international convention centres. Though some people question the inclusion of real estate projects within the ambit of PPP, it is an established fact that Governments venturing directly into real estate development in India have generally met with failure. Despite advantages in land acquisition and consolidation because of the support of the state machinery, poor construction quality and delivery schedules besides doubtful commercial decisions (including the location of

[1]These include one where the author was directly involved – a group housing complex of about 1200 residential units was developed with the specific purpose of housing athletes and officials during the National Games without the relevant State Government having to provide anything beyond a plot of land (about fifty acres) that was already owned by the State Government. Moreover, the State Government also gained in the form of a share of the residential units provided to it by the selected private sector developer free of cost – this was in fact the financial bid parameter in the PPP Project Structure.

real estate development projects) affected by political considerations and the complete lack of incentives for generating cash flows and profits have led to poor financial performance of state housing boards or similar entities in state after state. As such, the PPP route is a much better way for Governments to ensure that social objectives including affordable housing for the poor in urban areas and landmark buildings/facilities that would not be created by market forces because of better returns elsewhere are delivered without the Government taking on commercial risks that it is not equipped to manage. In fact, the PPP route for such real estate development is being explored in a number of countries – for example, Mauritius, a place where the author himself has been involved in such projects.

The illustration below shows an extract from the "CFlo" worksheet from a financial model developed to explore the feasibility of a mixed use development on about 100 acres through PPP. The key point that should be noted is that the overall structure of the Financial Model as well as the organisation of the key Output sheet used to calculate project returns (equity IRR and project IRR) remain largely unchanged, establishing that the structure can be adopted in sectors other than roads as is the case in the Sample Financial Model used in this book. In this case, the extract shown is actually the summation of identical cash flow projections for various components of the project, these being a convention centre cum exhibition area (non-commercial component with a project IRR in the range of 3%-4%), a hotel (project IRR of about 18%), commercial and retail space (project IRR of over 25%), a cultural centre (project IRR of about 6%), etc. Such an approach is fairly common for mixed use real estate development where the PPP Project Structure may be based on a "clubbing" of components that are not financially viable but socially desirable with financially viable components so that the project overall is viable for the private sector developer.

ILLUSTRATION 7.2

Extract from Cash Flow Projections – Real Estate PPP Project

Projected Cash Flows - All Components Combined (₹ Crore)	**Period**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Uses of Cash:							
Land Acquisition	127.10	0.00	0.00	0.00	0.00	0.00	0.00
Capital Expenditure Excluding IDC	0.00	266.57	628.57	245.13	0.00	0.00	0.00
IDC	1.96	9.73	27.89	1.79	0.00	0.00	0.00

Interest Payment	0.00	0.00	0.00	33.00	25.67	18.33	11.00
Loan Repayment	0.00	0.00	0.00	115.60	61.11	61.11	61.11
Income Tax Paid	8.02	24.06	80.93	54.33	17.08	30.65	42.36
Total Uses of Cash:	137.08	300.36	737.39	449.84	103.86	110.09	114.47
Sources of Cash:							
Cash From Operations – OPBDIT	49.95	149.86	508.40	371.59	91.97	142.72	163.79
Loan Taken	32.64	96.87	205.82	24.69	0.00	0.00	0.00
Sources of Cash Excluding Equity:	82.60	246.73	714.22	396.28	91.97	142.72	163.79
Equity Cash Flows (Balancing):	-54.48	-53.63	-23.17	-53.56	-11.89	32.63	49.32
Equity IRR - All Components Combined	30.5%						
Project Cash Flows (Post-Tax)	-85.16	-140.77	-201.10	72.13	74.89	112.07	121.43
Project IRR - All Components Combined	26.0%						

Note: Only a part the proposed 15-year Project Time-Line is shown in the illustration.

7.2 PORT PROJECTS

Port projects in the PPP/Project Finance Context may mean either:

(a) A single berth/jetty or similar facility within the boundaries of an existing port (including renovation/modernisation/transformation of an existing berth/jetty); a special case is a port comprising a single berth/jetty or similar facility; or

(b) Green-field multiple berth port developed from scratch.[2]

These two categories are fairly common even in the Indian context. However, a special case within each category is a "dedicated facility". Obviously, a "dedicated facility" only makes sense for consumers/producers of bulk commodities moved by sea – coal, petroleum, ores and minerals are natural examples of such bulk commodities though there exist other possible types where the economies of scale make a dedicated facility financially/ economically feasible. Quite a few of the ports/port facilities counted among PPP/Project Finance transactions in India are of the "dedicated facility" type. Companies/groups like Essar, Reliance, Tata as well as PSUs, oil and gas companies are good examples in this context. Given the focus of this book,

[2]In the PPP/Project Finance Context, preparatory work involving identification and preliminary engineering design may well have been done by the Government (Public) side.

such projects are not being listed here. These are reasonably easy to identify – Appendix D to this book provides a starting point for those interested.

A natural linkage with a port project, whether in the PPP/Project Finance Context or not, is transport linkages required for the port – both road and rail. Thus we see NHAI taking up port connectivity road projects while a private port operator also gets involved in a PPP/Project Finance transaction involving creation/up-gradation of a rail link.

