

CHARTERED INSTITUTE FOR SECURITIES & INVESTMENT

Investment Operations Certificate

Technology in Investment Management

Edition 13, February 2026

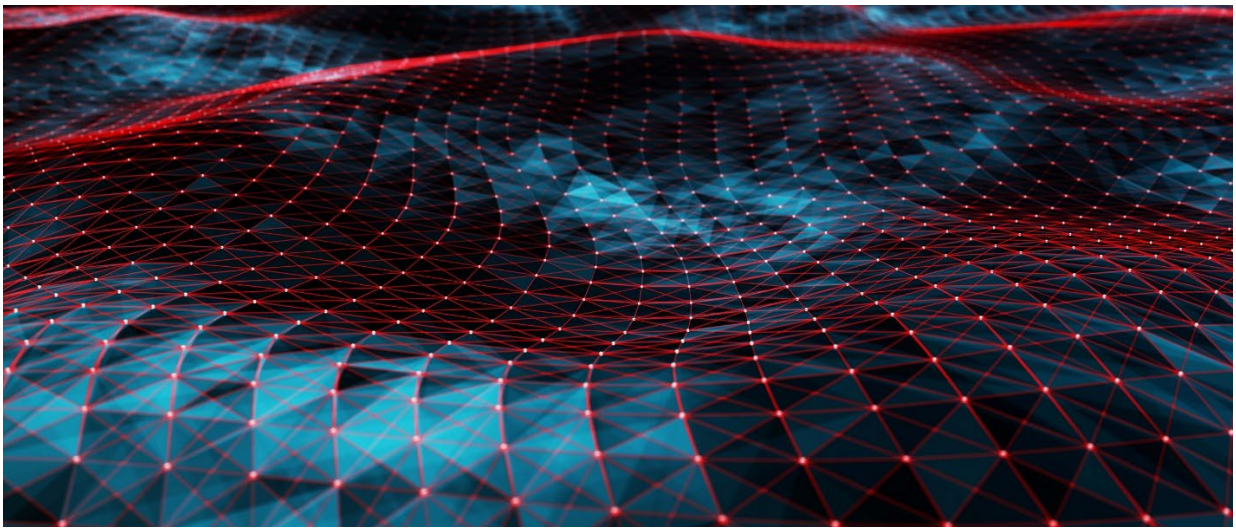
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Welcome to the Chartered Institute for Securities & Investment's Technology in Investment Management study material which has been written to prepare you for the Chartered Institute for Securities & Investment's Technology in Investment Management examination.

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20 Fenchurch Street, London EC3M 3BY, United Kingdom

Tel: +44 20 7645 0600 Fax: +44 20 7645 0601
Email: customersupport@cisi.org www.cisi.org/qualifications

Author
Paul Taylor, MBA, MBCS, FRSA, C/Mgr FCMI, FHEA, MIOD

Reviewers
Amos Dadzie
Chris Grune

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Version: 13.1 (February 2026)

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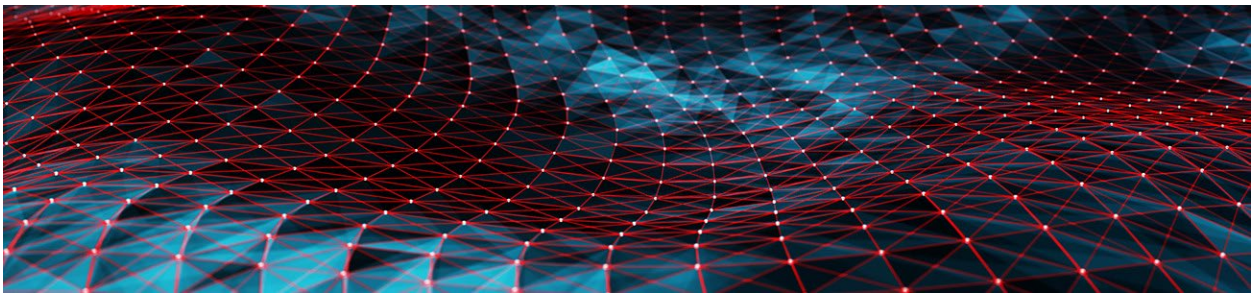
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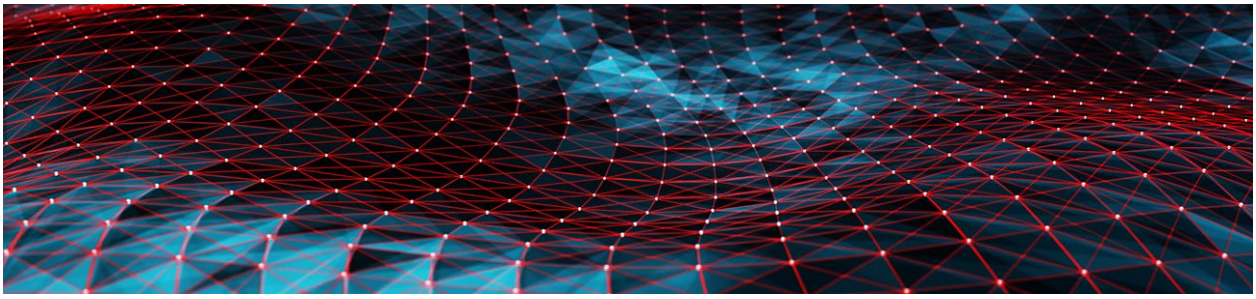
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Syllabus Learning Map



Chapter One
Technology in Investment Management

Section 1	Introduction
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This syllabus area will provide approximately 4 of the 50 examinations questions

1. Introduction

Technology is a critical function within asset management and is used in many areas (such as trading, settlement, client management, regulatory compliance plus many other areas). Therefore, it is essential that firms have both (a) a robust technology infrastructure and (b) the relevant capabilities and controls to manage it. It is very safe to say that asset management firms would not be able to operate without technology.

There are ten chapters in this workbook corresponding to the syllabus areas of the examination.

Chapter 1 introduces the reader to the industry participants and financial instruments that are relevant to the syllabus. It also introduces the reader to the different elements of a securities trade and explains the concept of automation. The achievement of automation is one of the goals of the technology department in most investment firms.

Chapter 2 describes the regulatory environment in which securities firms operate. It outlines how investment firms are regulated, the effect of regulation on the business applications that are used by an investment firm and also on the way that the firm's technology infrastructure is managed.

Chapter 3 describes the roles of trading venues, clearing houses and information vendors in the investment industry.

Chapters 4 to 7 inclusive take us through the processing of a securities trade, beginning with the order and ending with the position that results from the settled trade.

Chapters 8 to 10 inclusive deal with technology management issues, covering the management of day-to-day operations, the management of business change, the selection of suppliers of new applications, and the impact of outsourcing and offshoring.

2. Financial Services Sector Participants

1.1.1 Know the role of the following participants within the financial services sector: retail banks and building societies; investment banks; asset owners; fund managers; wealth managers; platforms; financial advisers; robo-advisors; custodians; third-party administrators (TPAs); trade venues

2.1 Retail Banks and Building Societies

Retail (or high street) banks provide services such as taking deposits from, and lending funds to, retail customers, as well as providing payment and money transmission services. They may also provide similar services to business customers. Historically, these banks have tended to operate through a network of branches located on the high street. They also provide internet and telephone banking.

In the UK, the sector has gone through a period of consolidation and, on occasion, integration with non-bank institutions, such as insurance companies.

Larger retail banks also offer access to their own, and third-party products such as investments, pensions and insurance.

As well as retail banks, most countries also have savings institutions that started off by specialising in offering savings products to retail customers, but now tend to offer a similar range of services as banks. In the UK, these are usually known as building societies. They were established in the 19th century when small numbers of people would group together locally and pool their savings, allowing some members to build or buy houses. Building societies are jointly owned by the individuals that have deposited or borrowed money from them – the 'members'. It is for this reason that such savings organisations are often described as mutual societies.

Over the years, many smaller building societies have merged or been taken over by larger ones. In the late 1980s, legislation was introduced allowing building societies to become companies or banks – a process known as 'demutualisation'. Some large building societies remain as mutuals, such as the Nationwide Building Society. They continue to specialise in services for retail customers, especially the provision of deposit accounts and mortgages.

2.2 Investment Banks

Investment banks provide advice to, and arrange finance for, companies who want to float on the stock market, to raise additional finance by issuing further shares or bonds, or carry out mergers and acquisitions. They also provide services for those institutions which might want to invest in shares and bonds, for example, pension funds and asset managers.

The financial crisis of 2007–10 saw the disappearance of many well-known investment banks, which were either taken over by other banks (for example, Merrill Lynch was taken over by the Bank of America), converted into bank holding companies or completely lost (eg, in the case of Lehman Brothers going bankrupt).

Typically, an investment banking group provides some or all of the following services, either in divisions of the bank or in associated companies within the group:

- **Corporate finance and advisory work, normally in connection with new issues of securities for raising finance, takeovers, mergers and acquisitions.**
- **Banking, for governments, institutions and companies.**
- **Treasury dealing, for corporate clients in foreign currencies, with financial engineering services to protect them from interest rate and exchange rate fluctuations.**
- **Investment management, for sizeable investors such as corporate pension funds, charities and private clients. This may be either via direct investment for the wealthier, or by way of collective investment schemes. In larger firms, the value of funds under management runs into many billions of pounds.**
- **Securities trading in equities, bonds and derivatives and the provision of broking and distribution facilities.**

Only a few investment banks provide services in all these areas. Most tend to specialise to some degree and concentrate on simply a few product lines.

2.3 Asset Owners

et owners are the organisations and individuals that legally own the assets managed by firms. The five most common asset owners within the UK are:

- **pension funds**
- **sovereign wealth funds**
- **insurance companies**
- **ultra-high net worth individuals (UHNWIs), and**
- **retail investors.**

Each of these are discussed in more detail below.

Pension Funds
Pension funds are one of the key planning methods by which individuals make plans for retirement. There are various plans available covering employee-based schemes, self-directed schemes, as well as personal schemes. (The subject of pension funds is a wide and complex area which is outside the scope of this qualification and would require several textbooks to fully cover.)

Pension funds themselves are large, long-term investors who invest in both traditional assets (such as shares, bonds and cash), alternative assets (such as private equity and property) and derivative instruments (to protect or hedge against market falls) to ensure that there is sufficient cash to pay the pensioners.

Sovereign Wealth Funds (SWFs)
A sovereign wealth fund (SWF) is a state-owned fund which invests in traditional assets (such as stocks, shares and bonds) as well as alternative assets (such as real estate, private equity, hedge funds, art and metal). SWFs are typically funded when governments have a budgetary surplus or have no (or very little) debt.

They are used for two main purposes. Firstly, to reduce the volatility of government revenues and mitigate against the boom-bust cycle, and secondly, to develop savings for the future.

Insurance Companies
Insurance companies provide one of the key functions of the financial services sector, which is to facilitate the effective management of risks. The insurance industry provides solutions for a wide range of risks such as vehicles, health, homeownership, payment protection, disability and many others.

Insurance companies collect premiums in exchange for the cover provided. This premium income is then used to buy investments such as shares and bonds. They will then realise these investments to pay any claims that may arise.

Ultra-High Net Wealth Individuals (UHNWIs)
While the definition of an ultra-high net wealth individual (UHNWI) does vary, a common definition is an individual with investable assets of at least $30 million usually excluding personal assets and property (such as a primary residence, collectibles and consumer durables). This group consists of the richest people in the world who control a vast amount of global wealth, and they will typically employ a wealth manager (see section 2.5) to manage their investments.

Retail Investors
A retail investor is an individual member of the public (as opposed to a corporation or

pension fund) who invests their money for their own personal benefit. Typically, these investors will invest a relatively small amount of money in retail products, such as mutual funds (like unit trusts) or individual savings accounts (such as ISAs).

2.4 Fund Managers

Fund management is the day-to-day decision-making, oversight and 'administration' of institutional or individual assets or portfolios for pension funds, insurance companies and collective investment schemes. It is also known as asset management, or investment management.

This sector also includes hedge funds, which are actively managed portfolios of investments that use advanced investment strategies such as leveraged, long, short and derivative positions in both domestic and international markets with the goal of generating high returns.

Fund managers run portfolios of investments for others. They invest money for institutions, such as pension funds and insurance companies, as well as for collective investment schemes, such as unit trusts and open- ended investment companies (OEICs), and for wealthier individuals. Some are organisations which focus solely on this activity; others are divisions of larger entities, such as insurance companies or banks.

Investment managers who buy and sell shares, bonds and other assets in order to increase the value of their clients' portfolios can conveniently be sub-divided into institutional and private client fund managers. Institutional fund managers work on behalf of institutions, for example, investing money for a company's pension fund, or an insurance company's fund, or managing the investments in a unit trust. Private client fund managers invest the money of relatively wealthy individuals. Institutional portfolios are usually larger than those of private clients.

Investment managers charge their clients for managing their money; they charge a small percentage fee based on the assets under management, and sometimes on the performance of the portfolio.

2.5 Wealth Managers

Wealth managers (who are also known as private client stockbrokers) arrange stock market trades on behalf of their private investors and charity clients. They may advise investors about which individual shares, bonds or funds they should buy or, alternatively,

they may offer execution-only services, where instructions are carried out but advice is not offered. When they act in an advisory capacity, these firms usually charge the client a percentage of the portfolio's value, but when they provide execution-only services, they usually charge a commission on the transaction.

As with fund managers, wealth managers can be independent companies, but often they are divisions of larger entities, such as investment banks or other asset managers.

2.6 Platforms

Platforms are online services designed to enable wealth managers, financial advisers and retail investors to manage their investment portfolios. They offer their users the ability to:

- **view and monitor all their investments on a single website**
- **research information about individual investments that they have invested in or are considering investing in**
- **place buy and sell orders online**
- **keep track of income due and income received**
- **monitor their tax liabilities**
- **perform portfolio modelling, such as 'what-if' scenario analysis, and**
- **compare the actual return on investment of the portfolio to that of a benchmark portfolio.**

Both advisers and platforms usually charge the client a percentage of the portfolio's value for the services that they provide. Some platform providers also charge an additional platform fee.

2.7 Financial Advisers

Financial advisers and some wealth managers offer private investors financial planning services, such as creating and managing pension plans, and other tax-sheltered investments, such as individual savings accounts (ISAs).

Their role is to establish the client's investment objectives and attitude to risk, and then to recommend suitable investments that will meet the client's requirements. For smaller customers, they often recommend that the majority of the portfolio be invested in collective investment schemes (CISs), such as unit trusts, because such schemes are the easiest way to diversify a small portfolio. For larger customers, they often appoint a discretionary wealth manager to manage their portfolios in a mixture of CISs, equities and

bonds, according to parameters specified by the adviser, who then charges the client an annual oversight fee.

Some Financial Advisers are independent of any fund providers which mean they can recommend any firms' funds; these advisors are often called Independent Financial Advisors (or IFAs). However, other advisors are 'tied' to specific fund providers which means they can only offer and recommend the funds provider by their owning fund providers; these providers are often called tied financial advisors.

2.8 Robo-Advisors

Robo-advisors are a relatively new type of financial adviser that provide investment services online (such as allocation and management of assets) based on a set of computerised rules and/or algorithms with a minimal amount of human involvement. By answering a short set of computer-generated questions, a client can set up a robo-advice account quickly and easily. The robo-advisor's algorithms will then invest the client's money into one of a small number of investment funds, based on the answers the client gave to questions about their investment objectives, their risk appetite and investment time horizon. These robo-advice services are low cost, as they require little or no human intervention by the firm providing the service, and are aimed at small investors wishing to invest modest sums.

These rules/algorithms are developed by financial firms with the assistance of data scientists and programmers and may also employ artificial intelligence (AI) and machine learning (ML). Therefore, complex, cost-effective, thoroughly tested and reliable technology is required to support a robo- advisor business.

2.9 Custodians

Custodians are banks that specialise in safe custody services looking after portfolios of shares and bonds on behalf of others, such as fund managers, pension funds and insurance companies.

The core activities they undertake include:

- **holding assets in safekeeping, such as equities and bonds**
- **arranging settlement of purchases and sales of securities**
- **collecting income from assets, namely dividends in the case of equities and interest in the case of bonds**

- **providing information regarding any corporate actions such as rights issues or stock splits**
- **providing information about the underlying companies and their annual general meetings**
- **managing cash transactions**
- **performing foreign exchange transactions where required**
- **providing regular reporting on all their activities to their clients**
- **managing stock-lending activity on behalf of their clients, and**
- **offering international custodian services to enable offshore investing.**

Cost pressures have driven down the charges that a custodian can make for its traditional custody services and have resulted in consolidation within the industry. The custody business is now dominated by a small number of global custodians which are often divisions of investment banks.

2.10 Third-Party Administrators (TPAs)

Third-party administrators (TPAs) undertake investment administration on behalf of other firms and specialise in this area. The number of firms and the scale of their operations has grown with the increasing use of outsourcing by firms. Outsourcing is explained in detail in chapter 10.

