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Finance for the Oil and Gas Industry

Ken Brown

Peter Moles

Kathryn Vagneur

Craig Robinson

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Edinburgh Business School
Heriot-Watt University
Edinburgh
EH14 4AS
United Kingdom

Tel + 44 (0) 131 451 3090
Fax + 44 (0) 131 451 3002
Email enquiries@ebs.hw.ac.uk
Website www.ebsglobal.net

Finance for the Oil and Gas Industry

Ken Brown MA MSc

Ken Brown, MA Econ (Hons), MSc International Banking and Financial Studies, is a Finance lecturer in EBS, having previously worked as a Finance lecturer in the Department of Accountancy and Finance at Heriot-Watt University. His main area of interest is mergers and acquisitions and he has contributed to publications on acquisitions.

Dr. Peter Moles MA, MBA, PhD

Peter Moles is on the faculty of the University of Edinburgh Business School. He took up this post following a career in the City in the international capital markets working for a number of banks, latterly for Chase Investment Bank. His responsibilities included the consultative selling of financial products, customer-related roles in product management, origination, trading, and corporate advisory. His last major post at Chase was as eurobond syndicate manager. His main research interests are in risk management, principally financial risk management, including foreign exchange management problems and the management of financial distress. He has an interest in how management decisions are made and the issues associated with managing complex problems. Training assignments have included KPMG programme, WM Company, NatWest Markets, the Advanced Management Programme in Scotland (AMPS), and Capital Markets training for PBG Bank, Lodz, Poland. He is the principal author of the *Handbook of International Financial Terms*and has written two textbooks: *Financial Risk Management* and *Derivatives*. He also wrote the financial evaluation modules for the mergers and acquisitions course. He is currently engaged in editing an encyclopedia of financial engineering and risk management.

Dr. Kathryn Vagneur BSc, MSc, PhD, CPA

Dr. Kathryn Vagneur manages a private investment portfolio in London. Previously, she was a director with PricewaterhouseCoopers.

Craig Robinson BA(Hons), MBA

Craig Robinson is a Teaching Fellow at EBS. Prior to joining academia, Craig spent some years working as a business manager for a Fortune 500 company at various locations across the UK, managing an average turnover of £2m per year. He teaches the on-campus *Economics* sessions and is involved with the *Quantitative Methods* elective. He is currently engaged in research on strategic planning in the oil and gas industry.

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Contents

Module 1

Introduction and the Tools of Finance

Contents

Craig Robinson

Learning Objectives

This module introduces the course and provides an overview of the content to come. As managers in the oil and gas industry students need to have a good working knowledge of finance which was introduced in the core *Finance* course and will be built upon over the next 13 modules. This second course is intended to enhance the students' portfolio of financial concepts and provide industry-specific examples where the concepts covered in this course and in core *Finance* are applied to oil and gas industry situations.

When you have completed this module you should be able to:

- describe the oil and gas industry as defined for the purposes of this course;
- describe financial management in the oil and gas industry in terms of the three major decision areas that confront the financial manager, namely;
  - the investment decision
  - the financing decision
  - the dividend decision
- describe the purpose and make-up of financial markets and how the oil companies use the markets;
- describe the various financial instruments that oil companies can use on the capital markets;
- understand the underlying principles of finance;
- understand how and when to use the tools of financial arithmetic;
- understand how these concepts and tools are applied in making financial decisions.

1.1 Introduction

In February 2008 BP announced that they had increased their oil price assumptions for investment appraisal over the next five years from $40 to $60 per barrel. Over the next twelve months the price of oil rose to a peak of $147 in July 2008, and by January 2009 had fallen to under $40. In May the same year EnCana, the Canadian oil company, announced that it was to split in two. On the announcement of the split, the company's share price rose by 8%.

There are financial issues at the heart of both these events, and it is useful for a manager within the oil and gas industry to have an understanding of how and why these things happened. This is what will be covered in the *Finance for the Oil and Gas Industry* course. Each module takes concepts covered in the core course and brings in new theories and concepts that are essential to a better understanding of finance. This is enhanced by using industry-specific examples to put financial theory in the context of the oil and gas industry.

Over the course of this module we will examine the oil and gas industry in general, and then look briefly at the material contained within each of the following modules. We will also examine the three major decision areas in finance in the context of the oil and gas industry and look at the financial system in general. This will be followed by a brief review of the basic tools of finance.

1.2 Defining the Industry

In order to present a course on the oil and gas industry, we must first define it. Companies operating in the industry are heterogeneous, ranging from large integrated companies such as Exxon-Mobil and Royal Dutch Shell, to small exploration and production companies like Cairn Energy. Each company faces some financial considerations that are the same throughout the industry, and some that are specific to the area of the industry in which it operates. For example Shell has to deal with international finance on a daily basis with operations across the globe. Cairn Energy also has to deal with international finance, but on a different scale as its operations are focused in specific geographic areas and parts of the supply chain.

Another company that operates within the industry but has a different focus is Centrica, formerly part of British Gas. Centrica is a large integrated company like Exxon, but produces and sells only gas. This creates a different set of decisions facing the company, yet it operates in the same industry as Exxon, Shell and Cairn.

By examining the oil and gas industry supply chain, we can build up a picture of the industry as a whole and better see the differences between companies like those mentioned above. The following description may not be completely accurate from an engineering viewpoint, but from a business point of view it is possible to separate the industry into its component business activities, as is depicted in Figure 1.1. Some of the companies within the industry operate the entire length and breadth of the chain, while others choose to operate in only one or two of the sectors.