In terms of revenues, ports derive revenues primarily from two categories – vessel related and cargo related (wharfage). In addition, a port will have other sources of revenues from land, i.e., rent, license fees, storage fees, etc. The Financial Model may thus need to address many such parameters. Also, the conversion of the physical quantities of traffic into revenues requires a number of assumptions covering:

- Volume and composition of cargo, projected over the Project Time-Line
- Composition of vessels in terms of carrying capacity or size, projected over the Project Time-Line
- Turn-around times of vessels, including trends over the Project Time-Line – this is related to the rate at which a given type of cargo (say, containers or petroleum products) can be handled by the port
- Rates of cargo and vessel related charges, including discounts if any and the likely changes in these rates in the future, i.e., over the Project Time-Line
- Rentals from various users or port land/real estate over the Project Time-Line
- Other miscellaneous sources of revenue as applicable, also over the Project Time-Line

Of course, the general features of the Financial Model in terms of estimating the required capital cost, its financing and operation & maintenance costs are all required as in any other Financial Model or sector. With a number of different types of cargo handled, with each type of cargo being characterised by different parcel and vessel sizes, besides differing handling rates for each type of cargo, the Financial Model of a port project may become fairly complex with regard to the projection of revenues. A related point will be the level of service provided. It is no use assuming volumes of traffic that cannot be handled by the existing facilities – this is simply because of the fact that shippers will have other ports as options if they lose money due to the poor service levels of the port in question – the projected revenues may thus never materialise! Of course, a local monopoly of a port is possible, especially given the lumpiness of investment required. However, that should not become a basis for projecting high revenues/profits in a Financial Model without adequate understanding of why the local monopoly exists and why competition will not make that monopoly non-sustainable in the long run.

A point related to the capacity is that service levels cannot be always looked at simply by comparing capacity of a port facility with the annual traffic. Doing that would mean assuming that vessels will call at the port in an orderly manner! Though this is obviously not going to be the case, this aspect is generally well taken care of by assuming a reasonable probability distribution that mimics/represents real-life vessel arrivals. In any case, these aspects form part of the technical/engineering studies and do not pertain directly to the Financial Model. However, the person developing the Financial Model has to be aware of such issues to avoid nasty surprises! That also holds for other infrastructure sectors as well.

To keep things simple, let us consider a relatively simple green-field port that handles only two types of cargo – (a) containers measured in terms of Twenty Foot Equivalent Units (TEUs); and (b) break-bulk cargo measure in metric tonnes (MT). The typical assumptions that are required for revenue projection are shown in the illustration below.

ILLUSTRATION 7.3

Typical Traffic Parameters for a Berth

Cargo Charges (Wharfage):	₹	
Containers	₹5500	per TEU
Break-bulk	₹150	per ton
Vessel Related Charges:		
Berth Hire	0.03	US$ per 8 hours or part
Port Dues	0.30	US$ per GRT per entry
Average parcel size (Break bulk) in tons	5000	for all years
Average parcel size (Containers) IN TEUs	300	from 2004 to 2009
Average parcel size (Containers) IN TEUs	350	from 2010 to 2014
Average parcel size (Containers) IN TEUs	400	from 2015 to 2019
Average parcel size (Containers) IN TEUs	500	from 2020 onwards
INR/US$	45	

(*Contd.*)

Depreciation of the INR against the US$	2.0%	p.a. till 2010, nil thereafter
Average vessel size		i.e. Gross Registered Tons (GRT)
Break-bulk ships (DWT)	10000	5375
Container ships (DWT)	10000	5375
Handling rates		
Break Bulk	5400	tons per day
Containers	400	TEUs per day till 2009
Containers	800	TEUs per day from 2010
Non-working time at berth	30%	of working time at berth

As can be seen, the required assumptions cover:

- Average parcel size for both types of cargo, which may be taken as given based on industry norms;
- The tariffs for both vessels as well as cargo; and
- Measures such as handling rates and non-working time at berth that reflect the efficiency of the port in question

It should be noted that some of the vessel related charges are in US$ terms, a standard practice globally which implies that port projects are exposed to foreign exchange risks. Also, a number of different units such as dead weight ton (DWT) and gross registered tonnage (GRT) are commonly used and depending on how the tariffs are stated, conversion from one unit to another may be required. Due to the phased development of the port, the handling capacity for containers doubles after 2009. In order to project revenues, all one needs in addition to the above assumptions is the projected level of traffic for the two types of cargo handled at the port. The illustration below shows an example of such revenue projected on the basis of traffic as shown.

ILLUSTRATION 7.4

Example of Projected Revenue for a Port

Projected Traffic (Depending on scenario chosen on the "Traffic" Sheet)						
Year ending March 31st,	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Break-bulk (Mn MT)	0.90	1.00	1.05	1.15	1.15	1.15
Containers (TEUs)	124400	144700	161700	183100	197000	211000

(Contd.)