2.11 Trading Venues

While this area is discussed in much detailed in Chapter 3, a short summary has been included here because they are key market participant.

A trading venue is a regulated marketplace where financial instruments (such as shares, bonds, derivatives, or ETFs) are traded. There are various different types of venues (such as Regulated Markets, Multilateral Trading Facilities and Organised Trading Facilities) which are focused on different asset classes.

3. Financial Instruments Covered by this Workbook

The financial instruments and transaction types that the workbook is concerned with in chapters 3 to 7 are: currencies; securities including bonds and equities; listed derivatives including futures and options; and over-the-counter (OTC) market derivatives. It is assumed that most examination candidates will be familiar with the basic characteristics of these instruments as a result of taking the Introduction to Securities & Investment Investment Operations Certificate (IOC) paper.

For the benefit of any candidate who is not taking the introduction examination, this section briefly summarises the characteristics of these instruments. More detailed information about them can be found in the Introduction to Securities & Investment workbook.

3.1 Currencies

The foreign exchange (FX or forex) market refers to the trading of one currency for another. It is, by far, the largest market in the world. It is a 24–hour market as it takes place across the time zones of Asia, Europe and America. Of the $6.6 trillion daily global turnover in April 2022, nearly 43% went through the UK, making London by far the largest global centre for foreign exchange. Trading in the US came in second place with 16.5%, with Hong Kong and Singapore tied for third, each with 7.6%.

Trading of foreign currencies is always done in pairs, where one currency is bought and the other is sold, and the price at which this takes place is the exchange rate. When the exchange rate is being quoted, the name of the currency is abbreviated to a three-digit ISO reference code; so, for example, sterling is abbreviated to GBP, which you can think of as an abbreviation for GB pounds. The most commonly quoted currency pairs are:

- **US dollar and Japanese yen (USD/JPY)**
- **Euro and US dollar (EUR/USD)**
- **US dollar and Swiss franc (USD/CHF)**
- **British pound and US dollar (GBP/USD).**

When currencies are quoted, the first currency is the base currency and the second is the counter or quote currency. The base currency is always equal to one unit of that currency; in other words, one pound, one dollar or one euro. For example, at the time of writing, the EUR:USD exchange rate is 1:1.2378 which means that €1 is worth $1.2378.

When currency pairs are quoted, a market maker or foreign exchange trader will quote a bid and ask price. Staying with the example of the EUR:USD, the quote might be 1.2377/79. So, if you want to buy €100,000 then you will need to pay the higher of the two prices and deliver $123,790; if you want to sell €100,000 then you get the lower of the two prices and receive $123,770.

The spot forex market is an OTC where brokers and dealers negotiate directly with one another. The main participants are large international banks which continually provide the market with both bid (buy) and offer (sell) prices. Central banks are also major participants in foreign exchange markets, which they can use to try to control the money supply, inflation, and interest rates. There are several types of FX transactions commonly used:

- **Spot rate – the 'spot rate' is the rate quoted by a bank for the exchange of one currency for another. The standard settlement period for a spot trade is T+2; however, a trade is considered spot for any settlement period between T and T+7. All spot trades physically settle, that is, the currencies are delivered on the settlement date.**
- **Forward transactions – in contrast, a transaction is considered forward if the settlement date is beyond seven days from the trade date. A buyer and seller agree on an exchange rate for a date in the future for a fixed sum of money. If the transaction is to physically settle, on the agreed date, the rate agreed is applied regardless of the prevailing market spot rate on that day. However, many forward transactions net settle, where one party receives and one party pays the difference between the agreed forward rate and current spot rate.**
- **FX swaps – the most common type of forward transaction is the currency swap. In a swap, two parties exchange currencies for a certain length of time and agree to reverse the transaction at a later date.**

3.2 Securities

Securities include bonds (also known as debt instruments) and equities. Securities may be bought and sold – the subject of much of chapters 3 to 7 of this workbook – but they may also be borrowed and lent. Stock borrowing and lending is covered in chapter 6.

3.2.1 Bonds

Bonds are essentially IOUs; the issuer of the bond receives money from the initial buyer of the bond, and undertakes to pay the holder of the bond regular interest and then return the money (the capital) at a specified maturity date (or redemption date). The regular

interest rate paid by the issuer is known as the coupon rate, and the date on which the interest is paid is known as the coupon date.

Although bonds rarely generate as much attention as shares, they are the larger market of the two in terms of global investment value. Bonds are issued by governments, supranational institutions and companies.

- **Municipal Bonds are issued by local, regional and state governments.**
- **Supranational Bonds are issued by agencies such as the European Investment Bank (EIB) and the World Bank.**
- **Corporate Bonds are issued by companies, such as large banks and other large corporate listed companies.**

Traditionally, bonds have been regarded as less risky than shares, provided their issuers remain solvent. This is because the issuer of a bond is obliged to pay the coupon irrespective of market conditions. Government bonds are regarded as being of particularly low risk, as governments are less likely to default, ie, fail to pay the interest or repay the capital on the bond. Corporate bonds, however, can face the risk of complete default; as the issuing company can become insolvent. Both carry interest rate risk, which means that the price of the bond could fall substantially if interest rates rise sharply, conversely the price can rise if interest rates fall.

3.2.2 Equities

Equities, or 'shares', are the other form of securities. Holding shares in a company is the same as having an ownership stake in that company. So, a shareholder in, say, technology giant Apple Corporation is a part-owner of Apple.

Shares are, however, riskier than bonds due to the following reasons:

- **There is always the risk that the company could go into liquidation (but of course, in this case, the holder of a bond issued by the same company may also be likely to lose out). However, substantial companies, such as Apple (known as 'blue chip' companies), are unlikely to do so.**
- **The chance that the shares may go down in value is more likely.**
- **There is the risk that the issuing company will have a poor trading year: if it makes little or no profit, it may be unable to pay a dividend (a profit distribution to shareholders), or may pay a lower one than in previous years. This is a serious risk for an investor relying on dividends as a major source of income.**

The major reason an investor would prefer equities over bonds is from the potential benefits that can arise from owning shares, namely dividends and the prospect of capital growth. Traditionally, equity investments have outperformed bonds and cash deposits over the longer term – that is, periods of ten years or more.

3.2.3 The Issuance of Securities

Stock exchanges and investment firms play a role in the issuance of both debt and equity securities, ie, they play a role in creating the security in the first instance. This activity is known as 'primary market activity'. The most common process of securities issuance is known as the initial public offering (IPO). IPOs are usually underwritten, that is to say a group of banks will (in exchange for a fee) commit to purchasing any shares that are not bought by investors at the end of the offer period. Underwriting, therefore, provides a guarantee to the issuer that all the shares will be sold.

An IPO is the first sale of a corporation's shares to investors on (one or more) public stock exchanges. The main purpose of an IPO is to raise capital for the corporation. While IPOs are effective at raising capital, being listed on a stock exchange imposes heavy regulatory compliance and reporting requirements.

Example

Meta (formerly known as Facebook) filed for an IPO in the spring of 2012. The shares were offered at $38 each, valuing the company at $104 billion, the highest valuation up to that date for a newly public company. On 16 May, one day before the IPO, Meta announced that it would sell 25% more shares than originally planned owing to high demand. The IPO raised $16 billion, making it the third largest in US history.

Trading in the stock began on May 18, but was delayed that day due to technical problems at the NASDAQ exchange. The stock struggled to stay above the IPO price for most of the day, forcing underwriters to buy back shares to support the price. At the close, the shares were valued at $38.23, only $0.23 above the IPO price and down $3.82 from the opening price.

The opening was widely described by the financial press as a 'disappointment'. The stock nonetheless set a new record for the trading volume of an IPO. On 25 May 2012, the stock ended its first full week of trading at $31.91, a 16.5% decline.

Note that an IPO refers only to the first public issuance of a company's shares. If a company later sells newly issued shares (again) to the market, it is called a 'follow-on' offering.

3.2.4 The Secondary Market in Securities

1.2.1 Know the elements of a secondary market equity trade

1.3.1 Know the elements of a secondary market bond trade

Once the security has been issued on the primary market, investors may buy and sell that security without the involvement of the issuer. This is known as 'secondary market activity'. This workbook is primarily concerned with secondary market trades; therefore, we begin by providing two example trades and introducing the candidate to the terminology that will be used throughout the workbook.

Example – Shares

On 7 April, Investor A buys 100 shares of Vodafone plc at a price of £10.00 per share, for value date 9 April. Investor A will pay the broker £1,000.00 (ie, 100 shares at £10 each) plus commission of £50.00, making a total of £1,050.00.

This workbook uses the following terminology to describe each of the elements of this trade:

Term	Explanation of term	Example
Trade date	The date that the trade is carried out.	7 April
Instrument	The identity of the instrument being bought or sold.	Vodafone plc shares
Trade price	The price of the instrument being bought or sold.	£10.00 per share
Trade quantity	The amount of the instrument being bought or sold.	100 shares
Instrument currency or trade currency	The currency in which the trade price is expressed.	GBP
Settlement currency	The currency in which the investor will pay for the instrument (usually, but not necessarily, the same as instrument currency).	GBP
Principal amount	The number of shares multiplied by the price.	£1,000.00 (100 x £10)
Fees	Commissions and any other charges paid by the investor.	£50.00

Consideration	Principal amount + fees and charges.	£1,050.00
Value date	The date on which the investor should pay the consideration of the trade and take legal ownership of the instrument (T+2).	9 April
Settlement date	The date on which the investor actually does pay the consideration of the trade, and takes legal ownership of the instrument. The settlement date should be the same as value date, but there may be a delay in the process. Possible causes of such delays are examined in chapters 4, 5 and 6 of this workbook.	9 April

The trade elements of a bond trade are slightly more complicated, because of the following:

- the fact that accrued interest must also be accounted for. Bond issuers usually pay coupons annually or semi-annually, but sometimes at more frequent intervals. The coupon is paid to the investor who holds the bond on the record date, which is usually one business day before the coupon date. Even if that investor only bought the bond a few days before record date, they will receive from the issuer the coupon for the entire coupon period, and the investor that held the bond for the earlier part of the coupon period will receive nothing. For this reason, when bonds are bought and sold on the secondary market, the accrued interest on the bond for the coupon period is also exchanged at the same time.
- the fact that bond prices are usually quoted as a percentage of the trade quantity.

Example – Bonds

The Cable and Wireless 4% Convertible Bond maturing 16 July 2025 last paid a coupon on 16 January 2020. On trade date 5 February 2020, for value date 7 February 2020, Investor A sells £100,000 face value of this bond to Investor B at a trade price of 96% of face value. Assuming that there are no commissions or fees, then the consideration that B has to pay A will be calculated as follows:

Principal amount:	£100,000 face value @ trade price 96%	£96,000.00
Accrued interest:	£100,000 face value x 4% for 22 days	£241.10
Consideration	£96,241.10	

The elements of this trade are therefore as follows:

Term	Explanation of term	Example

Instrument	**The identity of the instrument being bought or sold.**	**Cable and Wireless 4% Convertible Bond maturing 16 July 2025**
Trade price	**The price of the instrument being bought or sold.**	**96% (of trade quantity)**
Trade quantity	**The amount of the instrument being bought or sold.**	**£100,000**
Instrument or trade currency	**The currency in which the trade price is expressed.**	**GBP**
Settlement currency	**The currency in which the investor will pay for the instrument (usually, but not necessarily, the same as instrument currency).**	**GBP**
Principal amount	**Face value multiplied by the price.**	**£96,000.00 (£100,000 x 96%)**
Fees	**Commissions and any other charges paid by the investor.**	**Nil**
Interest days	**The number of days' interest that has been used to calculate the interest amount.**	**16 Jan to 7 Feb 2020 (ie, 22 days)**
Accrued interest amount	**The amount of interest that has been included on this trade. (Using 365 days per year in the case of sterling bonds.)**	**£241.10**
Consideration	**Principal amount + accrued interest + fees.**	**£96,241.10 (£96,000 + £241.10)**
Value date	**The date on which the investor should pay the consideration of the trade and take legal ownership of the instrument (T+2).**	**7 February 2020**
Settlement date	**The date on which the investor actually does pay the consideration of the trade and takes legal ownership of the instrument. The settlement date should be the same as value date, but there may be a delay in the process.**	**7 February 2020**

3.2.5 Consideration – An Inclusive Definition

By combining the above two examples, we can provide an inclusive definition of the term consideration that applies to all forms of securities trades – both bond trades and equity trades:

Consideration = principal amount + accrued interest + commission + fees and charges

The calculation of interest, commissions, fees and charges is covered in chapter 4.

3.3 Derivatives

A derivative is a financial instrument whose price is derived from the price of another asset such as a bond, an equity, an equity index or a currency. The asset on which the derivative instrument is based on is known as the 'underlying asset'.

Broadly speaking, there are two distinct groups of derivatives, which are differentiated by how they are traded. They are exchange-traded derivatives (ETD) and OTC traded derivatives.

3.3.1 Exchange-Traded Derivatives (ETDs)

Futures and options are examples of ETDs. Both futures and options have standardised features which are defined by the exchange on which they are listed. The role of the exchange is to provide a marketplace for trading to take place. The process of trading these instruments is examined in chapter 3.

Futures and options have underlying assets, such as currency exchange rates, interest rates, government bonds, equity indices (such as the FTSE 100 index), geographic area (such as Europe), economic areas (such as emerging markets), individual equities and physical commodities (such as metals and agricultural products). They can also cover types of underlyings (such as volatility), funds (such as ETFs) and cryptocurrencies.

Definitions

- **A future is a standardised, transferable, exchange-traded contract that requires delivery of the underlying instrument at a specified price, on a specified future date. Unlike options, futures convey an obligation to deliver or take delivery of the underlying instrument.**

- A call option gives the buyer (or holder) the right (but NOT the obligation) to purchase the underlying instrument at a specified price on or before a given date.
- A put option, on the other hand, gives the buyer (or holder) the right (but NOT the obligation) to sell the underlying instrument at a specified price on or before a given date.

3.3.2 Over-the-Counter (OTC) Derivatives

OTC derivatives are those derivatives that are negotiated and traded privately between parties without the use of an exchange. In other words, they are traded 'over-the-counter' or point-to-point. Products such as interest rate swaps, forward rate agreements and other 'exotic' derivatives are mainly traded in this way. The OTC market is larger than the exchange-traded market in terms of the value of contracts traded daily. Although, as a result of regulatory reform since 2008, some of the standard and more liquid classes of OTC derivative now have to be traded on a trading venue.

OTC derivatives are customisable and, therefore, complex instruments (more so than ETDs) and are not dealt with at length in this workbook. A more comprehensive explanation can be found in the Introduction to Securities & Investment workbook. The following subsections provide brief descriptions of the most common forms of OTC contracts.

The European Market Infrastructure Regulation (EMIR) has introduced new risk and reporting obligations on firms dealing in and clearing OTC derivatives. This is discussed further in chapter 2.

Interest Rate Swaps
Interest rate swaps are the most common form of swaps. They involve an exchange (or 'swap') of interest payments and are usually constructed whereby one leg of the swap is a payment of a fixed rate of interest and the other leg is a payment of a floating rate of interest. They are usually used to hedge exposure to interest rate changes and can be most easily appreciated by looking at an example.

Example

Company A is embarking on a three-year project to build and equip a new manufacturing plant and borrows funds to finance the cost. Because of its size and credit status, it has to borrow at variable rates.

It can reasonably estimate what additional returns its new plant will generate but, because the interest it is paying will be variable, it is exposed to the risk that the project may turn out to be uneconomic if interest rates rise unexpectedly.

If the company could secure fixed rate finance, it could remove the risk of interest rate variations and more accurately predict the returns it can make from its investment. To do this, Company A could enter into an interest rate swap with an investment bank.

As part of the swap, it pays a fixed rate to the investment bank and in exchange receives an amount of interest calculated on a variable rate. With the amount it receives from the investment bank, it then has the funds to settle its variable rate lending.

In this way, it has hedged its interest rate exposure risk.

The two exchanges of cash flow are known as the 'legs' of the swap and the amounts to be exchanged are calculated by reference to a notional amount. The notional amount in the above example would be the amount that Company A has borrowed to fund its project.

Typically, one party will pay an amount based on a fixed rate to the other party, who will pay back an amount of interest that is variable and originally based on the London Inter-Bank Offered Rate (LIBOR). The variable rate will usually be set as LIBOR plus, say, 0.5% and was reset quarterly.

LIBOR was phased out at the end of 2021. It was replaced by the Sterling Over Night Index Average (SONIA) for the GB pound, the Secured Overnight Financing Rate (SOFR) for USD, and for the euro, the Euro Short-Term Rate (€STR).Currency Swaps
A currency swap (also called a cross-currency swap) occurs when two parties exchange two payment streams in different currencies, calculated at a different interest rate, and also agree to return the original principal amount to each other at an exchange rate agreed at the start of the contract.