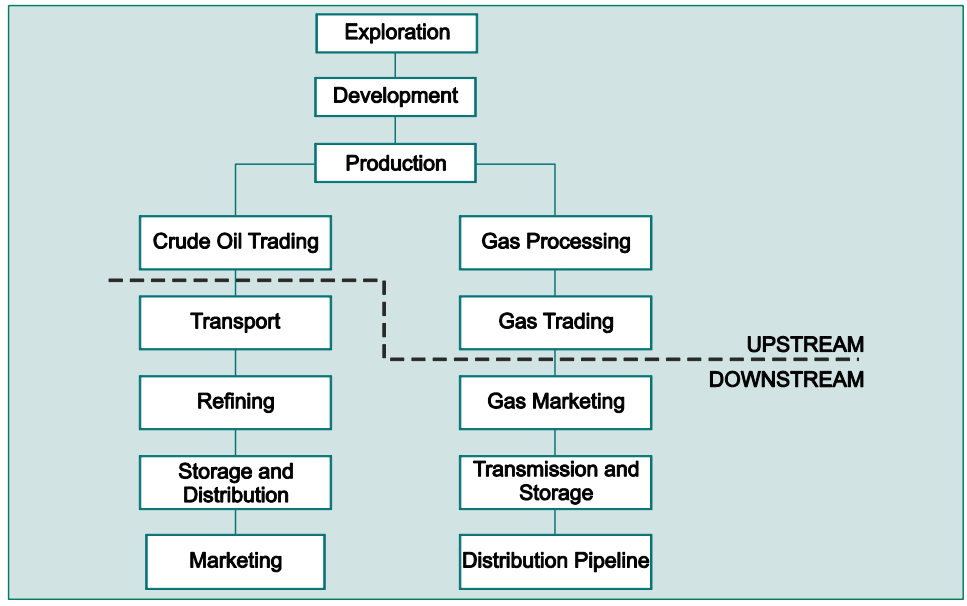

Figure 1.1 The oil and gas industry supply chain

1.2.1 The Upstream Industry

The oil and gas industry can be broken into two distinct sub-sections, the upstream and downstream. Some oil and gas companies also refer to the "midstream" industry, involving transport and storage, but for our purposes this is not a meaningful distinction. Below is a brief discussion of each section of the upstream supply chain in terms of financial management:

- **Exploration** by its nature is a speculative activity which involves a high degree of investment risk. Also companies supplying exploration services to the industry face a high degree of commodity price risk, and cyclical downturns in the price of oil and gas have a severe effect on both the level of activity and the level of research and development in this sector.
- **Development** of a new oil and/or gas field requires a great deal of up-front investment and again is an activity characterised by high commodity price risk. If a company is developing a new field, and has conducted an investment appraisal with an oil price assumption of $60 per barrel, and the price falls to $40 per barrel and remains at that level over the life of the project, then the investment may no longer have a positive NPV. Does the company hedge against this? Do they lock in to sell their oil at a particular price, or do they leave themselves open to changes in the price of oil? Sensitivity analysis and the correct investment appraisal techniques are also important at this stage. Real options, which are touched upon in the core Finance course, are also a useful tool for valuing options open to the company and will be examined in more depth in this course.
- **Production** involves getting the oil or gas out of the ground. Real options become very important at this stage; should the company invest in secondary recovery technology and continue to produce from a declining well, or should they abandon the project? How valuable is this option to abandon the well? These are all important questions that can be answered with financial tools. At this point the supply chain splits into oil and natural gas.

- **Crude Trading** involves the trading of crude oil on the world's commodity exchanges. It is at this point that the product is converted into cash and a working knowledge of the derivatives product set is essential for anyone trying to understand what happens at this point in the chain.
- **Gas Processing** needs to take place before the gas can be traded as a commodity. Financial considerations here include investment appraisal and real options. This activity is included as part of the upstream industry as it is a necessary prerequisite to gas being traded.
- **Gas Trading** operates on the world's commodity exchanges and the financial considerations are similar to those under crude trading.

The upstream industry is inherently more risky than the downstream industry, and is subject to a higher degree of commodity price risk. Why is this? Because it is here that the raw materials are produced, and it is this part of the industry supply chain that relies on the revenue from the trading activity to operate. Another factor that is not explicitly a financial consideration, but will impact on financial decision making in the oil and gas industry is that upstream activities are often far from the company's headquarters and in politically unstable areas. This introduces a further degree of risk, and makes effective risk management an important financial activity within any oil and gas company. The degree of risk in the upstream industry will also have an impact on financing and dividend decisions.

1.2.2 The Downstream Industry

The downstream can be considered a separate industry to the upstream. It will become clear that financial considerations in this part of the chain are different to those at the top. Also, while activities for gas and oil are similar until they are extracted, the downstream industry can be split into two distinct chains – downstream oil and downstream gas.

1.2.2.1 Downstream Oil

These activities take crude oil from the upstream industry and convert it into marketable products. These products are then sold through various different channels to industrial, business and retail customers.

- **Transport** involves various different methods of operation. Oil can be transported by ship or by pipeline, and financial considerations differ depending on the type of transportation used. For transportation by tanker the most immediate risk is to reputation, as oil spills have an extremely bad effect on the local environment. There are also investment appraisal considerations at this level as the building of a 32 000DWT vessel is a very large and long-term investment. Commodity price risk is high in the tanker market as shipping rates are seasonal, and cyclical with the price of crude oil. Pipeline operators face a similar financial environment.
- **Refining** is mass production characterised by complex engineering processes. The price of refinery output is influenced by the price of refinery input – crude oil. Looking at BP's historical refining margins over the past few years reveal that margins were higher in the third quarter of 2007, when the price of oil was $45, than in the third quarter of 2008 when the oil price averaged $108 per barrel, and hit an all time high of $147. Refining margins are also seasonal but are less subject to swings in the price of oil. Refining petroleum products produces reasonable steady returns quite unlike the upstream industry.