Number of break-bulk vessels	180	200	210	230	230	230
Average time at berth for break-bulk vessels (days)	1.20	1.20	1.20	1.20	1.20	1.20
Average time at berth for break-bulk vessels (hours)	29	29	29	29	29	29
Berth Occupancy (%)	59.4%	66.0%	69.3%	75.8%	75.8%	75.8%
Number of container vessels	415	414	462	524	563	603
Average time at berth for container vessels (days)	0.98	0.57	0.57	0.57	0.57	0.57
Average time at berth for container vessels (hours)	24	14	14	14	14	14
Berth Occupancy (%)	110.9%	64.5%	72.0%	81.7%	87.7%	94.0%
Port Dues (₹ Mn.)	47.67	50.17	54.91	61.61	64.80	68.07
Berth Hire (₹ Mn.)	15.74	13.30	14.41	16.08	16.72	17.37
Total Vessel Related Revenues (₹ Mn.)	63.41	63.48	69.33	77.70	81.52	85.44
Break-bulk Cargo Charges (₹ Mn.)	135.00	150.00	157.50	172.50	172.50	172.50
Container Cagro Charges (₹ Mn.)	684.20	795.85	889.35	1007.05	1083.50	1160.50
Cargo Related Revenues (₹ Mn.)	819.20	945.85	1046.85	1179.55	1256.00	1333.00
Total Port Revenues (₹ Mn)	882.61	1009.33	1116.18	1257.25	1337.52	1418.44

7.3 AIRPORT PROJECTS

In many respects, airport projects have similarities with port projects. In terms of revenue generation, airport projects are almost as complex as port projects. Internationally, a large proportion (up to 60%) of the airport's revenues derive from real estate rentals and license fees for parking, shops, re-fuelling, etc., if such facilities are not operated by the airport company, which is generally not the case. These revenues are generally termed "Non-Aeronautical Revenues". As such, the situation is not exactly similar in India where airports have mainly been operated by the Government till recently but there is no doubt that non-aeronautical revenues are increasingly vital for airports in the PPP/Project Finance Context, as illustrated by the failure of the operator at Delhi airport to raise the projected amounts from real estate (hotels, mainly) due to a down-turn, requiring in turn support from the Government and lenders to the project. As such, the projection of non-aeronautical revenues is largely driven by similar considerations and issues as covered in the earlier Section on real estate in this chapter. This should be kept in mind while developing a Financial Model for any airport project.

On the aeronautical side, the points are simpler. By and large, a bulk of the revenue comes from landing charges, which are linked to aircraft movements. The other sources are also related to aircraft movements, being in the form of navigation charges, parking charges, etc. As such, just as in case of ports, assumptions about traffic levels (both passenger and freight), the composition of aircraft (the aircraft mix) and the rates of landing charges, parking charges, etc., are required. All these are of course to be projected over the Project Time-Line as in case of ports. Other aspects such as capital cost and O&M expenditure also remain constant components of the Financial Model as in other sectors.

The illustration below shows some of the typical data/assumptions and calculations required for the Financial Model of an airport.

ILLUSTRATION 7.5

Typical Assumptions for an Airport Project's Financial Model

Financial Year (FY):	**FY2009**	**FY2010**	**FY2011**	**FY2012**	**FY2013**
Landing Charges - Domestic Passenger Flights (INR/ton)	170.8	187.9	187.9	206.7	206.7
Increase (%)		10.0%	0.0%	10.0%	0.0%
Landing Charges - International Passenger Flights (INR/ton)	227.7	250.5	250.5	275.6	275.6
Increase (%)		10.0%	0.0%	10.0%	0.0%
Average Nos. of Pax/Landing – Domestic	45	63	76	76	76
Change (%)		40.0%	20.0%	0.0%	0.0%
Average Nos. of Pax/Landing – International	75	98	118	118	118
Change (%)		30.0%	20.0%	0.0%	0.0%
Average Weight of passenger aircraft landing - tons (domestic)	58	58	58	58	58
Average Weight of passenger aircraft landing - tons (international)	160	160	160	160	160

With these assumptions and the projected levels of passenger traffic, it is now possible to project the revenue from landing charges that accrue to the airport company. Based on the projected number of passengers and the average number of passengers per flight, the total number of flights landing can be calculated. This is then multiplied by the average weight of the aircraft and the landing charge per ton to yield the revenue from landing charges. This is shown in the illustration below.

ILLUSTRATION 7.6

Calculation of Revenues from Landing Charges using Projected Passenger Traffic

Projected Passenger Traffic	FY2009	FY2010	FY2011	FY2012	FY2013
Domestic Arrival – Mn	2.962	3.699	4.620	5.771	7.208
Domestic Departure – Mn	2.962	3.699	4.620	5.771	7.208
International Arrival – Mn	0.724	0.876	1.060	1.282	1.552
International Departure – Mn	0.724	0.876	1.060	1.282	1.552
Number of domestic passenger aircraft landings calculated	45,562	51,375	58,484	73,048	91,241
Revenue from landing charges - domestic passenger (₹ Mn)	386	560	637	876	1,094
Number of international passenger aircraft landings – calculated	6,291	7,236	8,344	10,098	12,220
Revenue from landing charges - international passenger (₹ Mn)	240	355	410	545	660