Credit Default Swaps (CDSs)
A CDS is a contract under which two trade parties agree to isolate and separately trade the credit risk of one or more securities or other obligations issued by a third party.

Under a CDS agreement, a protection buyer pays a periodic fee to a protection seller in exchange for a contingent payment by the seller upon a credit event (such as a default or failure to pay) happening to the underlying securities. These underlying securities are sometimes called reference obligations. When a credit event is triggered, the protection seller either takes delivery of the defaulted security for the par value (physical settlement) or pays the protection buyer the difference between the par value and recovery value of the bond (cash settlement).

CDSs resemble an insurance policy, as they can be used by debt owners to hedge against credit events. However, because there is no requirement to actually hold any asset or suffer a loss, CDSs can be used to speculate on changes in credit spread. Also, it is important to remember that they are not regulated as insurance policies, and investors do not have the same level of regulatory protection as policyholders.

CDSs are the most widely traded credit derivative product. The typical term of a CDS contract is five years, although, being an OTC derivative, CDSs of almost any maturity can be traded.

The excessive issuance and trading of CDS contracts were considered to be a major cause of the credit crunch of 2008. At the time, these contracts could be traded – or swapped – from investor to investor without any regulator overseeing the trades to ensure the buyer had the resources to cover the losses if the security were to default.

As a result of the lessons learned from this turbulent year, regulators in the US and Europe have introduced radical new regulations for the oversight of the OTC derivative markets. These new regulations are examined in chapter 2 of this workbook.

Equity and Equity Index Swaps
This is where one of the payment streams is based on the return from holding an equity or equity index instead of being based on an interest rate.

Equity Contracts for Difference (CFDs)
A contract for difference (CFD) is a contract between two parties, buyer and seller, stipulating that the seller will pay the buyer the difference between the current value of an equity and its value at a future date. If the difference is negative, then the buyer pays instead to the seller. CFDs allow investors to speculate on share price movements, without the need for ownership of the underlying shares.

CFDs allow investors to take long or short positions and, unlike futures contracts, have no fixed expiry date or contract size. CFDs are often used by UK investors to gain exposure to the growth potential of an individual equity without the requirement to pay stamp duty.

CFDs are similar, in some respects, to spread bets, but are a more polished professional product. The key difference between spread betting and CFD trading is how they are taxed. Spread bets are free from capital gains tax (CGT), while profits from CFDs can be offset against losses for tax purposes. There is no stamp duty to pay with either product because you do not take ownership of the underlying assets when you trade. Both enable you to go long or short, though there are technical differences in how they work:

Spread betting involves staking an amount of money per point of price movement in the underlying asset. CFD trading involves exchanging the difference in price from the point at which the contract is opened to when it is closed. All spread bets have a fixed expiry date, while CFDs do not expire (with the exception of futures). Professional traders can get DMA on forex and shares with a CFD trading account.

4. The Concept of Automation

1.4.1 Understand the importance of automation

4.1 Automation Principles

Automation (or straight-through processing (STP) as it has been called in the past) is a set of working practices and systems that enable transactions to move seamlessly through the processing cycle, without manual intervention or redundant handling.

Automation enables the entire trade process for capital markets and payment transactions to be conducted electronically without the need for rekeying or manual intervention, subject to legal and regulatory restrictions.

The key principles of automation are the following:

- **The transaction (such as an order or trade) is entered into the firm's systems only once – it should never have to be rekeyed into another of the firm's systems.**
- **As most investment firms need to record the transaction into more than one system, there need to be automated interfaces between all systems that need to store records of the order or trade.**
- **Trade processing should consist of a set of logical stages, each one being dependent on the satisfactory conclusion of the previous stage. No stage should commence until the previous stage has been completed successfully.**
- **Clerical intervention should be avoided as far as possible, but clerical staff should be enabled to manage by exception – that is to say that if one of the processing stages fails to complete satisfactorily, the fact that this has happened should be presented to skilled staff in a form in which they can deal with the exception in the most efficient manner.**
- **The four principles listed above apply not just within the individual firm but also between the various firms involved in the transaction. This means that the industry needs to have common message standards when information needs to be exchanged between different organisations. These standards are described in chapter 6.**

Automation solutions have been instrumental in allowing the industry to shorten settlement cycles, as well as to meet the global demand resulting from the explosive growth of electronic trading. Now the concepts of automation are applied in order to:

- **reduce systemic and operational risk**
- **improve the certainty of settlement**
- **minimise operational cost, and**
- **improve customer service.**

As a result, investment firms' technology departments are often involved in process improvements that are designed to improve the automation rate.

4.2 To What Extent is Automation Actually Achieved in Practice?

The automation-enabled environment described above is ideal, and not all firms achieve full automation for all financial instruments. There is evidence that the more complex the instrument, the lower the automation rate.

The International Swaps and Derivatives Association (ISDA) Operations Benchmarking Survey
The International Swaps and Derivatives Association (ISDA) conducts a regular operations benchmarking survey of its member firms. The latest results are from the 2013 survey and include the following details.

'Large' firms reported that the average amount of days it took to agree a confirmation for various asset classes was as shown in the table below. 2009 figures are shown for comparison, and you will see that, while significant improvements have been made in four years. While there are no more updated figures, it is fair to say that further improvements will have been made.

Average Monthly Levels of all Outstanding Confirmations (in Business Days) for Large Firms

Instrument Class	2009 survey result	2013 survey result	% Improvement
Interest rate derivatives	6.8	0.9	86.76%
Credit derivatives	3.5	0.3	91.43%
Equity derivatives	9.7	5.0	48.45%
Currency options	2.6	1.5	42.30%
Commodity derivatives	2.4	0.6	75.00%

5. The Criticality of Data Management

1.5.1 Understand the criticality of data management: accuracy; timeliness; security

5.1 The Criticality of Data

Data is critical to the asset management industry. In fact, some commentators have said that it is the blood of the industry. It is used for a wide range of activities. Fund managers need portfolio data, price data and market news to manage their portfolios. Platforms and wealth managers will need complete and accurate information to allow them to manage their client base. Finally, data is also required to complete regulatory returns, for cost/profit management, managing cash and settling trades.

Therefore, data needs to be accurate, complete, timely and securely delivered, which is a challenge for many firms for two main reasons:

1. **Firms struggle to receive data from multiple sources in a similar and compatible format. Therefore, work is often required to re-align (or scrub or clean) this data.**
2. **Once the data has been received, firms often struggle to process it efficiently due to the complexity of multiple operating and technology platforms. To counter this, firms will often employ spreadsheets or offline processes to massage any data, which can lead to problems with keeping track of changes and maintaining the audit trail.**

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. *Which types of market participant deal with private individuals?*
   Answer Reference: Section 2

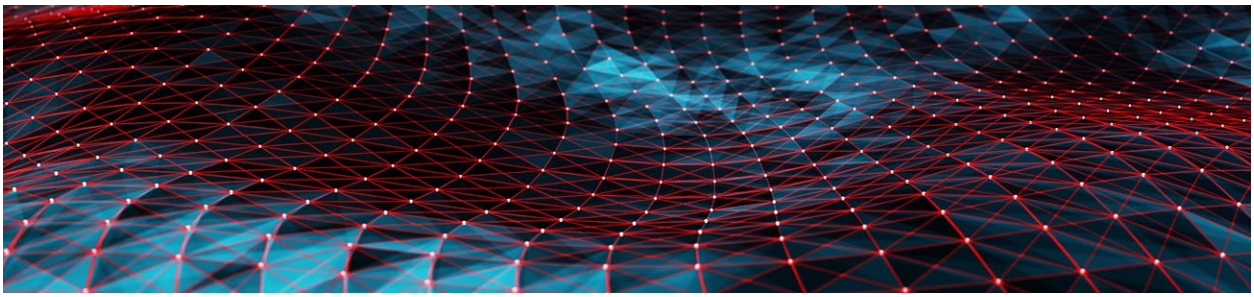
2. *How does an investment bank differ from a retail bank?*
   Answer Reference: Sections 2.1 and 2.2

3. *What is the role of the custodian?*
   Answer Reference: Section 2.9

4. *What is the difference between value date and settlement date?*
   Answer Reference: Section 3.2.4

5. *What is the difference between the 'principal amount' of a bond or equity trade and the 'consideration' of that trade?*
   Answer Reference: Section 3.2.4

6. *What are the five key principles of automation?*
   Answer Reference: Section 4.1



Chapter Two
The Regulatory Framework

Section 1 **UK and European Regulation**

Section 2 **Data Protection**

Section 3 **The Impact of Regulation on Technology**

This syllabus area will provide approximately 6 of the 50 examination questions

1. UK and European Regulation

Many candidates will be familiar with the fundamentals of regulation as a result of taking one of the regulatory Investment Operations Certificate (IOC) papers. For the benefit of any Technology in Investment Management candidate who is not taking one of these papers, this section briefly summarises the scope of the regulations that affect securities firms and discusses their technology implications.

1.1 The Need for Regulation

2.1.1 Understand the regulatory framework

The risk of monetary loss that can arise from dealing in all types of financial transactions has meant that financial markets have always been subject to the need for rules and codes of conduct to protect all parties, including investors and the public. As markets developed, there grew a need for market participants to be able to set rules so that there were agreed standards of behaviour, and to provide a mechanism so that disputes could be settled readily. This need developed into what is known as 'self-regulation', where, for example, a stock exchange, as well as providing a secondary market for shares, would also set rules for its members and police their implementation.

As markets, financial institutions and financial services developed, and the potential impact that they could have on both the economy and society grew, self- regulation became increasingly untenable, and most countries moved to a statutory approach and established their own regulatory bodies.

The development of global markets, and a series of crises ranging from Barings Bank to Enron and WorldCom, emphasised not only the need for improved regulation and standards, but for international cooperation to develop a common approach in a whole range of areas. This was hugely exacerbated in 2008 as the global community battled against the effects of the credit crunch. With the increasing globalisation of financial markets, there is a demand from governments and investment firms for a common approach to regulation in different countries.

The main purposes and aims of regulation in all markets globally are to:

- **maintain and promote the fairness, efficiency, competitiveness, transparency and orderliness of the securities and futures industry**
- **promote understanding by the public of, and trust in, the operation and functioning of the securities and futures industry**
- **provide protection for members of the public investing in, or holding, financial products**
- **minimise crime and misconduct in the securities and futures industry**

- **reduce systemic risks in the securities and futures industry, and**
- **assist in maintaining the market's financial stability.**

1.2 The Need for Regulation

2.2.1Know the function of UK and European regulators in the financial services sector: Markets in Financial Instruments Directive II (MiFID II)

1.2.1 The Financial Services and Markets Act 2000 (FSMA)

Modern regulation in the UK began with the passing of the Financial Services and Markets Act 2000 (FSMA), which introduced a new structure for the regulation of the financial services sector in the UK. FSMA established a new single regulator for the UK – the Financial Services Authority (FSA). It empowered the FSA with broad responsibility for both the prudential and business conduct regulation of firms within the financial services sector. To explain these terms:

- **Prudential regulation is concerned with the financial soundness of regulated financial services firms, making sure that they are not about to become bankrupt. The purpose of prudential regulation is to prevent investors and the economy in general from suffering losses as a result of the failure of individual firms or, at worst, multiple firms.**
- **Business conduct regulation is concerned with the way in which business is done, particularly the way investment and savings products are marketed and sold. Its purpose is to protect investors from losses that may arise from ethically dubious illegal practices, or poor management of business processes.**

Part II of FSMA, 'Regulated and Prohibited Activities', details the general prohibition which states that no person can carry on a regulated activity in the UK, or purport to do so, unless they are either authorised or exempt. 'Authorisation' is brought about by the relevant person applying to the regulator for permission to perform particular regulated activities, and the FSA giving such permission. The 'person' in this context is the firm, which could be incorporated as a company or could be an unincorporated entity such as a sole trader or partnership.

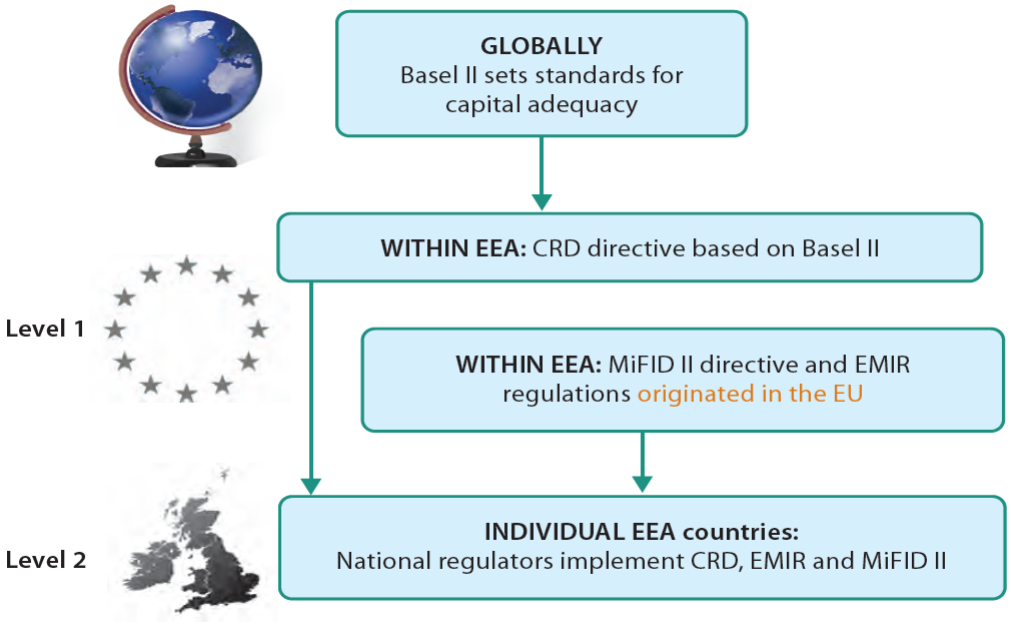
Regulated activities under FSMA are defined by the type of investment (such as shares, bonds or deposits) and the range of activity (there are 15 regulated activities in the act including dealing, managing, and accepting deposits).

All regulated firms are expected to adhere to the 11 principles, which state that a firm must:

1. **conduct its business with integrity**
2. **conduct its business with due skill, care and diligence**
3. **take reasonable care to organise and control its affairs responsibly and effectively, with adequate risk management systems**
4. **maintain adequate financial resources**
5. **observe proper standards of market conduct**
6. **pay due regard to the interests of its customers and treat them fairly**
7. **pay due regard to the information needs of its clients, and communicate information to them in a way which is clear, fair and not misleading**
8. **manage conflicts of interest fairly, both between itself and its customers and between a customer and another client**
9. **take reasonable care to ensure the suitability of its advice and discretionary decisions for any customer who is entitled to rely upon its judgement**
10. **arrange adequate protection for clients' assets when it is responsible for them, and**
11. **deal with its regulators in an open, cooperative way, and must disclose to the regulator appropriately anything relating to the firm of which the regulator would reasonably expect notice.**

The UK regulator also monitors its member firms' compliance with three sets of rules that originated from European Union legislation – the Markets in Financial Instruments Directive II (MiFID II), the Capital Requirements Directive and the European Market Infrastructure Regulation (EMIR). MiFID II is examined in section 1.3 of this chapter; the Capital Requirements Directive (CRD) (the EU's specific implementation of Basel II) and EMIR are described in sections 3.6.7 and 3.9, respectively.

When the European Union (EU) legislates for Europe as a whole, the legislation enacted by the EU is known as Level 1 legislation. Level 1 legislation is often at a high level; the detailed instructions that have to be complied with are usually found in the individual legislation of the member states. This is known as Level 2 legislation. The UK government and the regulators were responsible for the enactment and enforcement of Level 2 legislation concerning MiFID II, EMIR and Basel II in the UK. The process could be explained by the following diagram:



1.2.2 The Financial Services Act (FSA) 2012

This act abolished the FSA and replaced it with three new bodies:

Financial Policy Committee (FPC)
The Financial Policy Committee (FPC) is a committee which was established within the Bank of England (BoE), with responsibility for 'macro-prudential' regulation, or regulation of the stability and resilience of the financial system as a whole. Its role is:

'Contributing to the Bank's objective to protect and enhance financial stability, through identifying and taking action to remove or reduce systemic risks, with a view to protecting and enhancing the resilience of the UK financial system'.

Prudential Regulation Authority (PRA)
The Prudential Regulation Authority (PRA) is part of the BoE and is responsible for the prudential regulation of financial firms that manage significant risks on their balance sheets. In other words, it is responsible for the regulation and supervision of 'significant' individual firms including all deposit- taking institutions, insurers and other prudentially significant firms (about 1,500 firms in total). Its statutory objectives are:

> **'...to promote the safety and soundness of these firms and, specifically for insurers, to contribute to the securing of an appropriate degree of protection for policyholders'.**

The PRA has the primary objective of enhancing financial stability by promoting the safety and soundness of PRA-authorised firms in a way which minimises the disruption caused by firms which may fail. In fulfilling its objective, it takes an intrusive approach to regulation and supervision. Both the PRA and FCA still use the principles that were originally laid down by the FSA when it was founded.