This means that investment appraisal is not as complex and that commodity price risk is less of a concern. However for a company that engages in this activity only, derivatives and hedging of the oil price can be a big issue.

- **Storage and Distribution** requires that companies have to consider the cost of holding supplies. This is not a value generating activity but financial considerations such as lease vs. buy decisions on a fleet of tanker trucks and on storage facilities are necessary. Good management of working capital is also paramount.
- **Marketing** involves selling the refined petroleum products to the end customers. Financial decision to be made here include investment appraisal, lease vs. buy decisions on sites and real options for expansion into new areas. Customers at this end of the chain are diverse, and will be explored more in the *Strategic Planning for the Oil and Gas Industry* course.

The downstream oil industry is less risky than the upstream oil industry, and different financial considerations apply. Financing and dividend policy will involve different considerations to the upstream industry. The same can be said of the downstream gas industry, which we now turn to.

1.2.2.2 Downstream Gas

Due to the nature of the product (gas vs. liquid) the downstream gas industry involves different activities to the downstream oil industry. The fact that the gas has to move through pipelines to the end consumer means that a company that merely sells gas to consumers has little scope for high financial returns.

- **Gas Marketing** involves companies selling gas to retail, business and industrial end consumers. These companies purchase gas on commodities exchanges and then sell it on. They often purchase products months ahead through forward contracts, so a good knowledge of the derivatives product set is again useful for a financial manager here. Companies here are subject to considerable commodity price risk.
- **Transmission** is done through large cross-country pipelines that operate under very high pressure. These pipelines serve gas fired power stations and distribution networks that take the gas to business and retail customers. Financial considerations here include using the correct investment appraisal techniques and real options for abandonment and expansion. In the UK the transmission pipeline network is owned by National Grid.
- **Distribution** involves smaller networks that take gas to homes and businesses, and financial considerations here are likely to be similar to those at the transmission stage.

Companies in this part of the industry can generally rely on stable returns and a locked in customer base. This impacts financing and dividend policy as well as the other areas listed above.

1.2.3 The Definitive Guide to the Oil and Gas Industry?

This course does not purport to be an engineering manual and in some cases the division between the activities described above are opaque. Further there are areas of the industry that have not been explicitly acknowledged, such as petrochemical production and liquefied natural gas. These share similar characteristics to other parts of the chain and therefore do not require separate consideration. There are further parts to the supply chain that will not

be considered in this course, such as electricity generation and lubricant sales. We will draw the line around the industry as presented above and can now turn to the topics to be covered through the rest of this course.

1.3 *Finance for the Oil and Gas Industry* – An Overview

So far we have discussed the rationale behind this course and defined the industry as we will be looking at it. The next task is to provide the reader with an overview of the topics to be covered through the rest of the course. Each module builds upon concepts in the core Finance course and provides new financial tools for the manager in the oil and gas industry. Also examples from the industry are provided to put theory in context.

Module 1 provides an overview of the industry and also refreshes the reader with the workings of the financial system and the basic tools of finance. This sets the scene for the rest of the course.

Module 2 covers corporate governance issues and agency problems. Agency problems were covered briefly in core *Finance* and are discussed in more detail here. Corporate governance refers to the set of mechanisms that oversee and regulate human behaviour within organisations and within subgroups in those organisations and will be explored in more depth. Misaligned interests within oil and gas companies have caused problems in the past, and are likely to in the future. The Shell reserves reporting scandal of 2004 is just one example of where better governance structures could have averted a large scale financial disaster for the company.

Module 3 looks at interest rates and debt in more detail, and aims to provide the reader with a better understanding of the factors that influence the level of interest rates, and the effect that changes in these rates can have on the value of financial assets. Theories of interest rate determination will be introduced and the operating implications for oil and gas companies considered. The different types of debt securities that an oil and gas company can issue will be discussed. Managers in the oil and gas industry need to understand interest rates to make them more aware of outside influences that can affect the financial performance of their company.

Module 4 is concerned with capital budgeting in an oil and gas industry context. Concepts covered in core *Finance* will be reviewed and expanded upon. Sensitivity analysis will be examined as a key activity in determining the viability of a project in the oil and gas industry, and capital rationing within oil and gas companies will be studied. Managers in the industry need to understand the industry-specific complexities in valuing oil and gas projects. The BP example at the start of this chapter highlights this need.

Module 5 is concerned with company valuation techniques. These concepts are new but some of the techniques used will be familiar. It is necessary for managers in the oil and gas industry to understand the different methods of company valuation, and their respective advantages and disadvantages in order to better approach acquisitions and mergers. The oil and gas industry is often characterised by large companies acquiring small companies that have developed some valuable asset or knowledge. Through knowledge of the different methods of company valuation, managers can make better decisions in this important field. Real options are introduced in this module and options theory is expanded on later on in the course.

Module 6 deals with international finance, and places a particular emphasis on currency risk. Oil and gas companies often operate in diverse geographical areas and deal with a diverse range of contractors and subcontractors. This is complicated by the number of different currencies involved. Should the company hedge its currency exposure? What influences fluctuations in exchange rates? The manager in the oil and gas industry will be able to answer these questions and more after working through this module.

Module 7 addresses equity and commodity price risk in detail. The sources and types of risk relating to equity will be explored. The difference between equity as an asset and commodity assets which are consumable will be explored, along with some general determinants of commodity prices. The oil price itself will be dealt with in depth in the *Strategic Planning for the Oil and Gas Industry*.

Module 8 concerns payout policy; what does a company do when it has spare cash? What are the best ways to return this to shareholders? What is peculiar about oil and gas industry payout policy? This module will also delve further into the information content of dividends, and some of the reasons why an oil company may wish to have a low payout policy. This knowledge will be an asset to the oil and gas industry manager who has to understand the reasoning behind and make decisions on dividend and payout policy.