7.4 POWER PROJECTS

A key point with regard to power projects in the Indian context, whether in generation or transmission, is that tariff as well as other aspects like O&M expenses including depreciation, financing of the project and return on investment, period allowed for commissioning, etc., are regulated based on norms[3]. In other words, tariff setting is regulated and normative and the norms also cover aspects such as return on equity capital, the interest cost on debt financing of the project, repayment of debt, plant load factor, calorific value of coal (in case of coal-based plants), depreciation etc., thus covering all the key components of the Financial Model. Also, the norms are not static but are revised by the CERC from time to time, generally taking into

[3] Interested readers may refer to the CERC guidelines quoted in Appendix-C.

account the performance of the larger PSUs in these sectors like the National Thermal Power Corporation Limited and the Power Grid Corporation of India Limited in the preceding period. As in other sectors, the tariffs (and hence revenues) as well as other components such as O&M expenses including depreciation, debt servicing, have to be projected over the Project Time-Line.

A key implication of the above is that if a project is able to achieve standards higher than the norms in question, higher returns are possible. As such, this should not be regarded negatively because incentives linked to efficiency are in essence market-linked and some benefits may accrue to (or be shared with) consumers. In case of power distribution projects also, the Financial Model will typically involve projection of efficiency parameters. However, given the author's limited experience in such projects as well as the complexities of the power trading market in India, power distribution projects have not been touched upon here.

We conclude by taking a look at some illustrations from a power generation project. The illustration below shows some typical data and assumptions relating to operations required for a coal-based power generation project.

ILLUSTRATION 7.7

Typical Operating Assumptions for a Thermal Power Plant

Plant Capacity Details	Unit	Value
Installed Capacity	MW	500
Plant Load Factor	Percentage	85.0%
Plant Heat Rate	Kcal/kWh	2,424
Auxiliary Consumption	Percentage	6.5%
Primary Fuel (Coal)	**Unit**	**Value**
Gross Calorific Value	Kcal/kg	3,700
Secondary Fuel (Oil)	**Unit**	**Value**
Oil Consumption	Ml/kWh	1.00
Kilo calories per millilitre of Oil	Kcal/ml	10

The above assumptions can be used along with data on the Project Time-Lines (not shown) to generate the projected values of output and consumption of raw material for the power plant as shown below.

ILLUSTRATION 7.8

Calculated Power Generation and Raw Material Consumption for a Power Plant

Financial Year for Operation		1	2	3	4	5	6
Number of Months of Operation	Number	2	12	12	12	12	12
Units Generated	Million kWh	621	3,723	3,723	3,723	3,723	3,723
Less: Auxillary Consumption	Million kWh	40	242	242	242	242	242
Units Available for Sale	Million kWh	580	3,481	3,481	3,481	3,481	3,481
Consumption of Coal (Primary Fuel)	Million Tonnes	0.40	2.43	2.43	2.43	2.43	2.43
Consumption of Oil (Secondary Fuel)	Kilo Litres	0.62	3.72	3.72	3.72	3.72	3.72

Note: Not all periods of the Project Time-Line shown

As mentioned, an interesting aspect of such projects is that the tariff is set based on CERC norms. The tariff calculations for the power generating plant shown in the illustrations above are shown below.

ILLUSTRATION 7.9

Tariff Calculation for a Power Plant

Financial Year for Operation	1	2	3	4	5	6
Months of Operation	2	12	12	12	12	12
Annual Charges in (INR Million) as per CERC Guidelines						
O&M Expenses	109	653	653	653	653	653
Secondary Fuel Oil	19	112	112	112	112	112
Depreciation	275	1,650	1,650	1,650	1,650	1,650
Interest on Loan Capital	428	2,470	2,278	2,085	1,893	1,701
Interest on Working Capital	22	279	288	284	280	276
Return on Equity	335	2,314	2,314	2,314	2,314	2,314
Total Annual Fixed Charges	1,188	7,478	7,294	7,098	6,902	6,706
Primary Fuel Coal	457	2,745	2,745	2,745	2,745	2,745
Total Annual Variable Charges	457	2,745	2,745	2,745	2,745	2,745
Total Annual Charges	1,645	10,222	10,039	9,843	9,646	9,450

(Contd.)

Cost/Kwh (In Paise)						
Fixed Charges per kWh in Paise	205	215	210	204	198	193
Variable Charges per kWh in Paise	79	79	79	79	79	79
Total Charges per kWh in Paise	284	294	288	283	277	271
Discounting Factor (Rate=12%)	1.00	0.89	0.80	0.71	0.64	0.57
Levelised Cost/kWh (In Paise)						
Levelised Fixed Charges per kWh in Paise	179					
Levelised Variable Charges per kWh in Paise	79					
Levelised Total Charges per kWh in Paise	257					
Tariff for Merchant Power Plant						
Merchant Power Tariff as a % CERC Tariff	115%	115%	115%	115%	115%	110%
Total Charges per kWh in Paise	326	338	332	325	319	299

Note: Not all periods of the Project Time-Line shown

It should be noted that the figures of "Return on Equity", Interest on Working Capital, Depreciation, etc., in the tariff calculation above are based on CERC norms. Similarly, the operating efficiency norms such as plant load factor, etc. are based on these guidelines. As discussed, in case the actual expenses or operating parameters are better, the actual return on equity earned can be higher than that allowed as per the norms. There is nothing wrong in this as it creates incentives for achieving higher levels of efficiency in operations, provided of course that the norms are realistic. As a last illustration for this chapter, the cash flow projections for the power generating plant used for the earlier illustrations are shown below. Again, the key point is that barring one or two additional line items like change in working capital, the standard cash flow structure from the Sample Financial Model can very well be used for power generation projects, as is also the case in other infrastructure sectors.