Financial Conduct Authority (FCA)
The Financial Conduct Authority (FCA) focuses on regulation of all firms in retail and wholesale financial markets, as well as the infrastructure that supports these markets. It also has responsibility for the firms that do not fall under the PRA's scope (approximately 60,000 firms). The FCA's role includes:

- **supervision of investment exchanges and monitoring firms' compliance with the Market Abuse Directive (MAD)**
- **powers to investigate and prosecute insider dealing**
- **responsibility for overseeing the Financial Ombudsman Service (FOS), the Consumer Financial Education Body (CFEB) and the Financial Services Compensation Scheme (FSCS), and**
- **working closely with the FPC and PRA.**

Its statutory objective is to ensure that the relevant markets function well. Its role also includes:

> **'Enhancing confidence in the UK financial system by facilitating efficiency and choice in services, securing an appropriate degree of consumer protection, and protecting and enhancing the integrity of the UK financial system'.**

Timescale
The FCA and PRA began work in April 2013. Certain chapters in this workbook make references to specific FCA rules. Unless otherwise stated, candidates should assume that the PRA has an identical rule.

1.3 Europe-Wide Regulation

The European System of Financial Supervision (ESFS) is an institutional architecture of the EU's framework of financial supervision created in response to the financial crisis of 2007–08. First proposed by the European Commission (EC) in 2009, it replaced three existing Committees of Supervisors with three new authorities called European Supervisory Authorities (ESAs): the European Banking Authority (EBA); the European Insurance and

Occupational Pensions Authority (EIOPA); and the European Securities and Markets Authority (ESMA).

ESMA's mission is to enhance the protection of investors and reinforce stable and well-functioning financial markets in the EU. As an independent institution, ESMA achieves this mission by building a single rulebook for EU financial markets and ensuring its consistent application and supervision across the EU. ESMA contributes to the supervision of financial services firms with a pan-European reach, either through direct supervision or through the active coordination of national supervisory activity.

The idea behind ESMA is to establish an 'EU-wide financial markets watchdog'. Even though the UK left the EU in January 2021, ESMA will be relevant because UK firms will continue to trade and interact with firms within the EU. Both the UK and EU have agreed that, where possible, regulatory equivalence should be maintained.

1.4 The Regulatory Objectives of MiFID II

1.4.1 The Financial Services and Markets Act 2000 (FSMA)

The Markets in Financial Instruments Directive (MiFID) was enacted in 2004 and came into force on 1 November 2007, replacing the previous Investment Services Directive that was introduced in 1993. The legislation is detailed, prescriptive and wide-ranging – MiFID II's coverage is significantly broader than its predecessor.

MiFID II, an extension to the original MiFID, commenced on 3 January 2018 and applied to all firms in the European Economic Area (EEA), the then 28 EU states (which included the UK at the time) plus Iceland, Norway and Liechtenstein. In October 2011, the EC published its legislative proposals, which took the form of a revised Directive (MiFID II) and a new Regulation (MiFIR).

However, it is important to note that MiFIR is a regulation governed by European Law (so it automatically became law in member states when enacted), but MiFID II is a directive (which means it needs to be transposed into each member state's legislation individually). This has caused some issues which are discussed later in this section.

In general terms, these proposals represented a comprehensive and profound set of reforms which is leading to a reshaping of the financial markets, the products and services that banks provide and the relationship between banks and their customers. Although the directive is driven by EU regulators, it will have a wider impact, as capital markets are increasingly global. When non-European firms transact with European customers, MiFID II will apply.

The European Parliament endorsed MiFID II and MiFIR on 15 April 2014, and the Council of the European Union adopted the legislation on 13 May 2014. The MiFID II legislation was published on 12 June 2014. Both MiFID II and MiFIR entered into force on 2 July 2014, and were required to be transposed into national law by 3 July 2017. As indicated earlier, the law applied within member states (including the UK at the time) from 3 January 2018.

While the majority of member states have implemented MiFID II, some member states did not immediately transpose MiFID II into their local legislation. This led to a situation where some countries had MiFIR in law (because it is a regulation and automatically became law on 3 January 2018), but MiFID II was not in law (because the details had not been transposed into their local laws).

An outline of each of the key elements of MiFID II are listed below.

1.4.2 Conflicts of Interest

MiFID II recognises that conflicts of interest may occur when an investment firm may be acting, for example:

- **for both investors in and issuers of the same security at the same time**
- **for more than one investor that has an interest in a particular security, or**
- **for investors that have an interest in a particular security at the same time that the firm itself has an interest in the same security.**

MiFID II requires firms to have a conflict management policy that requires them to:

1. **take steps to prevent conflicts of interest giving rise to the material risk of damaging clients' interests**
2. **identify, proactively, business areas where conflicts are likely to arise**
3. **document each potential conflict and describe how its effect should be mitigated, and**
4. **disclose its policy to clients on request.**

1.4.3 Handling of Client Orders and Trade Execution

This is by far the most complex area of MiFID II. It imposes different rules on different types of industry participants. It also redefines two terms that were introduced by MiFID I:

- **Multilateral Trading Facility (MTF) – a system that brings together multiple parties (eg, retail investors or other investment firms) that are interested in buying and selling financial instruments, and enables them to do so. These systems can be stock exchanges, crossing networks or matching engines that are operated by an investment firm or a market operator. Instruments may include shares, bonds and**

derivatives. An investment exchange is a form of MTF. For more on these terms, see chapter 3, section 2.

- **Systematic Internaliser (SI) – a firm that, on a frequent and systematic basis, deals on its own account by executing client orders outside of an MTF or regulated market.**

MiFID II requirements are as follows:

Pre-Trade Transparency
MiFID II establishes minimum standards of pre-trade transparency for shares traded on regulated markets and MTFs.

Investment exchanges, other multilateral trading facilities and systematic internalisers that operate continuous order-matching systems must make aggregated order information available at the five best price levels on the buy and sell side.

For quote-driven markets – see chapter 3 – the best bids and offers of all market makers must be made available.

MiFID II also obliges an investment firm that is a systematic internaliser to undertake what is effectively a public market-making obligation. That is, the firm must provide definite bid and offer quotes in liquid shares for orders below 'standard market size'.

Post-Trade Transparency and Transaction Reporting
Transparency requirements will be extended to virtually all instruments (covering bonds, equities and derivatives)

All firms need to perform two types of reporting:

- **Transaction reporting (on T+1). Most firms employ a nominated Approved Reporting Mechanism (ARM) to report to the relevant regulator on their behalf. Although, some firms (typically large investment banks) will report to the regulator directly.**
- **Trade publication needs to be reported to a nominated Approved Publication Arrangement (APA) on a near real-time basis (less than 15 minutes depending on asset class).**

For transaction reporting, the obligation to report using a legal entity identifier (LEI) has effectively meant 'no LEI, no trade', hence firms are required to report (where appropriate) the LEIs of their clients, counterparties and other parties to the transaction. The investment firms' own LEIs have to be renewed (and paid for) annually. Every entity must have had an LEI by 3 January 2018 or it will not be able to undertake any trading.

National regulators receive all the transaction reports published and post-trade details from all the publishers within their jurisdiction and those routed to them by other National Competent Authorities (NCAs) via ESMA, these records are used for monitoring market abuse and insider dealing. Since Brexit, the UK regulators collect and analyse the transaction reporting data but do not forward the data to ESMA for EU-wide data consolidation.

Best Execution
Broadly speaking, best execution places an obligation on the sell-side firm to take 'all sufficient steps' to get the lowest available price for its customer when the customer is buying, and the highest available price when the customer is selling. There are, however, factors other than price that will be taken into account. Section 3 of chapter 4 provides examples of how best execution is achieved under different scenarios.

Article 21 of the MiFID II regulations requires firms that execute orders on behalf of clients to:

1. **establish an execution policy, which must contain information on the venues used to execute client orders. Those venues must allow it to obtain consistently the best possible result for execution for their clients**
2. **disclose the policy to clients and obtain their consent to that policy**
3. **monitor the effectiveness of arrangements in order to identify and correct any deficiencies and review the appropriateness of the venues in its execution policy at least yearly, and**
4. **upon client request, be ready to demonstrate that the client's order has been executed in line with its execution policy.**

Electronic Trading

- **Derivatives which are sufficiently liquid and eligible for clearing will need to be traded on a trading venue.**
- **A new category of trading venue, called organised trading facilities (OTFs), was introduced as part of MiFID II. An OTF is described as:**

  'any facility or system that is not an MTF or regulated market, operated by an investment firm or market operator, in which multiple third-party buying and selling interests in financial instruments are able to interact in the system in a way that results in a contract.

  Requirements were imposed on operators of OTFs and the operation of OTFs was introduced as a separate permission'.

1.4.4 Third-Country Firms

- **An equivalence decision has to be made by the EC in respect of third countries before firms from these jurisdictions can request to provide services.**
- **As a minimum, third-country firms seeking to provide financial services in the EU are required to establish a branch in the countries where they wish to offer services. Since Brexit, the UK is now considered to be a third country by the EC.**

1.4.5 Investor Protection

- **Receipt of monetary inducements by certain firms, such as portfolio managers and firms giving independent investment advice, is banned.**
- **Advice must meet certain criteria in order to be classified as 'independent', and additional information must be provided to clients.**
- **The definition of non-complex instruments was updated to remove 'structured UCITS', which prevents these funds from being sold without an assessment of their appropriateness for the client.**

1.4.6 Handling of Client Money and Assets

MiFID II rules include a general requirement to make adequate arrangements to safeguard clients' money and client assets, such as securities, that the firm may hold on their behalf. There are specific rules about:

- **record-keeping**
- **segregation, and**
- **reconciliation.**

1.4.7 Cost and Charges Reporting

MiFID II increased the depth and complexity of costs and charges information to be provided to clients. Two sets of reporting are required:

- **ex ante (or pre-sales) reporting will be required showing what costs are predicted, and**
- **ex post (or post sales) reporting will be required showing the actual costs incurred during the period.**

1.4.8 Reporting

Periodic portfolio reporting (including valuations) moved to a minimum quarterly frequency.

Furthermore, any drop in the value of the portfolio of 10% or more since the last periodic report was produced, needs to be reported to the investor within 24 hours.

1.4.9 Inducements

For firms, no monetary benefits and no more than 'minor' non-monetary benefits are permitted under MiFID II. The provision of third-party investment research to firms providing portfolio management services either has to be paid for by the business itself or from a separate client research payment account.

1.4.10 Product Governance in Relation to Distribution

Firms now need to implement suitable governance arrangements to ensure that the products and services they sell are compatible with the needs, aims and characteristics of their target market. Distributors have to obtain sufficient information to ensure that the products and services they provide are not missold.

1.4.11 Advice

MiFID II removed some ambiguity surrounding what is classified as advice (or independent advice). Firms need to ensure that if they are offering advice, then they have the relevant permissions, processes and skills to do this.

1.4.12 Client Agreements

For both professional and retail clients, MiFID II requires investment firms to provide a basic written agreement, setting out the essential rights and obligations of the firm and the client (unless the service is one-off investment advice with no regular review).

Client agreements need to be in place before providing services. The content should include:

- **information about the firm and its services**
- **instruments and strategies**
- **execution venues (best execution)**
- **costs and associated charges**
- **order handling**
- **client money and assets, and**
- **conflicts of interest.**

1.4.13 Telephone Recording

This covers both the recording of telephone conversations and retention of electronic communications relating to transactions concluded and advice given in relation to client

order services. In effect, all communications need to be kept for a period of five years and, where requested by the FCA, for a period of up to seven years.

1.4.14 Suitability

Firms must obtain information to understand each of their client's risk tolerance and capacity for loss.

1.4.15 Appropriateness

Firms must ensure that the products sold and marketed are appropriate to their clients' needs. There are tougher rules on what products are treated as complex and non-complex (especially with the use of derivative instruments).

1.4.16 The Technology Implications of MiFID II

The impact on firms and their technology model was massive. It could be argued that MiFID II had the biggest impact since Y2K or the introduction of the euro 20 years ago.

A range of new or upgraded systems was required for a range of needs and demands. For example:

- **transaction reporting**
- **trade reporting**
- **best execution reporting and oversight**
- **cost and charges reporting**
- **telephone recording**
- **recording additional client data, and**
- **tracking research consumption**

Nearly all firms struggled with meeting the MiFID II deadline and many were still running remediation projects and programmes to address implementation gaps at the time of its arrival, as well as to address any problems encountered since implementation.

1.5 Brexit

It is safe to say that Brexit is having a massive impact on the entire UK economy. At the time of publication (February 2023), the current situation is as follows:

- **The UK agreed to a Trade and Cooperation Agreement (TCA) on 24 December 2020 which came into effect from 31 December 2020 (23:00 GMT) when the Implementation Period ended.**
- **However, the TCA did not cover any provisions or rules for financial services. This meant that UK firms immediately lost their passporting rights to sell and support services from the EU into the EU from 31 December 2020 (23:00 GMT) onwards.**

Therefore, to allow the UK to continue to have access to the EU, UK firms have two options:

- **They can comply with the different regulations of the 27 EU states. However, this is complex, risky and costly.**
- **Alternatively, firms could rely on equivalence decisions. While some equivalence decisions have been granted (for example, central clearing counterparties (CCPs) and central securities depositories (CSDs)), these decisions are political and unilateral, and either side can withdraw with only 30 days' notice. Therefore, they are also complex, costly and risky.**

The TCA was accompanied by a non-binding Joint Declaration which committed the UK and the EU to cooperate on matters of financial regulation. This declaration led to a Memorandum of Understanding (MoU) agreed in March 2021.

The MoU established the Joint UK-EU Financial Regulatory Forum, which will serve as a channel that allows to debate and cooperate on financial services issues between the UK and EU. However, even with the MoU and the above Forum in place, it is still very likely that the UK and EU regulatory frameworks will diverge in the future.

As all firms are very reliant on technology, there will be technology implications.

In the short term, firms will need to enhance their systems to comply with any equivalence rulings, and longer term, systems will need to be able to cope with the additional demands of diverging regulation. However, until the UK and EU have a clear understanding of the future landscape it is not possible to be more specific.

Therefore, it is safe to say that the long-term situation is still very unclear.

2. Data Protection

2.3.1 Know the significance of data protection regulations

With the continued reliance on personal data for firms to perform their business activities (eg, online client servicing and proactive marketing), governments have implemented new legislation to control and monitor the use (and abuse) of personal data.

From an UK point of view, the most prominent legislation is called the UK General Data Protection Regulation (UK GDPR) which is effectively the UK's version of the EU GDPR which was created when the UK left the EU from 31st December 2020. UK GDPR is discussed in 2.1 and EU GDPR is discussed in 2.2.

2.1UK GDPR

As noted earlier UK GDPR came into force on 31 December 2020 when the UK left the UK and it mirrors the EU GDPR very closely.

UK GDPR sits alongside the Data Protection Act 2018 (DPA 2018), which supplements it with national rules (e.g., criminal justice, national security, journalism exemptions).

Its scope applies to organizations operating in the UK as well as organizations outside the UK if they offer goods/services to, or monitor, people in the UK.

Its key principles are very similar to the EU (see 2.3) namely transparency, fairness, accountability, data minimization, purpose limitation, accuracy, storage limitation, and security. It also allows UK individuals to have rights in regard to access to their data, rectification, erasure ('right to be forgotten'), portability, and objection to processing.

UK GDPR is regulated by he Information Commissioner's Office (ICO).

Finally, similar to EU GDPR, organizations can face heavy fines for non-compliance (up to £17.5 million or 4% of global annual turnover, whichever is higher).

2.2 EU GDPR

From an EU point of view, the most prominent piece of legislation is called the General Data Protection Regulation (GDPR).

The EU GDPR is a regulation within EU law that focuses on data protection and privacy. The Regulation applies if the data controller (the firm that collects data from EU residents), the processor (the firm that processes data on behalf of the data controller) or the data subject (the actual individual) is based in the EU. However, the regulation also applies to organisations based outside the EU, if they collect or process the personal data of EU residents.

The EU GDPR was developed to address gaps and issues with the previous data rules and really requires firms to carefully think about where personal data is stored, who can access it and how the data is protected. It came into force on 25 May 2018 across the EU. The UK adopted the GDPR as part of this process because they still members of the EU at the time.