Module 9 covers capital structure in more detail. Some concepts from core *Finance* will be reviewed and the area of financial distress will be explored in more depth. Agency conflicts will be discussed in terms of the oil and gas industry, and management of financial distress will be addressed. A good knowledge and understanding of this area is particularly important to the oil and gas industry manager after the credit crisis of 2008-9 and the concurrent drastic fall in the price of oil left many smaller oil and gas companies in a situation where they were unable to meet their interest payments. Oilexco North Sea, a wholly owned subsidiary of Canadian exploration company Oilexco, went into administration in January 2009 when they were unable to secure funding for their operations.

Modules 10–13 are a series of four modules that look at derivatives in more depth. Derivatives were addressed first in the final module of core Finance and the theory behind them is expanded on here. Many students have difficulty in understanding the different types of derivatives in the product set and their various uses, and this is the focus of the final modules. Modules 10 and 11 provide an introduction to forwards, futures, swaps and options and their various uses. Module 12 is concerned with options, and Module 13 deals with the Black–Scholes Option Pricing formula, which is needed for real options appraisal. A good understanding of risk management tools and their uses is essential for the oil and gas industry manager wishing to manage the risks highlighted in earlier modules.

This text also includes two pedagogical appendices that deal with financial statements and ratio analysis. These do not contain core items for the course but provide useful background material for the reader who wishes to improve on his or her accounting knowledge. These two appendices are not examinable but may help refresh the readers' memory and provide a helpful reference.

1.4 Financial Decision-Making in the Oil and Gas Industry

There are three main areas of decision-making within finance and every firm, no matter what shape or size, needs to make these decisions. These were presented in the core *Finance* course and will be discussed briefly in terms of the oil and gas industry below:

- **The investment decision** refers to the assessment of how much cash to invest, and what to invest that cash in. This is a difficult decision for oil and gas companies as investments are typically capital intensive and take a number of years to start generating cash. As highlighted in Section 1.2, the investment decision is a particularly difficult one in the upstream industry where cash flows are subject to considerable risk. Therefore a good understanding of sensitivity analysis, sound capital rationing and use of the correct investment appraisal technique are all imperative for the manager in the oil and gas industry.
- **The financing decision** involves deciding where to source cash for investment. Companies have three choices: they can use retained earnings, borrow on capital markets, or sell equity. There are numerous factors affecting this choice which will be explored in Module 9, but for oil and gas industry managers there is a need to be fully conversant in capital structure theory and the advantages and disadvantages of each type of financing. Most of the very large oil and gas companies, such as Exxon, Shell and BP, have a very low level of debt in their balance sheet. Why have they made this decision, when they could easily raise debt at a favourable rate even when credit conditions are poor? The oil and gas industry manager who understands capital structure theory in relation to their industry can answer these questions.
- **The payout decision** is concerned with how to return cash to shareholders, and how much to return to them. This is linked with both the previous decision areas, as an oil and gas company that decides to invest all of its free cash flow and borrow to fund a large project will have little left to return to the shareholders. The shareholders, however, may prefer this and be content with large capital gains due to the investment. The salient point here is that oil and gas industry managers must be aware of the options available to them in payout policy and how these decision affect shareholder wealth

These decisions have to be made by all companies in the oil and gas industry, no matter which part of the chain they operate in. A good working knowledge of the financial concepts involved in the decision-making process is therefore essential to the managers within oil and gas companies.

1.5 The Financial System

What is the financial system? It is the financial markets, the investing financial institutions, the investment banks and commercial banks, the other financial intermediaries, the companies and individuals that use the financial system to borrow and lend, the government, and the financial exchanges; the stock exchanges and derivatives exchanges.

The financial system does not necessarily always function through these financial exchanges. Most transactions in the foreign exchange market are off exchange, or over the counter. The financial system in operation today is global in nature. This is the culmination of a process that has been taking place over the past twenty years. The UK financial markets deregulated in 1986 and this facilitated the growth of London as one of the two global

financial hubs. About 50% of all forex transactions are traded out of London and the global nature of the financial system means that the markets are now closely interlinked. This can be seen with the speed with which the global banking system seized up in the Autumn of 2008 after the bankruptcy of Leman Brothers investment bank.

The global financial system currently operating out of London or New York is able to provide funds to creditworthy companies wherever they are based. The prospects of the company will be assessed by credit analysts, lawyers, accountants and investment bankers will draw up prospectuses that can quickly be put before prospective investors and the company can raise the necessary capital in a very short period of time. London and New York are currently uniquely placed to provide these services. Both financial centres have the critical mass in expertise in all the relevant areas needed to raise these large amounts of capital for large firms. If Exxon wished to issue a $5 billion bond, there are only two financial centres that would be able to achieve that: London and New York.

1.5.1 How Does the Financial System Work?

There needs to be a flow of funds from savers to borrowers, and this is what the financial system facilitates. It collects pools of cash from savers and through the markets or through financial intermediaries the cash is made available to companies to borrow.

Saving can be made by individuals building up a retirement fund. Those individuals have surplus funds that need to find a home where they will earn a reasonable, but safe return. Companies need to raise finance to expand their businesses. The companies can sell financial securities directly to investors (a primary issue) in the form of bonds or stocks, or the investor can buy financial securities on the stock exchange (secondary market) through financial intermediaries.

Often the funds flowing through the financial system don't go through the markets. Commercial banks traditionally raised most of their funds from a depositor base (during the build up to the Credit Crunch many of these banks turned to the inter-bank market for extra funds). Those funds would then be made available to companies as loans (as opposed to bonds which are market instruments). The banks are acting as intermediaries, passing the funds on to the end user.