ILLUSTRATION 7.10

Project Cash Flows and Returns for a Power Plant

Projected Cash Flows (₹ Mn)	1	2	3	4	5	6
Uses of Cash:						
Capital Expenditure Excluding IDC	3,039	8,840	9,332	6,632	0	0
IDC	144	665	1,538	1,684	0	0
Interest Payment	0	0	0	430	2,598	2,598
Loan Repayment	0	0	0	0	0	0
Income Tax Paid	0	0	0	0	0	63
Change in Working Capital	0	0	0	2,198	167	-31
Total Uses of Cash:	3,183	9,505	10,870	10,943	2,765	2,630
Sources of Cash:						
Cash From Operations – OPBDIT	0	0	0	1,044	6,503	6,313
Loan Taken	2,228	6,653	7,609	5,821	0	0
Working Capital Borrowing	0	0	0	1,648	125	-23
Sources of Cash Excluding Equity:	2,228	6,653	7,609	8,513	6,629	6,290
Equity Cash Flows (Balancing):	-955	-2,851	-3,261	-2,431	3,864	3,660
Equity IRR (Post-Tax)	16.1%					
Project Cash Flows (Post-Tax)	-3,039	-8,840	-9,332	-5,588	6,503	6,250
Project IRR (Post-Tax)	14.1%					

Note: Not all periods of the Project Time-Line shown

APPENDIX A

Use of the CD

The CD contains the following three folders:

1. Excel Functions
2. Illustrations
3. Sample Financial Model

The first folder contains a note on essential Excel functions for financial models (Word file *Note_Excel_Functions.docx*, 28 pages as formatted). Developers who require a better grasp of such functions may use this note for reference, printing the file required. The soft copies of the illustrations used in this note are also provided as Excel files, with the file name containing the illustration label A1, A2, etc. as used in the note.

The second folder contains soft copies of all the numerical illustrations used in the main text as Excel files, with sub-folders named according to the chapter where the illustration occurs. The files in these sub-folders are Excel files of the relevant illustrations with the file name indicating the numbering of such illustrations in the main text. Both Excel 97-2003 and Excel 2007 versions are provided.

The third folder contains soft copies of the ***Sample Financial Model*** used for illustration in the text. Both Excel 97-2003 and Excel 2007 versions are provided. Readers using the soft copy of the ***Sample Financial Model Sample Financial Model*** should go through instructions provided on the "Index" worksheet and in particular take care to enable the macro for interest during construction. The macro should be run using "Ctrl+A" whenever required because of changes in assumptions used.

APPENDIX B

References

The following list is illustrative of (a) Papers/Articles found useful by the author; and (b) Documents of the type that typically impinge on a transaction in the ***PPP/Project Finance Context***. It is by no means a comprehensive reading list. Nor to be considered compulsory reading for all readers. For interested readers seeking higher levels or skill or mastery with regard to financial modelling in the PPP/Project Finance Context, Appendix-D that follows is also recommended as some of the following are in any case available on the Internet.

Caveat: The caveats listed in Appendix-D also apply to this Appendix-C, albeit only as a protection against a much lower risk, given that the author has personally gone through the documents provided in the list of references below, unlike the dynamic and vast content accessible through the Internet web-sites listed in Appendix-C.

1. Aldridge Stephen, Fresh fields, *Financial Management*, June 2003
2. Anderson, Gary A, Barber, Joel R and Keys, James D, The Net Present Value Rate of Return: An Integration of the NPV and Expected Rate of Return of a project, Florida International University, Miami, paper submitted for the annual meeting of the Southern Finance Association, November 17-20, 2004
3. Blaustein, Richard, *Eliminating Risks in Spreadsheets, Analytic Solutions* (http://www.analyticsolution.com), 2008
4. Brearley, Richard A. & Myers, Stewart C., *Principles of Corporate Finance*, 6th edition (2000), Tata McGraw-Hill Publishing Company Limited, New Delhi
5. Central Electricity Regulatory Commission (CERC), Terms and Conditions of Tariff Regulations, 2009[1]
6. Damodaran, Aswath, lecture notes on www.ster.nyu.edu.
7. Institute of Chartered Accountants of India (ICAI), Accounting Standard 22 (AS-22): Accounting for Taxes on Income, issued 2001.

[1]With reference to Section 7.4.