EU GDPR outlines a set of key data protection principles that must be followed when collecting, processing and storing personal data:

- **Lawfulness, fairness and transparency – firms need to make sure their data collection practices do not break the law and nothing is being hidden from the data subject. This means firms need to clearly state in their privacy policy the type of data that is being collected and why it is being collected.**
- **Purpose limitation – firms should only collect personal data for clearly stated purposes and only retain it for as long as it is required for meet that purpose.**
- **Data minimisation – firms must only process the personal data that they need to achieve their processing purposes.**
- **Accuracy – the Regulation states that 'every reasonable step must be taken' to delete or fix any data that is inaccurate or incomplete. Furthermore, individuals have the right to request that inaccurate or incomplete data be erased or rectified within 30 days.**
- **Storage limitation – firms must delete personal data when it is no longer necessary.**
- **Integrity and confidentiality – the rules state that personal data must be:**

  'processed in a manner that ensures appropriate security of the personal data, including protection against unauthorised or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organisational measures'.

Under the EU GDPR, the national regulator can impose fines of up to €20 million or 4% of group worldwide turnover (whichever is the greater).

2.3 Overview of Similar Data Privacy Legislation across the Globe

The focus so far has been in the very similar UK and EU GDPR, nearl all countries have some type of data regulations.

2.3.1 United States of America (USA)

In June 2022, a US government committee voted in favour of a new bill, the American Data and Privacy Protection Act (ADPPA), which would protect personal data at the federal level. This legislation will need to go to voting at the congressional level. However, currently, the US does not have a single over- arching law providing consumer data protection, similar to the GDPR. Instead, there are a number of laws covering privacy requirements for consumers in specific sectors and many individual US states have their own data privacy laws.

2.3.2 Japan

In a similar manner to both GDPRs and CCPA, the Japanese have implemented a piece of legislation called the 'Act on the Protection of Personal Information' (APPI) to provide regulatory privacy protection. This APPI regulation is overseen by the Personal Information Protection Commission (PPC).

The APPI came into force in 2003 with a set of further amendments being made from 30 May 2017. These amendments were to ensure that information users obtain the prior consent or approval of the data subject prior to acquiring their sensitive personal information.

2.3.3 Australia

Finally, Australia implemented their Privacy Act in 1998 with the aim of promoting and protect the individual privacy. The scope covers Australian Government agencies, all organisations with an annual turnover of more than AUS $3 million, as well as a number of other organisations that handle personal information.

The act's key points cover the following:

- **open and transparent management of personal information**
- **anonymity and pseudonymity**
- **collection of solicited personal information**
- **dealing with unsolicited personal information**
- **notification of the collection of personal information**
- **use or disclosure of personal information**

- **direct marketing**
- **cross-border disclosure of personal information**
- **adoption, use or disclosure of government-related identifiers**
- **quality of personal information**
- **security of personal information**
- **access to personal information, and**
- **correction of personal information.**

2.4 Practical Technology Issues complying to UK GDPR and the other Data Privacy Regulations

Technology managers need to consider the following practical issues concerning the protection of personal data:

- **New governance and control processes have to be implemented to ensure a firm-wide focus on data protection.**
- **All systems need to include 'privacy by design'. This means that any new systems or changes to existing systems need to include requirements to ensure demands are catered for.**
- **The GDPR is applied to all firms processing personal data whether they are based in the UK or not. Therefore systems, process and procedures globally will need updating.**
- **Conditions of consent have been tightened, which means systems need to be updated to record which consents have been provided and which have not.**
- **Data subjects have the legal right to obtain details from data controllers on what personal data is being processed and for what purposes. Therefore, systems and processes will need to be implemented to allow these requests to be met.**
- **In particular, the GDPR has an element called 'data erasure' or the 'right to be forgotten'. This means that the data subject can enforce the data controller to stop distributing or holding personal data. This is a very challenging area for technology because most systems or databases are designed with the assumption that data cannot be physically deleted or erased.**
- **A data subject has the right to receive a report of any personal data held by a data controller in a 'commonly used and machine-readable format'. Therefore, systems and processes need to be enhanced to provide this data.**
- **Outsourcing arrangements – do the controls that apply to the firm's own employees also apply to any organisations to whom functions have been outsourced? What procedures are in place to ensure that these external organisations comply with these controls?**

3. The Impact of Regulation on Technology

2.4.1 Understand how firms are using technology to comply with regulation

2.5.1 Know the major technology implications of the following rules: FCA-specific regulation including Client Asset Sourcebook (CASS), Conduct of Business Sourcebook (COB), Senior Management Arrangements, Systems and Controls (SYSC); Senior Managers & Certification Regime (SM&CR); Approved Persons Regime (APER); Markets in Financial Instruments Directive II (MiFID II); Basel II & III; Foreign Account Tax Compliance Act (FATCA); Dodd Frank; European Market Infrastructure Regulation (EMIR); Central Securities Depository Regulation (CSDR); Know Your Customer (KYC); Digital Operations Resilience Act (DORA); EU Artificial Intelligence Act

3.1 Firms Need a Technology Capability to Comply with New and Changing Regulations

As this chapter will demonstrate, there is a constant flow of new, changing and complex regulations coming from the UK, EU, US and many other jurisdictions. In fact, several observers have humorously stated that regulation is the only growth area in asset management at the moment.

Therefore, to ensure firms comply with all these regulations, firms need to develop a number of technology capabilities:

- **Initially, technology systems need to be created to collect all the data required (at the right level of accuracy and timeliness), as well as having sufficient programs or business rules to process this data to produce the required outputs to comply with the regulations. This could cover T+1 data for MiFID-II Transaction Reporting, near real-time data for MiFID-II Trade Publication, trade data for best execution tracking and accurate settlement positions for Central Securities Depositories Regulation (CSDR) cash levy processing.**
- **Additionally, firms are creating dedicated technology teams to provide the necessary people and skills to develop, maintain and support the above technology. Previously, regulatory technology was seen as something 'done in people's spare time', but as regulatory change is now becoming business critical, these teams are often seen as having more and more importance.**

3.2 FCA Specific Regulation

Both the FCA and the PRA have three identical sets of rules covering the conduct of business, the management of customer assets and the responsibilities of senior management. These rules affect both the way that the technology function is organised in regulated firms, and also, they prescribe the way that some of the applications in those firms work. The individual rules are examined, where relevant, in later chapters of this workbook. In this chapter we shall simply describe the purpose of each of the three sets of rules.

3.2.1 Senior Management Arrangements, Systems and Controls (SYSC)

There are 21 individual rules. The purpose of these rules, according to the regulators is to:

1. **encourage firms' directors and senior managers to take appropriate practical responsibility for their firms' arrangements on matters likely to be of interest to the appropriate regulator because they impinge on the appropriate regulator's functions**
2. **increase certainty by amplifying Principle 3, ('A firm must take reasonable care to organise and control its affairs responsibly and effectively, with adequate risk management systems') under which a firm must take reasonable care to organise and control its affairs responsibly and effectively, with adequate risk management systems**
3. **encourage firms to vest responsibility for effective and responsible organisation in specific directors and senior managers, and**
4. **create a common platform of organisational and systems and controls requirements for all firms.**

3.2.2 Conduct of Business Sourcebook (COBS)

The FCA has 21 COBS rules. Rule 2.1 states the purpose of the rule set as a whole, which is to ensure that firms always act honestly, fairly and professionally in accordance with the best interests of their clients.

3.2.3 Client Asset Sourcebook (CASS)

The CASS rules set out how assets (including cash and securities) that belong to clients must be managed. The rules are examined in detail in chapter 6 of this workbook but, in summary form, they insist that if a firm is physically holding assets that belong to clients then these assets must be:

1. **segregated from assets that belong to the firm itself – so that, for example, there is no danger that assets belonging to clients could be used to deliver a trade conducted by the firm itself, and**
2. **regularly reconciled and, if a shortfall is found, then the firm has to rectify it.**

3.3 Senior Managers & Certification Regime (SMCR)

The background to this FCA and PRA regulation is implementing new rules on increasing individual accountability. Rules on individual accountability have been introduced to improve professional standards and culture within the UK financial services sector, which will make it easier for firms and regulators to be clear about who is responsible for what. Therefore, if things go wrong then it will allow senior managers to be held to account where they are at fault for misconduct that falls within their area of responsibility.

The Senior Managers Regime (SMR) came into force on 7 March 2016, for UK banks, building societies, credit unions and PRA regulated investment firms. The regime was rolled out to cover all FSMA- regulated firms by 2018.

While this is still a relatively new regulation, HM Treasury announced in December 2022 (as part of its Edinburgh reforms) that it intends to perform a review of SMCR during Q1-2023. Specific details are unclear, it is expected that the Government will request evidence to review the underpinning legislation with a review of the regulations performed after this.

The regulation consists of the following two main sections and also with the FCA's conduct rules.

3.3.1 Senior Managers Regime (SMR)

This focuses on the most senior individuals in firms who hold key roles or have overall responsibility for whole areas of relevant firms. Firms need to:

- **ensure each senior manager has a statement of responsibilities setting out the areas for which they are personally accountable**
- **produce a firm responsibilities map that joins these individual responsibilities together, and**
- **ensure that all senior managers are pre-approved by the regulators before carrying out their roles. A 'duty of responsibility' has also been implemented, which means senior managers are required to take the steps that are reasonable for a person in that position to take, to prevent a regulatory breach from occurring.**

3.3.2 Certification Regime

This applies to 'material risk-takers' (staff who are subject to the dual-regulated firms' remuneration code and other staff who pose a risk of significant harm to the firm or any of its customers). Firms need to:

- **have identified all certified individuals**
- **have assessed them as fit and proper, and**
- **have procedures in place to reassess the fitness and propriety of certified staff on an annual basis.**

The Financial Services Register now reflects the Senior Managers and Certification Regime (SMCR) information for relevant firms.

3.3.3 Certification Regime

A large amount of data needs to be kept to ensure firms comply with SM&CR; namely:

- **All senior managers' statements of responsibilities.**
- **A firm's responsibilities map.**
- **Details of regulatory approvals and whether all certified individuals have been assessed as being fit and proper.**

Therefore, firms are looking to employ technology to ensure all this data is recorded, audited, monitored and easily accessed as and when required.

3.4 Approved Persons Regime (APER)

The SMCR replaced the Approved Persons Regime (APER) for the majority of solo-regulated firms on 9 December 2019. It aims to reduce harm to consumers and strengthen market integrity by setting a new standard of personal conduct for everyone working in financial services.

An 'approved person' is an individual who is approved to do one or more activities (or 'controlled functions') for an authorised firm. To be an approved person, the individual must meet the following three requirements:

1. **Meet the requirements of the FCA's 'fit and proper' test and follow its principles.**
2. **Comply with the Statements of Principle and Code of Practice (these explain the behaviour the FCA expects of approved people).**

3. **Report anything that could affect their ongoing suitability to the FCA and the authorised firm.**

The technology implications of this are mainly around monitoring staff capability and managing system access. Most firms have some sort of system to document what skills individuals have to determine whether they are suitable to be a 'controlled function' or, if not, what training or other staff development is required. Furthermore, firms will also have technology systems and processes in place to restrict system access to people who are approved or suitably skilled.

In a similar manner to SMCR (see 3.3.2 above), firms are using technology solutions to ensure all this data is recorded, updated and monitored as required.

3.5 Markets in Financial Instruments Directive II (MiFID II)

This regulation (and its impact on technology) was covered in sections 1.3 and 1.4 earlier.

3.6 Basel II and III

3.6.1 Background

The Bank for International Settlements (BIS) is an international organisation (located in the Swiss city of Basel) that fosters international monetary and financial cooperation. It also serves as the primary global standard setter for the prudential regulation of banks and provides a forum for regular cooperation on banking supervisory matters. One of its key aims is to promote international monetary and financial stability. It was instrumental in setting up what is now known as the Basel Committee on Banking Supervision (BCBS).

The Committee was formed in response to the messy liquidation of a German bank in 1974. On 26 June 1974, a number of banks had released Deutschmarks to Bankhaus Herstatt, a small private bank in Cologne, in exchange for dollar payments deliverable in New York. On account of differences in the time zones, there was a lag in the dollar payments to the counterparty banks and, during this gap, and before the dollar payments could be affected in New York, Bankhaus Herstatt was liquidated by German regulators. As a result, those banks that had paid Deutschmarks to Herstatt never received the dollars in exchange.

This event contributed to the process by which the Basel Committee later published a set of minimal capital requirements for banks in 1988. This was known as the 1988 Basel

Accord or Basel I. The aim of the Basel Accord was to ensure that bank regulators throughout the world applied similar prudential standards to the banks that they regulated.

Since 1988, operational risk has grown to assume a level of importance approaching that of credit and market risk. Because of the dramatic changes in financial markets, products, management practices, technological innovations and supervisory approaches, banks are beginning to use increasingly sophisticated processes to measure and assess their operational risk exposure. Basel I is now widely viewed as outdated, as it is risk-insensitive and can easily be circumvented. A more comprehensive set of guidelines, known as Basel II, was therefore published in 2004 and was implemented by over 100 countries in 2007. Operational risk is addressed for the first time in the revised Accord.

3.6.2 The Basel II Accord in Operation

To promote greater stability in the financial system, Basel II uses a 'three pillars' concept:

1. **Minimum capital requirements (Pillar 1).**
2. **Supervisory review (Pillar 2).**
3. **Market discipline (Pillar 3).**

The Basel I Accord dealt only with parts of each of these pillars. For example, as explained above, of the key Pillar 1 risks, credit risk was dealt with in a simple manner, market risk was an afterthought, and operational risk was not dealt with at all.

Although there are other definitions, the most widely accepted definition of operational risk today is:

> **'The risk of loss resulting from inadequate or failed internal processes, people and systems or from external events'.**

This is the formal definition which has been drawn up by the Basel Committee.

3.6.3 Pillar 1

The first pillar provides improved risk-sensitivity in the way that capital requirements are calculated for three major components of risk that a bank faces: credit risk, market risk and operational risk. In turn, each of these components can be calculated in two or three ways of varying sophistication. Other risks are not considered fully quantifiable at this stage.

The minimum overall capital ratio is between 8% and 15% depending on which approach to risk measurement the firm chooses to adopt, but the methods of measuring market, credit and operational risk exposure are now more elaborate.

Capital ratio = Capital requirement / (Credit risk exposure + market risk exposure + operational risk exposure)

The 'market risk' element, dealing with trading losses, is unchanged from Basel I, which was amended for this purpose in 1997.

The 'operational risk' part is new – it says that banks' capital should reflect the risk of mistakes and wrongdoing. The Basel Committee provides seven examples of where banks and investment firms may be exposed to operational risks.

Pillar 1 requires a more detailed explanation. It lays down a new means of measurement acceptable to international regulators. In seeking to provide common standards, it outlines three different measurement approaches of increasing complexity for calculating risk exposure:

- **The Basic Indicator Approach – as the name implies, this is the most basic approach and requires a bank to hold a fixed percentage (denoted 'alpha') of its gross income as operational risk capital. This fixed percentage is set by the Basel Committee at a level of 15%. It is anticipated that smaller, domestic institutions that do not possess sophisticated risk management tools and techniques will use the basic indicator approach.**
- **The Standardised Approach – this approach is more refined than the basic indicator approach because it divides a firm's activities into a number of standardised business lines, allowing different risk profiles to be allocated to each. In other words, it introduces the concept of risk-weighted assets (RWAs). This is intended to provide a more representative reflection of an organisation's overall operational risk. Like the basic indicator approach, it uses gross income as a broad indicator that reflects the scale of business operations within each business line and therefore the likely scale of operational risk. It splits a firm's gross income between a number of defined business lines and then multiplies this by a factor (denoted 'beta') specific to each business line to produce the amount required to be held as operational risk capital for that particular business. The overall amount of operational risk capital is then the sum of all these calculations.**
- **The different factors reflect the assumed riskiness of each business and range from 12–18%. The standardised approach relies on indicators and factors set by the regulators and recognises that many institutions do not yet have sufficient loss data and analytical risk processes to calculate their own capital charge. It provides a basis for moving towards a more sophisticated methodology and encourages better operational risk management. In order to qualify to use this approach, a firm must convince its regulator that it has the necessary management structure, expertise and systems to measure and control its operational risk.**
- **The Advanced Measurement Approach (AMA) – this is the most risk-sensitive of the three approaches. It allows banks to use their own internal measurement system and loss data as a basis for calculating the capital charge. The primary motive for a**

firm to move from the standardised approach to AMA is to reduce its capital allocation requirement which rewards more sophisticated risk management. AMA can cover a range of measurement techniques, providing that the regulators approve them. Approval will mean the inclusion of quantitative and qualitative measures. Where qualitative measures are used, they must have the potential to be objectively validated.

Banks that adopt AMA are allowed to use their own 'value-at-risk (VaR) models' for calculating market risk exposure, providing they pass a review process. The objective of the review process is to ensure integrity and consistency in the market risk calculation. The basic standards demanded by the Directive are:

- **the VaR estimate must be to a 99% confidence level**
- **losses must be calculated on the basis of a ten-day holding period, and**
- **historic data must cover a minimum period of 250 days.**

VaR is covered in more detail in chapter 4.