As mentioned earlier, the banks themselves may raise further funds from the financial markets for lending purposes. The inter-bank market will lend funds to banks, but the borrowing bank will have to repay this money in the short term. As long as this market functions normally the banks can roll-over these inter-bank loans and keep raising finance for corporate borrowers. With the Credit Crunch the inter-bank market ceased to work. The inter-bank market operates as a kind of monitoring device on the participating banks. Banks can see who is operating in the market, who is borrowing and lending and for how much and what rates are being paid. There is a large degree of embedded trust in the market and banks could raise funds at rates very close to the benchmark libor rate (London Inter Bank Offer Rate). With the Credit Crunch the trust broke down. Banks were fearful of being on the wrong side of a deal and the other party would default resulting in a loss exposure. Activity dried up and the borrowing spread over libor ballooned out. Credit dried up. The banks were not lending to each other, so this made it very difficult for companies to borrow directly from the banks.

If companies needed finance but this route of borrowing directly from banks was closed, the alternatives are borrowing from the bond market, or raise equity finance, i.e., sell bonds or sell new shares.

1.5.2 What Are the Functions of the Financial System?

The financial system and the institutions in the financial system have evolved over centuries. Banks are not the same the world over. Banks in Europe will perform different functions to banks in the UK and to banks in the US. Over time and especially since the turn of the century, financial institutions worldwide have become more similar in what they do and how they make money.

It is more important to look at the functions of the financial system rather than to look at the financial institutions. The financial functions are more stable than the financial institutions. The job of collecting savings and disbursing loans remains basically the same as it always has, although the institutions that do that job may have changed over time. That change has been due to the competitive nature of the markets, so that innovation and competition has resulted in greater efficiency of the performance of financial functions.

There are six core functions of the financial system.

1. **Resource transfer across time and space**
   The financial system allows resources to be deployed over different time periods, over different areas of the world and across different industries.
   Buying a house or saving for retirement are examples of shifting resources from different time periods. New businesses might not be able to get started if they could not raise funds from investors.
   Savings can be transferred from one part of the world, where there may be fewer attractive investment opportunities to areas where there are good growth prospects. In the 1970s the petrodollars earned by the Gulf States were saved and deposited in the London financial markets. The funds were then recycled and lent out to areas that showed growth prospects. The funds went to Latin America and the industrialising nations of East Asia. Earlier examples were when UK savings were channelled into building the US railroad infrastructure in the mid nineteenth century. This pattern has been repeated over the years and the latest case of recycling of savers funds is the investment by China in the US government treasuries market. The Chinese now own $1 trillion of US financial assets.
   The financial markets allow savers to benefit by investing in opportunities that offer higher returns. A scarce resource (cash) is made available to businesses that need it to expand, whether this is in UK, Mexico or probably sometime in the near future Iraq.
   The financial system will be efficient in channelling funds to new industries and industries that offer high returns. The financial system is the conduit for transferring these funds; it does not always mean that the transfers are optimal. In the late 1990s there was a colossal amount of investment in the telecoms and internet industries. That level of investment speeds the development of these industries. However, with the internet boom there was overinvestment and much of the invested capital was destroyed.
2. **Risk management**
   The financial system is an efficient mechanism for transferring funds across time, borders and industries, and it is also efficient at transferring risks. Specialist financial institutions such as insurance companies arrange the transfer of risk. Individuals or busi-

nesses can buy protection from downside risk. The insurance they buy has option like qualities (see Modules 10–13). The insurance policy is a put option, you pay a premium to the insurer and if the negative event happens, the insurance company will pay out. The put option is a derivative instrument that increases in value as the underlying asset falls in value. When the insurable event comes about the value of the insured item falls and the party being insured gets the value of the insurance cover.

The insurance companies bundle the risks together so that the cost of the insurance can be as low as possible. It would be too expensive to try and offer insurance outside of the financial system. With the economies of scale and expertise in assessing the risks the insurers can offer an efficient means of offsetting risk. The insurance companies are the party that is taking the risk. They have to pay out if the insurable event happens.

An oil company decides not to insure its facilities on the basis that they think the premiums are too high and the claims they have made in the past have been a fraction of the premiums. The cost of being wrong is surely too high for the oil company. Investors would have to deal with the uncertainty of not knowing when this might blow up on the company. Investors would demand a higher risk premium; the cost of capital would rise for the company. With insurance and the effective risk transfer it brings, investors are reassured.

When lenders lend to a business they are not bearing all the risk. Most companies will have equity investors. The equity investors represent the transfer of some of the risk as far as the debt holders are concerned. If the company gets into financial distress it is the shareholders who bear the risk first. They are the cushion for the debtholders. The debtholders may lose some of their capital, so debtholders share some of the business risk facing the company along with the shareholders.

Lenders can also transfer risk in other ways. If an individual or business borrows from a bank and the bank asks for collateral, then the bank is effectively transferring the risk of the loan back on to the borrower.

3. **Payment clearing and settlement**

   The financial system needs an efficient way for individuals and businesses to settle up their financial transactions. Oil companies operating overseas will have to arrange large numbers of payments for raw materials, to pay wages, to settle contracts, to pay governments. The financial system does this seamlessly. For individuals, travelling on business or pleasure, the ability to take a small piece of plastic and be guaranteed accommodation, transport, food and most other goods and services is a huge source of comfort. That is one of the key functions of the financial system operating quietly in the background, taken for granted. Imagine a country where this payment system was not accepted and there were currency controls and no convertibility of the local currency. The ability to do business efficiently there would break down.

   The efficient functioning of the financial system is dependent on a smoothly operating clearing and settlement system. The adoption of the euro has removed a lot of inefficiency from doing business in Europe. Italians trading with the French no longer have to change lira into francs or worry about the exchange rate. The euro has made trading within Europe much more efficient.