8. Institute of Chartered Accountants of India (ICAI), Accounting Standard 9 (AS-9): Revenue Recognition, issued 1985
9. Institute of Chartered Accountants of India (ICAI), Accounting Standards Interpretation (ASI) 3 (Revised): Accounting for Taxes on Income in the situations of Tax Holiday under Sections 80-IA and 80-IB of the Income Tax Act, 1961, as revised in 2005
10. Institute of Chartered Accountants of India (ICAI), Exposure Draft Guidance Note on Accounting for Service Concession Agreements, 2008
11. Gazette of India, Government of India (GoI), National Highways Fee (Determination of Rates and Collection) Rules, 2008 issued under Section 9 of the National Highways Act, 1956, and effective from Financial Year ending March 31st, 2009, with base rates for the Financial Year ending March 31st, 2008
12. Ghersi, Henrique & Sabal, Jaime, *An Introduction to Project Finance in Emerging Markets*, March 2006
13. Joshi, Piyush, –*Law Relating to Infrastructure Projects*, 2nd edition (2003), LexisNexis (a division of Reed Elsvier India Private Limited), First Reprint (2009)[2]
14. Lynch, Penelope A., *Financial Modelling for Project Finance*, Euromoney Publications Plc, London
15. Ministry of Road Transport and Highways, GoI, Guidelines for Investment in Road Sector
16. Kelleher, John C. & MacCormack Justin J., –*Internal Rate of Return: A Cautionary Tale*, The McKinsey Quarterly, McKinsey & Company, August 2004
17. Planning Commission, GoI, –Approach to Regulation: Issues and Options, Consultation Paper, August 2006
18. Raghunathan V., –*Stock Exchanges and Investments*, 2nd edition (1994), Tata McGraw-Hill Publishing Company Limited, New Delhi
19. Savvakis C. Savvides, –*Risk Analysis in Investment Appraisal, Project Appraisal*, Volume 9, Number 1, March 1994

[2]The first edition of this book was published in 2001 by Butterworths, India. The second edition referred is an expanded version with two additional sector-specific chapters covering Natural Gas and Ports in addition to sector-specific chapters on Electricity, Telecommunications, National Highways and Roads, Water and Airports also found in the first edition.

APPENDIX C

List of Useful Web-Sites

Caveat: The following list of web-sites is indicative and provided to give an average reader some flavour of the entities involved in PPP/Project Finance transactions in India. The author neither claims nor implies any responsibility for content on these web-sites and cannot be held liable for any action based on such content. Note: Some entities are shown in a smaller font size only for the sake of uniformity within the lists. This does not in any manner reflect importance (or lack thereof). By and large, the list entries are arranged alphabetically within each category i.e. categories (a) to (k) below.

Category (a): General

India national portal
http://www.india.gov.in/

PPP in India
http://www.pppinindia.com/

Public-Private Infrastructure Advisory Facility (PPIAF)
http://www.ppiaf.org/ppiaf/

PPP (HM Treasury, United Kingdom)
http://www.hm-treasury.gov.uk/ppp_index.htm

Category (b): Ministries & Statutory Bodies[3] of GoI

Airports Authority of India
http://www.aai.aero/

[3]The term "Statutory Body" means entities set up and operating under specific Acts of the Indian Parliament as opposed to Government owned PSU's set up under the umbrella act for corporate entities regardless of ownership, i.e. the Companies Act. As such, regulators may also be considered statutory bodies but have been shown separately for convenience.

Central Electricity Authority
http://www.cercind.gov.in/

Central Road Research Institute of India (CRRI)
http://www.crridom.gov.in/

Central Water Commission
http://www.cwc.nic.in/

Chennai Port Trust
http://www.chennaiport.gov.in/

Department of Telecommunications
http://www.dot.gov.in/
(Ministry of Communications and Information Technology)

Directorate General of Civil Aviation
http://www.dgca.gov.in/

Indian Ports Association
http://www.ipa.nic.in/

Jawaharlal Nehru Port Trust
http://www.jnport.com/

Kolkata Port Trust
http://www.kolkataporttrust.gov.in/

Ministry of Civil Aviation
http://civilaviation.nic.in/

Ministry of Power
http://www.powermin.nic.in/

Ministry of Renewable Energy
http://www.mnre.gov.in/

Ministry of Road Transport and Highways[4]
http://morth.nic.in/

[4]At some time, this has also been a Department under a larger Ministry of Shipping, Road Transport & Highways, with the other Department being Shipping. As a Ministry, it has two Wings - "Roads" (essentially the National Highways network, along with NHAI) and "Transport". (see following footnote)

Department of Shipping, Ministry of Shipping, Road Transport & Highways[5]
http://india.gov.in/sectors/transport/ministry_shipping.php

Mumbai Port Trust
http://mumbaiport.gov.in/

National Highways Authority of India
http://www.nhai.org/

Planning Commission
http://planningcommission.gov.in/

Secretariat for Infrastructure, Planning Commission
http://infrastructure.gov.in/

Reserve Bank of India (RBI)
http://www.rbi.org.in/

Category (c): Public Sector Unit (PSU) - GoI

Ennore Port Limited
http://www.ennoreport.gov.in/

Housing & Urban Development Corporation (HUDCO)
http://www.hudco.org/
(Under administrative control of the Ministry of Urban Development)

IREDA[6]
http://www.ireda.gov.in/
(Under administrative control of the Ministry of New and Renewable Energy)

India Infrastructure Finance Corporation Limited (IIFCL)
http://www.iifcl.org/
(Under administrative control of the Ministry of Finance)

NHPC[7] *Limited*
http://www.nhpcindia.com/

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[5]The web-site remains accessible at the time of writing, with re-direction to the Ministry of Road Transport and Highways web-site listed above.