In order to qualify to use the advanced measurement approach, the regulators require banks to comply with more stringent criteria than the standardised approach. They list generic qualitative and quantitative criteria aimed at ensuring that a bank has satisfactory risk management processes, risk measurement systems and risk infrastructure in place to be able to use AMA.

3.6.4 Pillar 2

This pillar requires supervisors to ensure that each bank has sound internal processes to assess capital adequacy based on a thorough evaluation of its risks. It provides a framework for dealing with all the other risks that a bank faces, such as reputational risk, liquidity risk and legal risk, which the Accord combines under the title of residual risk.

3.6.5 Pillar 3

The third pillar greatly increases the disclosures that the bank must make. This is designed to allow the market to have a better picture of the overall risk position of the bank and the capital adequacy of its positions and to allow the counterparties of the bank to price and deal appropriately.

3.6.6 The Technology Implications of Basel II

Basel II has three different sets of implications for the technology department. Firstly, like MiFID II, it was a major change programme in its own right that needed to be managed appropriately. Chapter 8 deals with these issues. Secondly, it affects the content of business applications. For example, firms that have decided to use either the standardised

approach or the advanced measurement approach for calculating their capital requirements must ensure that they have the business applications in place to perform these calculations.

Applications that are affected by Basel II are discussed in detail elsewhere in this workbook. They include:

- **applications that are able to calculate VaR (these are discussed fully in chapter 4, section 2)**
- **applications that can mark positions to market (these are discussed fully in chapter 4, section 2)**
- **applications that can perform interest accruals (these are discussed fully in chapter 6, section 4.1.1)**
- **applications that can perform both internal and external reconciliations of cash and securities (these are discussed fully in chapter 6, sections 6.2 and 6.3).**

Finally, the emphasis on operational risk affects the way that the technology department manages its activities. Poor management and processes can contribute to the occurrence of the seven operational risk events identified by the Basel Committee. For example:

1. **Internal fraud – misappropriation of assets, tax evasion, intentional mismarking of positions and bribery. (These activities can be facilitated by practices that allow, inter alia, unauthorised access to applications and underlying data. They may be mitigated by the use of application password control and the deployment of systems that support the concept of segregation of duties.)**
2. **External fraud – theft of information, hacking damage, third-party theft and forgery. (As for (1) above, but in addition, these problems can be mitigated by the deployment of measures such as anti- virus software, anti-spyware software and firewalls.)**
3. **Employment practices and workplace safety – discrimination, workers, compensation, employee health and safety. (There are no specific technology-related issues to this event; it is a company-wide issue.)**
4. **Clients, products, and business practice – market manipulation, anti-trust, improper trade, product defects, fiduciary breaches and account churning. ('Product defects' in this context includes defects in the software and hardware that is used to process the firm's data. Good technology practice involves the use of standardised, reliable methodologies to discover and document business requirements, select software vendors and packages, build, test and deploy software and manage projects. It also involves the use of configuration management and change control procedures to ensure that the right software versions are deployed. These topics are examined more deeply in chapters 9 and 10.)**
5. **Damage to physical assets – natural disasters, terrorism and vandalism. See event 6, directly below.**

6. **Business disruption and systems failures – utility disruptions, software failures and hardware failures. (These risks may be mitigated by proper Business Recovery Plans, which are examined in chapter Software failures may also arise as a result of product defects (Basel II Event no. 4).)**
7. **Execution, delivery, and process management – data entry errors, accounting errors, failed mandatory reporting and negligent loss of client assets. (These events, in turn, may be caused by product defects.)**

3.6.7 Basel III

In December 2010, Basel Committee members agreed a new standard, Basel III, to replace Basel II.

Basel III will require banks to hold 4.5% of common equity (up from 2% in Basel II) and 6% of Tier I capital (up from 4% in Basel II) of risk-weighted assets (RWAs). Basel III also introduces additional capital buffers:

1. **A mandatory capital conservation buffer of 2.5%.**
2. **A discretionary countercyclical buffer, which allows national regulators to require up to another 2.5% of capital during periods of high credit growth.**

In addition, Basel III introduces a minimum 3% leverage ratio and two required liquidity ratios. The liquidity coverage ratio (LCR) requires a bank to hold sufficient high-quality liquid assets to cover its total net cash outflows over 30 days; the Net Stable Funding Ratio requires the available amount of stable funding to exceed the required amount of stable funding over a one-year period of extended stress.

The following tables show the originally expected implementation dates for the transition from Basel II to Basel III.

Capital Requirements

Date	Milestone – Capital Requirement
2013	Minimum capital requirements – start of the gradual phasing-in of the higher minimum capital requirements.
2015	Minimum capital requirements – higher minimum capital requirements are fully implemented.
2016	Conservation buffer – start of the gradual phasing-in of the conservation buffer.
2019	Conservation buffer – the conservation buffer is fully implemented.

Leverage Ratio

Date	Milestone – Leverage Ratio
2011	Supervisory monitoring – developing templates to track the leverage ratio and the underlying components.
2013	Parallel run I – the leverage ratio and its components will be tracked by supervisors but not disclosed and not mandatory.
2015	Parallel run II – the leverage ratio and its components will be tracked and disclosed but not mandatory.
2017	Final adjustments – based on the results of the parallel run period, any final adjustments to the leverage ratio.
2018	Mandatory requirement – the leverage ratio will become a mandatory part of Basel III requirements.

Liquidity Requirements

Date	Milestone – Liquidity Requirements
2011	Observation period – developing templates and supervisory monitoring of the liquidity ratios.
2015	Introduction of the LCR – introduction of the Liquidity Coverage Ratio (LCR).
2018	Introduction of the NSFR – introduction of the Net Stable Funding Ratio (NSFR).

The implementation dates for the transition to Basel III have been deferred internationally

3.7 Foreign Account and Tax Compliance Act (FATCA)

3.7.1 Background

Foreign Account Tax Compliance Act (FATCA) was enacted in the US in March 2010 and came into effect in January 2013. It was an important development in US efforts to combat

tax evasion by US persons holding investments in offshore accounts. To put it simply, it compels US citizens, either in the US or outside the US to file annual reports on any foreign account holdings.

FATCA requires certain US taxpayers holding financial assets outside of the US to report certain information about financial accounts held by US taxpayers, as well as foreign entities in which US taxpayers hold a substantial ownership interest to the Internal Revenue Service (IRS), the US tax authority. FATCA also affects some non-US financial institutions known as foreign financial institutions (FFIs), such as UK securities and investment companies.

To allow UK financial institutions to comply with their FATCA obligations, the UK has entered into an Intergovernmental Agreement (IGA) with the US for the information required under FATCA from the UK financial institutions, to be provided to His Majesty's Revenue & Custom (HMRC) to forward on to the US.

3.7.2 Implementation of the Act

Existing Accounts
FFIs are required to investigate all existing accounts to determine whether the owner of the account is a US resident, a US citizen, or a US-registered company. Accounts of less than $50,000 for an individual and less than $250,000 for an entity can be treated as non-US accounts, but all other client information must undergo a search for evidence or indications of US status. The aim of the electronic search is to find US data without initially having to personally contact the client. Where the search results indicate that the account owner is of interest to the US authorities, the FFI needs to check whether all the appropriate IRS documents are on file for that client. An FFI can rely on KYC documents that it has already collected, provided that these contain the level of detail and are in the format demanded. Client relationships for which there is not yet sufficient documentation available need to be further scrutinised and requests made for documents from the account holders.

There are special due diligence arrangements for accounts of more than $1 million that are more onerous and anticipate that a relationship manager could know the status of their account holders, irrespective of the documentation held. Their knowledge of the account must be taken into consideration as part of the review. If an FFI does not receive the requested documentation from a client, then the client is considered a 'recalcitrant account holder', which ordinarily would result in the application of a 30% FATCA withholding tax and reporting to the IRS; however, UK FFIs will report to HMRC.

New Accounts
When new accounts are opened, FFIs must obtain and examine documentary evidence establishing the US or non-US status of individual account holders. For new individual accounts that are identified as held by US persons, the FFI will obtain Form W-9 from the

individual holders of the accounts. All the client onboarding information collected in connection with a new individual financial account will be examined to identify the possibility of potential US status.

Accounts need to be scrutinised where the following arises:

- **documentation suggesting that account holders are US residents or US citizens**
- **a US address associated with an account holder of the account (whether a residence address or a correspondence address)**
- **a US place of birth for an account holder of the account**
- **any other details of potential US status, including a 'care of' address, holding address, or PO box**
- **a power of attorney or signatory authority granted to a person with a US address**
- **standing instructions to transfer funds to an account maintained in the US or directions received from a US address, or**
- **a US telephone number.**

3.7.3 Withholding and Reporting

In general, a withholding agent (a US or foreign person that has control, receipt, custody, disposal or payment of any item of income of a foreign person that is subject to withholding) is required to withhold 30% on a withholdable payment made to an FFI, unless the FFI meets the requirements we have already covered. In addition, an FFI must withhold 30% on any payment it makes to a recalcitrant account holder, as well as any payment it makes to another FFI, unless that FFI meets certain requirements. However, none of these procedures for withholdings will apply to UK FFIs that are subject to the agreement between the US and UK.

UK FFIs are likely to need to report the following information about their US accounts to HMRC:

- **The name, address, and taxpayer identification number (TIN) of each account holder that is a specified US person and, in the case of any account holder which is a US-owned foreign entity, the name, address, and TIN of each substantial US owner of such entity.**
- **The account number.**
- **The account balance or value at year-end.**
- **Gross dividends, interest and other income paid or credited to the account (timing will be determined in the FFI agreement).**

3.7.4 The UK/US Agreement

The UK (along with France, Germany, Italy, and Spain) took part in joint discussions with the US government to explore an intergovernmental approach to FATCA, supporting the

overall aim to combat tax evasion, while reducing risks and burdens on financial institutions. An intergovernmental agreement was signed in September 2012 which provides a mechanism for UK financial institutions to comply with their obligations without breaching data protection laws. Under the agreement, financial institutions pass information to HMRC which will then automatically exchange this information with the IRS.

Because of the very complex due diligence requirement of FATCA, many financial firms in the UK do not accept US citizens or residents as clients.

3.7.5 Technology Implications

There are a number of technology implications. At the time that the regulation went live, one-off reports or downloads had to be developed to allow firms to determine whether any of their existing accounts had any US ownership.

Furthermore, on an ongoing basis:

a. **specialist workflows had to be developed to enhance the account-opening process to ensure all the required documentary evidence was gathered, and**
b. **reports had to be written to provide the necessary regulatory information to HMRC.**

3.8 The Dodd-Frank Act

3.8.1 Introduction and Background

The Dodd-Frank Wall Street Reform and Consumer Protection Act is a US law that was passed in July 2010 and implementation began in stages in 2012. It is the most significant change to financial regulation in the US since the 1930s, affecting all the US regulatory agencies and almost every aspect of the nation's financial services sector.

The events that led to the passing of Dodd-Frank were the shocks to the financial system caused by the credit crunch in 2007 and 2008 and, in particular, the bankruptcy of Lehman Brothers in September 2008. When the liquidators began their work, they found it very difficult to unwind the firm's OTC derivative positions. These were worth over $60 billion and involved over 8,000 trading counterparties. One year after the bankruptcy, the liquidator was still employing over 300 people to reconcile and unwind these transactions.

Dodd-Frank was an enormous piece of legislation covering many aspects of the financial markets, regulation and corporate governance. There were too many individual sections to cover in depth in this workbook, but many readers will find themselves having to deal

with specific and far-reaching Dodd- Frank requirements concerning transaction reporting in general, and the post-trade treatment of OTC derivatives in particular.

3.8.2 Overview of the Dodd-Frank Legislation

The main provisions include:

1. **Consumer protection – Dodd-Frank created a new independent watchdog within the Federal Reserve (known as the 'Fed'), with the authority to ensure consumers receive the clear, accurate information they need to shop for mortgages, credit cards and other financial products, and protect them from hidden fees, abusive terms and deceptive practices.**
2. **Investor protection – Dodd-Frank provided tough new rules for transparency and accountability for credit rating agencies to protect investors and businesses.**
3. **Ends 'too big to fail' bailouts – Dodd-Frank aims to end the possibility that taxpayers will be asked to bail out financial firms whose collapse would threaten the economy. It is designed to:**
   - **establish a safe way to liquidate failed financial firms**
   - **impose tough new capital and leverage requirements that make it undesirable to get too big**
   - **update the Fed's authority to allow system-wide support but no longer prop up individual firms.**
4. **Advance warning system – Dodd-Frank created a council to identify and address systemic risks posed by large, complex companies, products and activities before they threaten the stability of the economy.**
5. **Executive compensation and corporate governance – Dodd-Frank provided shareholders with a say on pay and corporate affairs with a non-binding vote on executive compensation and golden parachutes.**
6. **Regulatory enforcement – Dodd-Frank strengthened oversight and empowers regulators aggressively to pursue financial fraud, conflicts of interest and manipulation of the system.**
7. **Technical expertise – Dodd-Frank created a new Office of Financial Research (OFR) within the Treasury staffed by economists, accountants, lawyers, former supervisors, and other specialists, with the aim of supporting the council's work by collecting financial data and conducting economic analysis.**
8. **Making risks transparent – through the OFR and member agencies, the council collects and analyses data to identify and monitor emerging risks to the economy and make this information public in annual reports to Congress.**

3.8.3 Technology Implications of Dodd-Frank

Items 3, 4, 7 and 8 in the above list have led the existing US regulators, in particular the Commodity Futures Trading Commission (CFTC) which regulates most derivative trading

in the US, to impose new regulatory requirements which will require significant business application upgrades.

The act is not the only driver for these changes; similar requirements have arisen from the European Markets Infrastructure Regulation (EMIR). EMIR is discussed in section 3.9 of this chapter. The application changes introduced as a result of Dodd-Frank include the following:

Transaction Reporting

- **Swap trades now need to be reported within 15 minutes of trade execution. Regulatory transaction reporting is discussed more fully in chapter 5.**
- **The counterparty of any trade is now identified by a legal entity identifier (LEI). The significance of this code is discussed more fully in section 1 of chapter 5.**

Clearing and Settlement of OTC Derivative Transactions
Historically, most OTC derivative trades have been settled directly between participants, without the involvement of a clearing house. Regulators are insisting that where suitable clearing arrangements are in place, OTC derivative trades should be cleared through a recognised clearing house (RCH). The clearing process is examined in detail in chapter 3.

The Use of OTC Derivative Trade Repositories
One of the reasons that the liquidators of Lehman Brothers found the task so complex was that there was no single database containing all the firm's OTC derivative trades. As a result, the CFTC is now insisting that all such trades are entered into a trade repository maintained by an independent third party. Trade repositories are examined in chapter 3. Note that the EU's EMIR regulations – see section 3.9 of this chapter – has an almost identical requirement.

3.9 European Market Infrastructure Regulation (EMIR)

In 2010, the EC published its final proposal for the European Market Infrastructure Regulation (EMIR), which was designed to improve transparency and reduce the risks associated with the derivatives market. EMIR also established common organisational, conduct of business and prudential standards for central counterparties (CCPs) and trade repositories. The scope of the regulation is very similar to that of the US Dodd-Frank legislation which is covered in section 3.8 of this chapter.

The regulation introduces:

- **a reporting obligation for OTC and ETD derivatives; this involves the use of trade repositories which are discussed in chapter 4**
- **a clearing obligation for eligible OTC derivatives**
- **measures to reduce counterparty credit risk and operational risk for bilaterally-cleared OTC derivatives**
- **common rules for CCPs and for trade repositories, and**
- **rules on the establishment of interoperability between CCPs.**

There is an impact on organisations' technology infrastructures. Systems needed to be implemented to ensure that:

- **firstly, the required derivative contracts are captured and then reported to the appropriate trade repositories in the required format and timescales**
- **secondly, the necessary clearing obligations are followed, and**
- **finally, there is sufficient data and controls to support the new risk management standards needed to support the counterparty credit risk and operational risk needs.**

Chapter 3, section 3.6 (Trade Repositories) discusses the technology implications for connecting to trade repositories.