4. **Pooling of resources and creating shares**

   In the early days of the oil and gas industry it was possible for individuals and small businesses to run an oil business. As the industry and the world economy grew, the funds needed to set up oil companies or similar businesses grew beyond the means of

individuals and families. The financial system provides a mechanism for businesses to access the funds necessary to grow these businesses.

Individuals may no longer have the financial ability to fund these ventures, but they can pool together with others (in a stock market) and buy a share in the business.

Suppose you want to buy a house in Monte Carlo, but you don't have the $3m needed to purchase it. You only have $100 000 and you can't buy a thirtieth of the house. The financial system would provide a way. By pooling with others you could raise the $3m and you would have a thirtieth share in the house and would be able to use it for so many days per year.

On the 12th February 2009 the price of Warren Buffet's investment vehicle, Berkshire Hathaway was $88 500 per share. If you want to buy a single share that's how much money you would need. If you only wanted to invest $10 000 in Berkshire Hathaway what could you do? There are pooled investment vehicles; mutual funds (unit trusts) or closed investment funds (investment trusts) that invest significant proportions of their assets in Berkshire Hathaway, so an investor can get exposure that way.

Most companies will subdivide their shares so that investors can buy whatever amount they wish.

5. **Provider of information**

   Financial assets will be accurately priced if all the information about the asset is known about and freely available. The quantity and quality information that financial markets provide has improved dramatically over the past ten years. The quantity of information available for all investors has been due to the progress of the internet. Almost all investors have access to comprehensive information on companies and financial assets. The quality of the financial information may not have improved as much as the quantity, but it is more accessible to more investors. The prices that the financial markets set for assets provide critical signals to managers regarding the success of their strategy.

   Managers, if they know the intrinsic value of their businesses, can take action to remedy undervaluation or overvaluation by the market. If the market appears to be undervaluing the company's shares, managers can take the decision to repurchase shares. This would send a credible signal to the financial markets that the shares were undervalued. This is new information and the share price would be likely to rise on the action

6. **Dealing with conflicts of interest**

   Incentive problems exist in the markets. How much should executives be paid? There is also the problem of asymmetric information, where one party has more information than the other and can take advantage of that situation. There are the problems of adverse selection and perverse incentives. Adverse selection is a situation where asymmetric information plays a role in one party takes a self-interested decision, where, if the information was disclosed they would be denied that choice. An example of this is where a company knows it is facing much higher risk than they are disclosing and attempt to buy insurance on that risk. Or a bank that offered loans without checking on credit histories, once this was known about; the bank would attract borrowers with a higher credit risk.

   Perverse incentives are where the incentives have the opposite effect to that intended. An example was the rat extermination program in India. A bounty was offered for each rat pelt handed in. This led to rats being farmed, so that people could claim the bounty. A finance example would be paying bankers proportionately to the size of the bank. The intention may be to increase the power and profitability of the banks, but as the Credit Crunch has shown, the drive for size has exposed the banks to catastrophic risks.

There is also the problem of moral hazard, where, for example, a party having some insurance cover takes excessive risks or takes fewer precautions against the insured events. These are problems where there is a conflict of interest between the contracting parties.

An efficient financial system eases the problems of moral hazard, adverse selection, principal-agent problems, in order that the benefits of the financial system; pooling of savings, resources transfer, risk sharing and specialisation can be captured.

By backing loans and bonds with collateral, debtholders reduce some of the incentive problems surrounding lending. With secured borrowing the lenders do not have to monitor borrowers so closely, reducing agency costs. Insurance policies with high excesses (deductibles) remove some of the moral hazard. Risky firms who prefer lower excesses will be identified by the insurers and charged higher premiums to reflect this.

Aligning managerial compensation with shareholders interests is something of a holy grail in finance. In the 1970s conglomerate companies in the US were identified as being hugely wasteful in terms of destroying shareholder wealth. Some of these companies were oil companies that had diversified far from their core business. Increasingly since that time investors have sought to remedy this problem. However, over the past thirty years there have been numerous occasions when the remuneration packages that have been put in place fail to align the interests of shareholders and managers. The dot.com bubble and the Credit Crunch exposed unbalanced reward systems where managers seem to take all the upside and suffer very little downside. The latest thinking on managerial incentives is to tie in option and stock grants for the very long term, where executives would be restricted in what stock sales they could make. Some of the points covered in this section will be covered in more detail in Module 2.

1.6 A Review of the Tools of Finance

The last part of this introductory module will be devoted to a review of the tools of finance introduced in the core *Finance* course. This is intended to provide a refresher in a number of basic areas that are integral to the more complex concepts presented later on in the course. The reader should have a solid grasp of these basic concepts before moving on to the more advanced material.

1.6.1 Basic Concepts

- **The Time Value of Money**

  There exists a set of basic mathematical tools that every manager should have a grasp of. Many of these revolve around the principle of the time value of money. This is the assumption that the value of money is dependent on the time at which it is received. Does a company prefer to receive $5000 today, or in five year's time? Clearly $5000 received in five years does not have the same value to an organisation or an individual as $5000 received today. In order to determine the value of the $5000 to be received in the future we need to discount it to its present value. This activity of discounting future cash flows to their present value appears time and again in finance, and is the basis of many more complex financial models. We will return to the process of discounting later.