[6]Indian Renewable Energy Development Agency, a limited company under the administrative control of the Ministry of Renewable Energy, GoI.

[7]National Hydro-Electric Power Corporation, under administrative control of the Ministry of Power, GoI.

NTPC[8] Limited
https://www.ntpc.co.in/

Power Finance Corporation Limited[9]
Some of the PSUs such as IREDA and PFC are also non banking finance companies (NBFCs) focussed on financing of specific infrastructure sectors. As such, though these are subject to regulation by the Reserve Bank of India, the prudential norms applicable to other NBFCs are not applicable as the RBI has allowed these norms to be modified by the Board of NBFCs owned by the GoI.
http://www.pfc.gov.in/

PGCIL[10]
https://www.powergridindia.com/PGCIL_NEW/home.aspx

PTC[11] India Limited
http://www.ptcindia.com/
(The five PSU's listed above are under administrative control of the Ministry of Power)

Rail Vikas Nigam Limited (RVNL)
http://www.rvnl.org/

Category (d): Ministries/Departments & Statutory Bodies of State Governments[12]

Gujarat Infrastructure Development Board (GIDB)
http://www.gidb.org/

Punjab Infrastructure Development Board
http://www.pidb.org/

Infrastructure Development Department, Karnataka
http://www.idd.kar.nic.in/

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[8]National Thermal Power Corporation, under administrative control of the Ministry of Power, GoI

[9]Some of the PSUs such as IREDA and PFC are also non banking finance companies (NBFCs) focussed on financing of specific infrastructure sectors. As such, though these are subject to regulation by the Reserve Bank of India, the prudential norms applicable to other NBFCs are not applicable as the RBI has allowed these norms to be modified by the Board of NBFCs owned by the GoI.

[10]Power Grid Corporation of India Limited

[11]Formerly Power Trading Corporation

[12]Many State Governments have PPP cells with separate web-sites.

Category (e): PSU (State Government)[13]

Gujarat State Road Development Corporation (GSRDC)
http://www.gsrdc.com/

Infrastructure Development Corporation of Karnataka (iDECK) Ltd.
http://www.ideck.net/

Maharashtra State Road Development Corporation (MSRDC)
http://www.msrdc.org/

Project Development Company of Rajasthan Ltd. (PDCOR)
http://www.pdcor.com/

Road Infrastructure Development Company of Rajasthan Ltd. (RIDCOR)
http://www.ridcor.in/

Tamil Nadu Road Development Corporation Ltd.
http://www.tnrdc.com/

Category (f): Regulators (Central)

Airports Economic Regulatory Authority of India
http://aera.gov.in/

Central Electricity Regulatory Commission
http://www.cercind.gov.in/

Petroleum & Natural Gas Regulatory Board
http://www.pngrb.gov.in/

Securities & Exchange Board of India
http://www.sebi.gov.in/

Tariff Authority for Major Ports
http://www.tariffauthority.gov.in/

Telecom Regulatory Authority of India
http://www.trai.gov.in/

Category (g): Regulators (State)

Delhi Electricity Regulatory Commission
http://www.derc.gov.in/

[13] Some are joint ventures with financial institutions/companies such as IL&FS and IDFC.

Gujarat Maritime Board
http://www.gmbports.org/

Category (h): SPVs in Infrastructure Sectors

Airports

Bangalore International Airport Limited (BIAL)
http://www.bengaluruairport.com/portal/page/portal/BIAL_PageGroup/BIAL_HOME

Cochin International Airport Limited (CIAL)
http://www.cochin-airport.in

Delhi International Airport Limited (DIAL)
http://www.newdelhiairport.in/traveller.aspx

GMR Hyderabad International Airport (P) Limited (GHIAL)
http://www.hyderabad.aero/traveller.aspx

Kannur International Airport Limited (KIAL)[14]
http://www.kannurairport.org

Ports/Special Economic Zones (SEZ)

Chennai Container Terminal Limited[15]
http://www.dpworldchennai.com/
(Now called DP World Chennai after the acquisition of the original promoter/sponsor P&O by Dubai Ports (DP) in 2006)

Nhava Sheva International Container Terminal Limited
http://70.40.216.149/dpworldmumbai/
(Now called DP World Nhava Sheva after the acquisition of P&O by Dubai Ports in 2006)

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[14] Company incorporated by the State Government – no private participation in the SPV at the time of writing. Induction of a private party through bidding for the implementation of the project is envisaged.

[15] It may be noted that this is first container terminal in India - The container terminal operated by Chennai Port Trust was the first dedicated container terminal to become operational in India in 1983. The existing SPV resulted from the taking over the existing container terminal taken over by P&O in 2001. There is now another container terminal at Chennai being developed as a joint venture of the Port of Singapore Authority (PSA) and Sical Logistics Limited.