3.10 Central Securities Depositories Regulation (CSDR)

3.10.1 What is the CSDR?

he Central Securities Depositories Regulation (CSDR) is a new piece of EU regulation which aims to harmonise the authorisation and supervision of EU central security depositories (CSDs) as well as certain settlement aspects. Its key objectives are as follows:

- **to harmonise the different rules applicable to the CSDs in the EU**
- **to establish a level playing field among EU CSDs**
- **to increase the safety of securities settlement in the EU**
- **to increase the efficiency of security settlement across EU CSDs, and**
- **to try and create an integrated market for securities settlement with no distinction between national and/or cross-border securities transactions.**

3.10.2 What is the CSDR?

CSDR can be summarised into four phases:

- **Phase 1 – Omnibus/Segregated Accounts – This places an obligation on CSDs and their direct participants to offer their clients the choice between omnibus segregation and individual client segregation, as well as forcing them to inform them of the costs and risks associated with each option. This piece of CSDR is now live.**
- **Phase 2 – Internalised Settlement Reporting – This covers what a settlement 'internaliser' must report to their local competent authorities quarterly, ie, the volume and value of all transactions that they settle outside securities settlement system. This requirement went live in the UK in July 2019.**
- **Phase 3 – Settlement Discipline Regime (SDR) – CSDR introduced a number of rules to prevent settlement fails from 1 February 2022:**
  a. **Ensuring all settlement details are provided as soon as possible.**
  b. **Charging daily accruing but monthly payable cash penalty fines on delayed settlements.**

  (As part of Phase 3, it was planned to implement mandatory buy-ins for settlement delays and failures. However, ESMA stated in November 2021 that this requirement would be delayed and therefore not go live from 1 February 2022. The length of the delay is unclear at the moment, but it is likely to be at least two years (ie, until sometime in 2024).

- **Phase 4 - Electronic Book Entry – All stocks trading and settled in the EU must be held in electronic book-entry form. From January 2023, all new issuances of shares should be in electronic book-entry form. From January 2025, all transferable securities (not just new issues) should be held in electronic book-entry form – share certificates will be phased out altogether.**

3.10.3 What are the Technology Implications of CSDR?

The technology implications for CSDR are interesting and the amount of impact really depends on which phase is being addressed.

Regarding the first phase (Omnibus/Segregated Accounts); the technology implications are generally low because:

a. **most CSDs already provided this functionality, and**
b. **most participants and custodians support them.**

However, the second phase did provide a number of challenges that needed addressing. Trading and settlements systems need to be enhanced to determine what activity was in scope as an 'internaliser' so that quarterly reports could be produced and submitted to the local competent authority.

The third phase will require some significant technology upgrades. Settlement and accounting systems will need to be enhanced to record settlement delays so that:

a. **cash levies can be accrued, paid and then claimed back as necessary, and**
b. **late settlements can be tracked to determine when a mandatory buy-in is required.**

The final phase (phase 4) should not require major technology upgrades because the majority of CSDs can cope with electronic bookkeeping, but those firms who offer certificated share trading will need to advise their clients of the requirement to dematerialise their shareholdings.

3.11 Know Your Customer (KYC)

There are three reasons why banks and investment firms need to take positive steps to know their customers.

Firstly, the Basel Committee on Banking Supervision (BCBS) published its approach to know your customer (KYC) policies for banks in 2001. These published safeguards went beyond simple account- opening and record-keeping and required banks to formulate a customer acceptance policy and a tiered customer identification programme which involves more extensive diligence for higher-risk accounts. It also included a recommendation for proactive account monitoring for suspicious activities.

Secondly, in the UK, the Money Laundering Regulations 2010 and the regulatory rules legally required firms to adopt identification procedures for new clients (to 'know your customer') and keep records in relation to this proof of identity. The obligation to prove identity is triggered as soon as reasonably practicable after contact is made and the parties resolve to form a business relationship. Failure to prove the identity of a client could lead to an unlimited fine and a jail term of up to two years.

Finally, MiFID II regulations require firms to classify their clients as one of the following:

- **eligible counterparty – eg, another regulated bank or stock exchange member firm**
- **professional client – eg, a pension fund, or**
- **retail client – eg, a private individual.**

These classifications have increasing levels of protection. Clear procedures must be in place to classify clients and assess their suitability for each type of investment product, the appropriateness of any investment advice given, and the suitability of any transaction suggested to them.

By using the collected customer information, investment advisers can establish who they are authorised to do business with and understand their client's risk tolerance, investment knowledge and financial position. This information will allow informed decisions to be made regarding what can and cannot be included in a client's portfolio.

3.11.1 Verification Checks

Client Due Diligence (CDD)
The Money Laundering Regulations insist that CDD procedures are carried out when the regulated firm:

- **establishes a business relationship**
- **carries out an occasional transaction**
- **suspects money laundering or terrorist financing, or**
- **doubts the integrity of information previously obtained for CDD purposes.**

Enhanced Due Diligence (EDD)
The Money Laundering Regulations require that, under certain circumstances, regulated firms must employ EDD. The types of clients that require EDD are:

1. **persons who were not personally present when the CDD identity checks were carried out, and**
2. **politically exposed persons (PEPs) – who are in turn defined by the regulations as 'individuals (and their immediate family members) who, in the preceding year, have exercised a prominent public function in a state or institution outside the UK'.**

Under CDD, the types of acceptable documentary evidence to prove the identity of a new client would include the following:

For an individual:

3. **an official document with a photograph will prove the name, eg, passport, international driving licence**
4. **a utilities bill with name and address will prove that the address supplied is valid.**

For a corporate client (a company):

5. **proof of identity and existence would be drawn from the constitutional documents (Articles and Memorandum of Association) and sets of accounts**
6. **for smaller companies, proving the identity of the key individual stakeholders (directors and shareholders) would also be required.**

For a trust:

7. **the identity of the settlor (the person putting assets into trust), the trustees and the controller of the trust (the person who is able to instruct the trustees) would all be verified, along with a copy of the trust deed.**

Case Study – Coutts & Co

In March 2012, the Financial Services Authority (FSA) fined Coutts & Co (a subsidiary of RBS) £8.75 million for failing to take reasonable care to establish and maintain effective anti-money laundering (AML) systems and controls relating to high-risk customers, including PEPs.

In 2010, the FSA visited Coutts as part of its review into banks' management of high-risk money- laundering situations. The FSA's investigation identified that Coutts did not apply robust controls when starting relationships with high-risk customers and did not consistently apply appropriate monitoring of those high-risk relationships. In addition, the FSA determined that the AML team at Coutts failed to provide an appropriate level of scrutiny and challenge.

The FSA identified deficiencies in nearly three-quarters of the PEP and high-risk customer files reviewed. Specifically, in one or more of each inadequate file Coutts failed to:

1. **gather sufficient information to establish the source of wealth and source of funds of its prospective PEP and other high-risk customers**
2. **identify and/or assess adverse intelligence about prospective and existing high-risk customers properly and take appropriate steps in relation to such intelligence**
3. **keep the information held on its existing PEP and other high-risk customers up-to-date, and**
4. **scrutinise transactions made through PEP and other high-risk customer accounts appropriately.**

Coutts agreed to settle at an early stage and therefore qualified for a 30% discount. Were it not for this discount, the FSA would have imposed a financial penalty of £12.5 million.

3.11.2A Technology Perspective on KYC

There are very few roles within the securities industry where interaction with an external end client is required. The verification information given above describes the process for taking on new clients or maintaining existing clients and would typically be handled by dedicated client-facing support or sales teams.

An exception to this generalisation might be where technology resources are supporting a system used by external clients. In these cases, the type of information that is required to validate a client would be driven by the nature of the request. For example, a customer reporting a bug in a piece of code – ie, providing information – might not need to be fully authenticated in the same way as someone asking for system access or password administration.

The typical technology role associated with KYC activities is to support and build the underlying systems. In the securities industry there is a requirement to track, consolidate and report on client-related activity at a greater level of detail and frequency than before this legislation was put in place. Many organisations have purchased or built customer relationship management (CRM) systems that act as a central repository for client information. These CRM systems allow relevant functions to authenticate using KYC procedures and to have access to a central system with the latest record of the verification information that has been captured, including, where required, scanned images of ID and paperwork. Fully implemented CRM systems should also contain a history of all client contact, eg, a record of all letters, emails, trades, calls and cash flows.

A further point to consider is that the greater the level of automation that there is in a firm, the fewer chances there are for manual checking. This means that client information must be validated as soon as it is entered into the system.

3.12 Digital Operational Resilience Act (DORA)

3.12.1 What is DORA

The Digital Operational Resilience Act (DORA) is an EU regulation—Regulation (EU) 2022/2554—that took effect on 17 January 2025 and its prime purpose is to ensure financial institutions can withstand, respond to, and recover from Information and Communication Technology (ICT) related disruptions (such as cyberattacks, system failures, third-party risks

DORA was created due for two main reasons

i. **Rapidly increasing technology dependency and associated raising threats. As financial institutions increasingly rely on digital systems, they become more vulnerable to cyberattacks, failures, and operational disruptions. A breakdown in one system could ripple across borders and impact the broader economy. DORA aims to address these systemic risks with a unified legal framework.**
ii. **Secondly, to harmonise previously scattered rules - Prior to DORA, ICT resilience regulations varied widely across EU member states. This divergence created compliance hurdles, especially for cross-border financial services. DORA hopes to standardises the rules to create legal clarity and consistency.**

DORA is built around five integrated pillars to ensure financial entities are both protected and resilient:

i. **ICT Risk Management - Establish and maintain a robust, governance-backed framework for identifying, assessing, and mitigating ICT risks.**
ii. **Incident Reporting - Standardise the detection, classification, and timely reporting of major ICT-related incidents to regulators and stakeholders.**
iii. **Digital Operational Resilience Testing - Implement regular resilience testing—including threat-led penetration testing (TLPT)—to validate an institution's capacity to withstand disruptions.**
iv. **Third-Party Risk Management - Strengthen oversight of critical ICT service providers (eg, outsourced tech, cloud providers), including due diligence, contractual obligations, and ongoing monitoring.**
v. **Information Sharing - facilitate secure sharing of cyber threat intelligence—patterns, alerts, indicators of compromise—among financial institutions to enhance collective resilience.**

To comply with DORA, firms have to implement the following:

1. **Embedding robust ICT risk management and governance**
2. **Ensuring consistent incident reporting standards**
3. **Requiring rigorous resilience testing**
4. **Tightening controls over third-party dependencies**
5. **Encouraging proactive cyber threat information sharing**

3.12.2 How as DORA relate to the UK

The UK has not adopted DORA (because the UK is now not part of the EU).

However the UK has created a parallel framework (Operational Resilience Rules plus Critical Third-Party regime) that aims for the same outcome: namely; ensuring financial firms can withstand cyber and digital disruptions.

Although it is important to note that the EU's DORA is very much ICT focused where as the UK equivalent covers wider operational resilience.

Regarding the two parts of the framework:

- **Operational Resilience Framework (PS21/3) - Introduced by the FCA, PRA, and Bank of England in 2021 and firms must be fully compliant by 31 March 2025. Firms must map 'important business services,' set impact tolerances, and test resilience.**
- **Critical Third-Party (CTP) Regime - This was effective from 1st January 2025. This regulation allows UK regulators to oversee critical ICT providers (eg, cloud providers) what support the financial sector.**

The UK firms have had to implement similar changes per DORA to comply with the new framework; namely robust risk management, incident reporting, rigorous resilience testing, third party management and proactive cyber threat information sharing.

Businesses operating in both EU and UK jurisdictions will face a dual compliance burden dealing with the two different sets of rules.

3.13 EU Artificial Intelligence Act

3.13.1 Overview of the Act

The EU Artificial Intelligence Act (AI Act) is the European Union's landmark law on artificial intelligence, formally adopted in 2024 and expected to start applying gradually from 2025–2026. Firms outside the EU that want to sell AI systems in Europe will also need to comply.

The Act is designed to

- **Ensure AI systems used in the EU are safe, transparent, non-discriminatory, and respect fundamental rights.**
- **Promote trust and innovation in AI while preventing harmful uses.**
- **Create the world's first comprehensive legal framework for AI.**

The AI Act is a risk based regulations covering 4 levels of risk

- **Unacceptable risk - This covers several areas such as:**
  (a) AI that manipulates behavior
  (b) social scoring systems by governments and
  (c) real-time biometric surveillance in public spaces with limited law enforcement exceptions.
  All this type of AI is completely banned
- **High risk - Such as AI in critical infrastructure, healthcare, education, employment, law enforcement, and migration. This risk category is allows but it is subject to strict obligations before they can be marketed or used, such as risk assessments, data quality standards, human oversight, transparency, cybersecurity.**
- **Limited risk - This covers areas such as chatbots and deep fakes, and is allowed subject to transparency obligations.**
- **Minimal/low risk - All other AI sits here (such as spam filters) and there are no specific compliance rules.**

The AI Act is expected to become a global standard-setter, much like the GDPR did for data protection.

3.13.2What is the impact to the UK

The UK approach is little more fragmented. At the time of writing (August 2025) there is no single AI law yet. The UK government (post-Brexit) opted for a pro-innovation, sector-based approach which existing regulators (such as the ICO, CMA, FCA, Ofcom, MHRA) applying existing laws to AI within their domains.

Most notability, unlike the EU AI law, there is no risk allocation within the UK

A statutory framework may come later, but the UK is deliberately avoiding an 'AI Act' equivalent for now. But firms operating in both jurisdictions may face a dual compliance burden covering (a) strict EU rules plus (b) looser but fragmented UK oversight.

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **Which UK regulator is responsible for the supervision of investment exchanges?**
   Answer Reference: Section 1.2.2

2. **What are the three main MiFID II requirements for firms that handle customers' orders?**
   Answer Reference: Section 1.4.3

3. **What are the principles of the UK and EU General Data Protection Regulation (GDPR)?**
   Answer Reference: Section 2

4. **What are the main ways that financial regulation affects the work of the technology department?**
   Answer Reference: Section 3.1

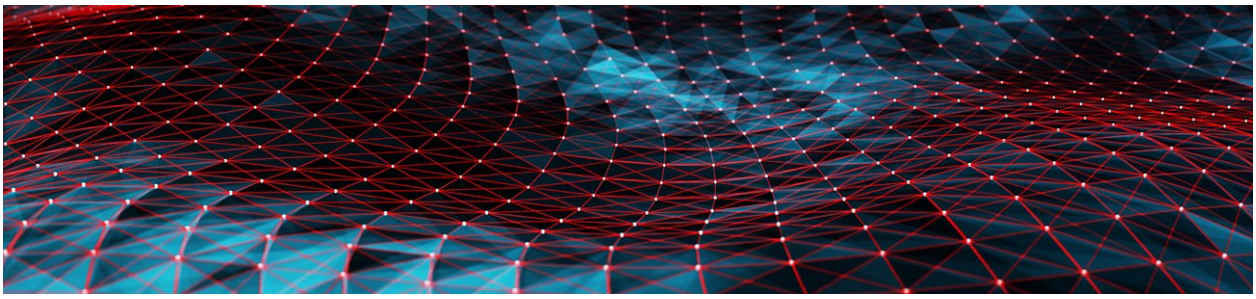
5. **Which group of FCA/PRA rules requires regulated firms to 'vest responsibility for effective and responsible organisation with directors and senior management'?**
   Answer Reference: Section 3.2.1

6. **What three requirements must a person meet to be an Approved Person?**
   Answer Reference: Section 3.4

7. **What are the seven operational risk events defined by the Basel Committee?**
   Answer Reference: Section 3.6.6

8. **What is the definition of a recalcitrant account holder, and which piece of legislation introduced this term?**
   Answer Reference: Section 3.7.2

9. **Under the UK 'know your customer' rules, what types of documentary evidence are suitable to prove the identity of a new corporate client?**
   Answer Reference: Section 3.11.1



Chapter Three
Technology and the Functional Flow of Financial Instruments

Section 1 Introduction

Section 2 The Roles and Functions of Trading Venues

Section 3 Clearing Houses

Section 4 Real-Time Information Sources

This syllabus area will provide approximately 3 of the 50 examination questions

1. Introduction

Section 2 of this chapter describes the roles of trading venues, and the types of trading platforms they provide for their member firms. Section 3 describes the role of clearing houses and provides examples of the trade flows between exchange member firms, exchanges and clearing houses – all of which play a part in processing the trade. Section 3 goes on to look at changes to the competitive landscape of exchanges and clearing houses, and looks at the role of external real-time information sources.

2. The Roles and Functions of Trading Venues

3.1.1 Understand the function and connectivity of investment exchanges, multilateral trading facilities, organised trading facilities, systematic internalisers and funds platforms: classification; economic functions; order handling systems; connectivity

2.1 Definitions of Terms

A multilateral trading facility (MTF) is any type of system or service that brings together multiple parties interested in buying and selling financial instruments, especially those that may not have an official market. MTFs are controlled by approved market operators (such as large investment banks). Trading is normally performed electronically and buy/sell trades are matched using a matching engine. The US equivalent of an MTF is an alternative trading system (ATS).

An investment exchange (also known as a regulated market, stock exchange, share market, stock market, bourse or derivatives exchange) is a corporation or mutual organisation which provides facilities for counterparties and firms to trade securities (such as bonds, derivatives and physical commodities such as precious metals and agricultural products) in a smooth and safe manner. Investment exchanges are not allowed to trade as a principal (eg, they are not allowed to 'take a position' in a security).