- **Opportunity Cost**
  Every course of action involves forsaking other courses of action. The opportunity cost of an action is the best alternative foregone. For example, an individual has $100 to invest and has the choice between investing in company A or company B. If he chooses to invest in A, then he gives up the opportunity to invest in B – the investment in company B is his opportunity cost. Opportunity cost is an important concept for decision making purposes and is recognised in finance through the discount rate. All money invested can be left in a bank at a certain rate of interest – this is its opportunity cost. If a particular investment offers a lower rate of return than this interest rate then it is not worth undertaking.
- **Cost of Capital**
  The cost of capital is the return that a capital supplier expects from his or her investment. The capital suppliers can be shareholders or bondholders. Shareholders invest their capital in return for ownership of a piece of the company, and they expect a return on this investment in the form of dividends. Bondholders invest their capital in return for a specified annual payment, or coupon, over a number of years. In addition to this bondholders receive their initial investment, or principal, back when the investment matures. The cost of capital is used to discount cash received in the future to the present time.
- **Expected Return and Risk**
  The higher the risk of an investment, the higher the return must be. Capital suppliers expect to be adequately compensated for the risk they take and risky investments must have high returns. Conversely, low risk projects will have low returns. Risk is discussed in depth in the core Finance course and will be developed as a specific concept in greater depth in the modules to follow.
- **Valuing Financial Securities**
  Financial securities come in two main forms – stocks/shares, and bonds. The rational valuation of a financial asset is the value of all its future cash flows discounted to the present. The cash flows from shares are the dividend payments, and the cash flows from bonds are the annual coupon and principal repayment on maturity. Shares' cash flows are discounted by the company's cost of capital, and bonds are discounted by the set of spot rates on the market, known as the term structure of interest rates. The term structure of interest rates is discussed in more detail in Module 3.

These are all basic concepts that underlie much of the financial theory and practice presented in this course. This should serve merely as a reminder of concepts covered in the core *Finance* course. We will now review some of the mathematical tools in finance in some more detail.

1.6.2 Present and Future Values

We have already stated that a sum of money received now is worth more than the same sum received in five years time. This is due to a number of reasons including inflation and the opportunity cost of interest foregone. The **present value** of a cash flow at some point in the future is given by the formula

$$PV = \frac{\mathrm{FV(n)}}{(1+r)^n}$$

where FV is the future value of the cash flow, n is the number of periods in the future, and r is the interest or discount rate. By raising the discount rate to the power of the number of

periods, the calculation takes compounding into account. Present value can also be calculated using the appropriate discount factor in statistical tables. A present value table is provided in Table A1.1 in Appendix 3 of this text. The discount factors are used as follows

$$PV = \text{PVIF}_{r,n} \times \text{FV(n)}$$

where PVIF is the present value interest factor, or discount factor from the table.

For example, if I were to have two options:

1. receiving $800 now , or
2. receiving $1000 three years in the future

Which would I choose? I can get a 5% annual return on my money at the bank.

The present value of $1000 in three years is given by

$$PV = \frac{1000}{(1.05)^3} = 863.84$$

So the $1000 in three years time is worth approximately $864 to me at the present time. Clearly the $800 to be received now has a present value of $800, so I would choose to receive the money in three-years time, option 2, as it has a higher present value. Another way of looking at this is if I accepted the $800 now, and put it in the bank at 5% per annum for three years, what would it be worth? To calculate this we need to know the **future value** of the cash flow. The future value of any cash flow is given by the formula

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

where *PV* is the present value of the cash flow, *n* is the number of periods in the future, and *r* is the interest rate. A future values table can be found in Table A1.3 in Appendix 3.

So what is the $800 received now worth in three years time? This is given by

$$FV = \$800 \times (1.05)^3 = 926.10$$

So it is worth $926 three years in the future. From either perspective the second option is more attractive to me.

It is worth noting at this point the effect of different interest rates on present and future value calculations. A higher interest rate causes the present value of a future cash flow to be lower, and the future value of a present cash flow to be lower. The reverse is true of lower interest rates. Take again the previous simple example. If the interest rate at the bank was 8%, which option would I choose? Again this question can be answered either by calculating the future value of $800 at 8% for three years, or the present value of $1000 in thee years time at a rate of 8%.

Using the formulae above:

$$PV = \frac{1000}{(1.08)^3} = 793.83$$

$$FV = \$800 \times (1.08)^3 = 1007.77$$

The future value of the sum to be received now is $1007, and option 1 is confirmed as being more attractive. It should be clear to the reader that the present and future values of cash flows are directly related to one another through the rate of interest or discount. Simple calculations such as the example above can be tackled in either way – the result is the same. The effect of interest rates on the value of investments will be discussed in more detail in Module 3. Present value is an important concept for investment decision-making purposes, which will be addressed in Module 4 on capital budgeting.

1.6.3 Annuities

An annuity yields a fixed sum each period for a given number of periods. Any set of cash flows identical each period and are subject to the same interest or discount rate can be classified as an annuity. People with private pension funds often invest in an annuity when they retire, paying a fixed sum in return for an annual or monthly payment for a given number of years.

The present or future value of an annuity is best calculated using statistical Table A1.2 in Appendix 3. The annuity factors are used as follows

$$\text{PVA} = \text{PVAIF}_{r,t} \times CF$$

where PVAIF is the annuity factor, *t* is the number of periods, *r* is the discount rate and CF is the per period cash flow amount. For example, if I was offered an investment where I would be paid $400 every year for ten years, how much would I be prepared to pay for it, if I can get 6% in my bank account? Clearly not $4000 as this does not take into account the time value of money. There are two ways to calculate the present value of this annuity. We can discount each cash flow to its present value:

$$\text{PVA} = \frac{400}{(1.06)^1} + \frac{400}{(1.06)^2} + \cdots + \frac{400}{(1.06)^{10}} = 2944.04$$

This gives us a present value of $2944. Alternatively we can use the annuity tables to calculate the present value of this stream of cash flows.

$$\text{PVA} = \text{PVAIF}_{0.06,10} \times 400$$

To get the present value annuity factor, go to Table A1.2. Then find the column for 6% and row for 10 periods, which gives us an annuity factor of 7.3601. So the annuity calculation is

$$\text{PVA} = 7.3601 \times \$400 = \$2944.04$$

So I would be prepared to pay $2944 for this set of cash flows. The annuity calculation saves time on long-winded present value calculations and is useful when the interest rate and cash flow amount are constant.