Mundra Port and SEZ Limited
http://www.portofmundra.com/

Rail

Pipavav Rail Corporation Limited
http://www.pipavavrailway.com/

Kutch Railway Company Limited
http://www.kutchrail.org/

Roads

Delhi Gurgaon Super Connectivity Limited
http://dgexpressway.com/

Noida Toll Bridge Company Limited (NTBCL)
http://www.ntbcl.com/index.aspx

Power[16]

BSES Rajdhani Power Limited[17]
http://www.bsesdelhi.com/index.html

North Delhi Power Limited (NDPL)
http://www.ndplonline.com/

Sasan Power Limited (UMPP)
http://www.reliancepower.co.in/

Torrent Power AEC Limited
http://www.torrentpower.com/

Gujarat Coastal Power Limited
http://www.tatapower.com/

Category (i): Industry Groups

Independent Power Producers Association of India (IPPAI)
http://www.ippai.org/

Cellular Operators Association of India (COAI)
http://www.coai.com/

Category (j): Others

Infrastructure Development Finance Corporation Ltd. (IDFC)
http://www.idfc.com/

Infrastructure Leasing & Financial Services (IL&FS) Limited
http://www.ilfsindia.com/

Tamil Nadu Urban Development Fund (TNUDF)
http://www.tnudf.com/index.asp

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About the Author

BACKGROUND & EDUCATION

Born in Darjeeling in 1970, Prabuddha[1] (prabuddkd@gmail.com) attended a number of schools during his early childhood, before settling down at the age of ten in a school in Jamshedpur, an industrial town located about 250 kilometres from Kolkata. He passed the Indian Certificate of Secondary Education (ICSE) and Indian School Certificate (ISC) examinations from the same school, topping his school batch in ICSE (1987) and obtaining a rank on the All India Merit List for English in ISC (1989) with a score of 95% in the subject (94% in ICSE). In terms of higher education, Prabuddha holds a Bachelor's degree with Honours in Economics from St. Xavier's College, Kolkata (1992) and a Post Graduate Diploma in Management from the Indian Institute of Management, Ahmedabad (IIMA, 1994).

WORK EXPERIENCE

After passing out of IIMA, Prabuddha worked with Ashima Syntex, CRISIL, PricewaterhouseCoopers (PwC) and IL&FS Infrastructure Development Corporation Limited (IIDC), focussing on infrastructure development and financing since early 1998 after initial stints in corporate finance and credit rating. During this period (1998 to 2009), he worked on over fifty (50) consulting and Public-Private-Partnership (PPP) project development

[1]This unusual name, rare even among Bengalis with their penchant for unusual names, means "(the) truly (from *Prakrit*, *Sanskrit*) "wise" (from *Buddha* or *Bodh* (awareness), Sanskrit). The name was chosen by his maternal uncle (*Mama*) as one borne by one of *Mama*'s Economics professors at the Calcutta University in the 1970's – even the author was privileged to meet the gentleman who inspired his name when he enrolled for a degree in Economics at the Calcutta University in 1989. Prabuddha strives to live up to the name to the best of his abilities. As such, choices were limited by family tradition (see footnote number 2).

assignments across various infrastructure sectors like roads, ports, airports, power generation/transmission, Special Economic Zones (SEZs) and urban infrastructure including water supply and real estate. Since March 2010, Prabuddha has been a freelance consultant and trainer in the PPP/ Project Finance/Infrastructure domain, with a focus on his functional core competence, that is financial modelling and analysis.

EXPERIENCE AND INTEREST IN ACADEMICS AND TRAINING

Prabuddha has acted as visiting faculty at various management schools, including a full-credit second year course on 'Financial Markets' at XLRI, Jamshedpur. He has also been a guest speaker at various seminars and conducted a number of training sessions on financial modelling as well as various aspects of infrastructure development and PPP, both within entities where he has been employed and outside these entities. Prabuddha's experience as a trainer in the PPP/Project Finance/infrastructure domain as well as financial modelling in that domain covers sessions/programs organised by CRISIL's training arm, the United States Agency for International Development, the Indian Institute of Port Management, Kolkata, the National Construction Council of Zambia, the Lal Bahadur Shastri National Academy of Administration, Dehradun, Amity University, etc. He may be contacted at his e-mail address (given above) for conducting corporate training programs on financial modelling for PPP/Project Finance.

PERSONAL AND FAMILY LIFE, INTERESTS & HOBBIES

Prabuddha is married to Arpita, an Information Technology professional. They have two sons Prabhanu (born 2001) and Pramit[2] (born 2003) and live in New Delhi. Apart from his professional interests, Prabuddha is passionate about mountains, trekking, scale models, automobiles, paragliding and maintenance/modification of his 1986 Yamaha RD350 motorcycle. Besides being an avid reader since childhood, Prabuddha has also taken up photography as a hobby in recent years.

[1]Incidentally, Prabhanu (meaning *mid-day sun*) and Pramit (meaning (the) true friend) represent the fourth generation in the author's family to bear names commencing with the letters P, R and A in the English alphabet - Prabuddha's father (an electrical engineer) and grandfather (a school teacher) having been named Prabir (meaning (the) *truly brave*) and Pran (meaning *life*) respectively.