Annuity calculations can also be used in a similar fashion to calculate the future value of a stream of cash flows. For example if I decide to invest $1000 per annum in a high interest bank account at an annual rate of 9%, how much will this be worth after ten years? Again we can calculate the answer using a future value annuity table, like the one in Table A1.4. The calculation required is

$$\text{FVA} = \text{FVAIF}_{0.09,10} \times CF$$

Using the table we can find the correct factor, which is 15.937.

$$\text{FVA} = 15.937 \times \$1000 = \$15\,937$$

So if I were to invest this amount over ten years I would have $15 937 at the end of the period. The future value annuity calculation again avoids the long process of calculating interest and the new capital amount for each year.

1.6.4 Perpetuities

A perpetuity is a fixed cash payment each period which continues indefinitely. The perpetuity framework is used in finance for a number of different purposes, including share valuation, terminal valuation of company cash flows and valuation of undated bonds. An

individual may want to use the perpetuity calculation if they were planning on buying a flat to let out and wanted to calculate the maximum price they should pay.

A perpetuity is valued as follows

$$PV = \frac{CF}{r}$$

The cash flow divided by the discount rate gives the present value of a perpetual set of cash flows. For example, if I am planning to buy a flat to let out, and expect to get an annual after tax income of $4000, and the interest rate I earn at the bank is 6%, what is the maximum amount I should pay for the property?

$$PV = \frac{\$4000}{0.06} = \$66\,667$$

The maximum amount I should pay for the flat is $66 667. If the current owner will not take less than this, then I should walk away from the flat and find an alternative investment.

Another consideration with the perpetuity calculation is that often a set of cash flows such as the ones presented above often grow over time. It is not realistic to assume that when I buy a flat to let out the rent will stay at $4000 per annum indefinitely. Due to the effects of inflation the annual rent is likely to grow over time. The formula for a growing perpetuity is as follows

$$PV = \frac{CF}{r-g}$$

where g is the annual growth rate of the cash flow. Returning to the previous example, if I know that rent inflation in the area I will purchase the flat tends to run at 3% per annum, the revised valuation of the set of cash flows is

$$PV = \frac{\$4000}{0.06-0.03} = \$133\,333$$

Now that I have taken the growth of the cash flow into account, the present value of the investment is higher, and I would be prepared to pay more than previously calculated. The growing perpetuity formula is the basis for the dividend growth model, which is used for share valuation and is covered in more detail in Module 8.

1.6.5 Compound vs. Simple Interest

Interest paid on capital comes in two forms: simple and compound. Simple interest does not take previous interest payments into account. The most common example of this is a corporate bond. If the coupon (interest) rate on a three-year bond is 6%, and the par value is $100, then $6 of interest will be paid each year, and previous interest payments will not be added to the capital amount.

Compound interest is interest calculated on both initial capital investment and accrued interest from previous periods. For example, putting $1000 in a savings account at 5% per year will result in the investor having $1050 at the end of period 1. The 5% interest for the second period will be paid on the initial $1000 plus the $50 of accrued interest.

However compound interest has many variations. Most of the discussions on the tools presented above have used a "per period" approach. But how long is that period? It is not important when presenting simple examples but very important to the company that is borrowing to finance a new project, or to an individual taking out a mortgage on a new property. Some loans are offered at an annual rate of x% and are compounded more than

once per year. If this is the case it is necessary to calculate the *annual percentage rate* or APR. This can be done using the following formula

$$\text{APR} = \left(1 + \left(\frac{r}{m}\right)\right)^{m} - 1$$

where r is the annual rate and m is the number of times the interest is compounded per year. For example if I am offered a loan at a rate of 10%, compounded monthly what is the annual percentage rate?

$$\text{APR} = \left(1 + \left(\frac{0.10}{12}\right)\right)^{12} - 1 = 0.1047$$

So the APR of a loan at 10% compounded monthly is 10.47%. But what if the interest is compounded daily?

$$\text{APR} = \left(1 + \left(\frac{0.10}{365}\right)\right)^{365} - 1 = 0.1051$$

If the interest is compounded daily then the APR is 10.51% While this may seem like a small difference, for an oil and gas company that takes out a $100m loan to finance a large expansion project the numbers are important. If interest is compounded monthly then annual interest payments are $10 470 000 while daily interest compounding results in an annual interest payment of $10 510 000, an annual difference of $40 000.

The larger the number of compounding periods, the higher the actual amount of interest paid. Some lending institutions compound interest continuously. This means that interest is added to the capital amount as soon as it is earned and there is no passage of time in between compounding. In order to calculate the annual rate on a loan offered at 10% per year compounded continuously, the following formula is needed

$$\text{APR} = e^{r}$$

Where e is the root of the natural logarithm, 2.718… and r is the rate on the loan. This means that a loan offered at 10% compounded continuously is 10.52%. This would cost the oil company in the example above a further $10 000 per year in interest payments. It should now be clear that the type of compounding applied to a loan or an investment is crucial to its cost or future value.

Learning Summary

This module has introduced the oil and gas industry for the purposes of this course, and has discussed some important features of the industry as it relates to the subject of finance. The three main decision making areas in finance have been reviewed and the financial system has been examined. Finally a review of basic finance concepts was presented. You should now be ready to move on with the main body of the course, which contains material not covered in the core *Finance* module.

N.B. Due to the introductory nature of this module, no review questions are provided