The Markets in Financial Instruments Directive (MiFID) II introduced a new type of trading platform called an organised trading facility (OTF). An OTF is not a regulated market or MTF but still allows the buying/selling of bonds, structured finance products, emissions allowances or derivatives. Equities are not permitted to be traded through an OTF. The introduction of OTFs meant that many transactions currently categorised as off-venue came within a trading environment which should increase market transparency, reduce the amount of opaque market models/products and increase the quality of price discovery, investor protection and liquidity.

MiFID II also redefined systematic internalisers (SIs) which are investment firms that execute client orders on their own account outside a regulated market, MTF or OTF without employing a multilateral matching system. An SI must publish firm bid/offer quotes for liquid instruments which must reflect the current market. For illiquid instruments, it must disclose quotes on request. (SIs replaced the previous broker crossing networks).

In the UK, investment exchanges are presently regulated by the FCA, which has classified them as follows:

- **A Recognised Investment Exchange (RIE) is one that is based in the UK and is recognised by the FCA – see section 2.2 for a list of these exchanges and a brief description of their business.**
- **A Recognised Overseas Investment Exchange (ROIE) is one that is based outside the UK but admits UK banks and securities firms as members, and is recognised by the Financial Conduct Authority (FCA). There are currently eight exchanges in this category, including NASDAQ in the US and the Australian Securities Exchange Limited.**
- **A Designated Investment Exchange (DIE) is an overseas exchange that does not carry on a regulated activity in the UK and is not a regulated market. Designation allows securities firms to treat transactions effected on a designated investment exchange, in the same way as they would treat transactions effected on an RIE. Overseas exchanges may apply to the FCA to be included on the FCA's list of designated investment exchanges. Before adding an investment exchange to the list of designated investment exchanges, the FCA will look at whether the investment exchange provides an appropriate degree of protection for consumers. The FCA will also undertake a public consultation prior to adding the investment exchange to the list of designated investment exchanges.**

A funds platform is a service that is used by intermediaries (such as financial advisers) and direct investors to manage their investment portfolios.

2.2 Recognised Investment Exchanges (RIEs)

- **The London Stock Exchange plc (LSE) is the largest formal market for securities in the UK and facilitates deals in equities, bonds and some derivatives such as exchange-traded funds and covered warrants.**
- **The London Metal Exchange ltd (LME) trades a wide variety of futures and options contracts based on non-ferrous metals, ferrous metals, minor and precious metals.**
- **ICE Futures Europe trades futures and options on a wide range of interest rate, indices, commodities and energy products.**

- **CBOE Europe ltd offers trading in more than 6,000 securities across 18 major European markets.**
- **Aquis Stock Derivatives Exchange ltd is an equity market for small- and medium-sized companies who want to raise money from investors to finance and grow their businesses. It allows companies to come to the public markets for the first time to raise equity finance, or for existing listed companies to raise further finance.**
- **Euronext London ltd, which supports UK customers trading on the Euronext markets in Amsterdam, Brussels, Dublin, Lisbon, Oslo and Paris.**
- **IPSX UK ltd, the world's first regulated stock exchange dedicated to the initial public offering and secondary market trading of companies owning single institutional grade real estate assets and multiple assets with commonality.**

2.3 Economic Functions of an Investment Exchange

There are three economic functions of an investment exchange:

1. **To provide a means for companies to raise new capital in the form of equities and bonds.**
2. **To provide facilities for investors to trade equities, bonds and other securities.**
3. **To create standardised derivative instruments such as futures and options which are based on the underlying securities, and to provide facilities for investors to trade in these derivative instruments.**

Investors who wish to trade instruments that are listed on an investment exchange have to route their orders to a stock exchange member firm. That member firm's technology department will need to organise connectivity to a large number of exchange computer systems to facilitate trading. The following section describes the major systems used by the LSE.

In principle, there are three types of exchange order-handling systems used throughout the world.

An order-driven system has no designated or official market makers. A member firm that wishes to buy a given investment at a given price submits an order to the relevant exchange system, while at the same time other member firms that wish to sell the same product submits sell orders to the system. When a buyer's bid meets a seller's offer (or vice versa), the exchange's matching system will decide that a deal has been executed. The identity of the buyer is not known to the seller, and vice versa.

A quote-driven system is one where some of the exchange's member firms take on the obligation of always making a two-way price in each of the products (typically, equities) in

which they make markets. These firms are, therefore, known as market makers. If another member firm wishes to buy or sell then they approach the market maker directly, either by telephone, or more likely electronically, by using the exchange system concerned. In a quote-driven market, the identity of the buyer and seller are known to each other.

Order-driven systems are most suitable when the products concerned are highly liquid; that is to say that on every trading day there will be large volumes of trading activity. Quote-driven systems on the other hand are most suitable for products which are illiquid; that is to say that on most trading days there are usually low volumes of trading activity.

Hybrid systems offer both facilities – most orders are fulfilled through the order queue, but market makers exist side by side to guarantee trade execution if there is not enough liquidity in the order queue.

2.4 London Stock Exchange (LSE) Systems

2.4.1 Trading Systems

The LSE offers the following trading systems to its member firms:

- **SETS (hybrid platform) – SETS (Stock Exchange Electronic Trading Service) is used for trading all securities in the FTSE All Share Index as well as the more liquid of the AIM securities and the major Dutch stocks. SETS is London Stock Exchange's flagship electronic order book, trading FTSE 100, FTSE 250, FTSE Small Cap Index constituents, exchange-traded funds (ETFs) and exchange-traded products (ETPs), plus other liquid AIM, Irish and London Standard-listed securities. It is the London Stock Exchange's hybrid trading service that combines electronic order-driven trading throughout the day with integrated market maker liquidity provision, delivering guaranteed two-way prices.**
- **SETSqx (hybrid platform) – SETSqx (Stock Exchange Electronic Trading Service – quotes and crosses) supports four electronic auctions a day (at 08:00, 11:00, 15:00 and 16:35) along with continuous stand-alone, quote-driven market making. It is used to trade all UK domestic equities not traded on SETS.**
- **SEAQ (quote-driven platform) – SEAQ (Stock Exchange Automated Quotations) is the quote- driven platform for the fixed-interest market and those AIM securities not traded on either SETS or SETSqx.**
- **Order Book for Retail Bonds (hybrid platform) – in February 2010, the exchange launched this new trading platform for UK gilts (government bonds) and a selection of sterling-denominated corporate bonds. The trading day is made up of an initial opening auction phase followed by continuous trading supported by market makers until market close. There is no closing auction.**

The LSE's trading systems are based on its Millennium Exchange software platform, which went live in 2011. This system was built by Millennium IT, the Sri Lankan software and services company that the LSE bought for £18 million in 2009.

2.4.2 Other LSE Systems

As well as the exchange's trading systems, there are a number of other LSE systems that the member firm may need to arrange connectivity to. The word 'may' is used in this context because some of the services are also provided by other organisations that compete with the LSE to provide these services.

- **Regulatory News Service (RNS) – companies whose shares or bonds are listed on the exchange have a legal duty to make announcements about price-sensitive information as soon as possible. Price-sensitive information includes, inter alia, details of P&L forecasts, changes in major shareholders, appointments and resignations of directors, plus any other major announcements. The RNS allows the listed companies to make these announcements, and investors to view them and take action. The RNS is, therefore, made available to listed companies, LSE member firms, professional investors and the media.**
- **The Corporate Events Diary is an online calendar for tracking upcoming corporate events affecting UK securities traded on the LSE. It offers advance warning of both stock situation notices and ex-dividend status in a simple, easy-to-use calendar format that allows users to:**
  - **keep up-to-date with corporate events**
  - **anticipate the pricing impact of key events on securities, and**
  - **prepare both trade capture and operational teams for impending announcements.**
- **The SEDOL Masterfile is a database of securities that provides a common, unique identification code (the SEDOL code) that all market participants may use to identify an individual security. It covers securities listed on all the world's major markets, not just those listed on the LSE.**
- **European regulatory trade reporting – broker-dealers in Europe have a legal obligation to report all trades to their regulators electronically. The reason that a regulatory trade report is required is so that the regulators can monitor the markets to track insider dealing and other forms of market abuse (see chapter 2, section 3). The LSE, among other organisations, provides facilities for firms to make regulatory trade reports.**
- **Participant services are designed to supply member firms with information about their market share or quality of execution for example.**

2.5 Providing Connectivity to Investment Exchanges' Systems

The member firm's IT department is responsible for providing connectivity to those investment exchange systems that users need to carry out their business. In a large firm, this will probably include all the LSE systems, but a smaller firm may need to use only some of the systems described in this chapter. Many firms will also require connectivity to other exchanges which may be located in the UK or overseas.

Connectivity to trading systems, of course, needs to be real time and capable of processing data at high speeds in a robust manner. Hardware, software and interface connection failures at times when the markets are under pressure from volatile prices and/or high trading volumes can cost the member firm very dearly. Member firms' technology departments may be involved either in developing trade capture applications that include real-time interfaces to exchange systems, or in implementing package systems that include these interfaces.

2.5.1 In-House Development

If the firm is developing in-house, then the developers will need access to the following types of publications and facilities that are provided by all the relevant exchanges:

- **Data exchange specifications (DESs) – these cover the message formats for data that is to be sent to or received from the exchange. DESs also explain the sequence of messages.**
- **Data dictionaries – most messages are based on data dictionaries. A data dictionary is a defined as a centralised repository of information about data such as meaning, relationships to other data, origin, usage and format.**
- **Data security standards – these cover the rules for data encryption (if required).**
- **Service level standards – these cover a variety of standards that the member firm must meet, including:**
  - **the normal working days and hours of business of the service to which you are communicating**
  - **any rules about the timeliness of a message: for example, regulatory trade reporting messages must be sent not later than three minutes after the trade was executed**
  - **specific rules about non-standard conditions, such as trade cancellation and amendment.**
- **Testing facilities – all exchanges offer testing facilities so that the firm can test its new developments; some exchanges insist that a level of mutual testing has been carried out before a new application or new member firm is allowed to connect to its systems.**

Details of all the publications and services that each individual exchange offers are usually to be found on its website, sometimes in a secure area.

2.5.2 Packages

Because of the cost of the initial development and then the cost of the day-to-day maintenance, many member firms do not build their own trading systems; instead, they implement packages that (as well as providing other facilities) provide the connectivity required to all the exchanges that the user firm requires.

These packages can come in many different shapes to meet the specific requirements of the firm and are often considered modular. Modular systems often contain a number of core elements or modules but then can have additional functionality added either at the time of purchase or at a later date via paying for additional modules such as access to additional market interfaces or reporting and performance functionality.

These packages often try and provide a front-to-back solution for a firm such that the trading, portfolio management, reporting, performance, compliance monitoring/risk management and client data are all held or managed on the same system. This can be attractive to smaller companies and those with less complex clients and instrument requirements. More complex clients may need to support several packages to cover the breadth of their own particular business.

2.6 Funds Platforms

A funds platform is a service used by wealth managers, intermediaries (such as financial advisers) and direct investors to manage some, or all, of their investment portfolios. As well as traditional mutual funds (unit trusts, open-ended investment trusts (OEICs), investment trusts and/or société d'investissement à capital variables (SICAVs)), platforms can support a wider range of asset types such as cash, equities, bonds/gilts, structured products and property funds.

The main selling point of platforms is that they provide a one-stop shop for people who want to hold funds or shares, thus removing the need to have multiple relationships with different providers, such as stockbrokers and asset managers. Intermediaries and consumers access the platform using an often sophisticated website and/or mobile app, which allows them to view their investments and process buy/sell orders. Some platforms have extra tools to support 'what-if' planning, stop-losses, limit orders and more complex reporting.

Platforms will manage the 'back end' connectivity with the actual marketplace; for example, by using Euroclear's EMX or Calastone messages for mutual fund dealing, SWIFT messaging for cash and so on.

In the majority of cases, platforms allow investors to hold their investments within tax-efficient wrappers such as individual savings accounts (ISAs), and many platforms also offer the facility to manage self- invested personal pensions (SIPPs). In these cases, it is possible to transfer ISAs and SIPPs from other providers onto the platform.

Charges vary for the different types of products one can invest in. All platforms will charge for trading assets on exchanges (such as equities or ETFs), but some platforms may not charge for trading mutual funds (although their fee is likely to be included as part of any administration charge). Additionally, some platforms will charge a flat annual fee, whereas other platforms may charge a fee percentage based on the assets under management. Therefore, care needs to be taken when selecting a platform to fully understand the fee structures in place.

3. Clearing Houses

3.2.1 Understand the function and connectivity of central counterparty services

3.1 Introduction

Central counterparty services or, as they were originally called, clearing houses, provide one or both of two services to their customers. These are:

- **settlement and custody services, and**
- **central counterparty (CCP) services.**

For UK cash-settled securities, the settlement and custody services are provided by Euroclear UK & Ireland (EUI) and the central counterparty services are operated by a number of different organisations, depending on the exchange where the trade is executed. Sections 3.3 and 3.4 of this chapter describe the two services in more detail.

3.2 Recognised Clearing Houses (RCHs)

Following the passing of the Financial Services Act 2012, clearing houses are now recognised by the Bank of England. As of August 2025, the Bank recognises the following UK clearing houses:

- **LME Clear ltd**
- **CME Clearing Europe ltd**
- **Euroclear UK & Ireland ltd (EUI) (although Euroclear is not a recognised central counterparty)**
- **LCH ltd (London clearing house), and**
- **ICE Clear Europe ltd.**

Following the implementation of the European Market Infrastructure Regulation (EMIR) regulations, clearing houses within the EU can also choose to be recognised by the pan-European regulator European Securities and Markets Authority (ESMA). As of August 2025, the following 16 clearing houses had chosen this route:

- **Nasdaq OMX Clearing AB 5**
- **Cboe Clear Europe N.V (changed name from European Central Counterparty N.V. on 14 November 2022)**
- **KDPW_CCP**
- **Eurex Clearing AG**
- **Cassa di Compensazione e Garanzia S.p.A. (CCG)**
- **LCH SA**
- **European Commodity Clearing**
- **Keler**
- **CCP Austria Abwicklungsstelle für Börsengeschäfte GmbH (CCP.A)**
- **BME Clearing**
- **OMIClear, C.C., S.A.**
- **SKDD-CCP Smart Clear d.d (SKDD-CCP)**
- **ICE Clear Netherlands, and**
- **Athens Exchange Clearing House (Athex Clear)**

3.3 Settlement and Custody Services

These services are provided for the securities market only; there is no direct equivalent for derivatives trades. For the UK securities markets they are provided by Euroclear UK & Ireland ltd (EUI).

Although EUI is regulated as a recognised clearing house, its role is quite different from that of the CCP. Membership of EUI is open to stock exchange member firms, institutional investors, custodians and registrars.

EUI and its equivalent institutions in other countries are often described as central securities depositories (CSDs). The services that EUI provides are described below.

3.3.1 The Settlement Service

The principal function of EUI is to settle all transactions in UK- and Irish-registered equities, and it uses its CREST system to carry out these functions. Trades are usually settled against payment (DvP – see below) in GBP, EUR and USD, but may be settled free of payment (FoP), in certain circumstances.

In the EUI environment, investors are able to hold their securities either in dematerialised form, where there are no share certificates and evidence of ownership is in the form of an accounting entry in the EUI system itself; or increasingly rarely in certificated form.

EUI offers settlement throughout the day with effective delivery-versus-payment (DvP) occurring between 05:30 and 13:00 each business day. At that point, the buyer of securities takes delivery of the securities, and the buyer's payment bank guarantees to pay the seller's payment bank, which in turn is obliged to pay the seller. When a trade is originated in the SETS system, the trade will have been novated by a CCP, which will take on the obligations of both parties to the trade and enable multilateral settlement netting. The role of CCPs is examined in the next section.

As part of the settlement process of registered securities, EUI has automated interfaces to the systems used by registrars; as settlement occurs, the registrars are provided with the necessary information to update the register and, if required, issue share certificates.

3.3.2 Other Services

Other services provided by EUI to its members include the following:

1. Custody services – stock belonging to members is held in accounts on their behalf.
2. Payment of dividends to members.
3. Processing of corporate action entitlements to members.
4. Specialised facilities for stock lending and borrowing.

3.3.3 Communicating with EUI

Most packaged equity settlement systems contain all the necessary interfaces to communicate with EUI. In the event that the firm is building its own equity settlement system, then EUI publishes a Data Exchange Manual (DEX) which contains descriptions of

all the necessary message formats. The DEX may be downloaded from www.euroclear.com.

3.4 Central Counterparty Services

Central counterparty services are provided to firms which carry out trades in:

- **securities**
- **exchange-traded futures and options, and**
- **OTC derivatives.**

The principle is as follows. When an order to buy from Party A is matched with an order to sell from Party B in order-driven market systems such as SETS, neither of the parties is aware of the identity of the other party. As soon as the exchange has matched the orders, its systems inform a clearing house. The clearing house then takes over the obligations to make payments and/or deliver the relevant securities or derivatives.

This process – the substitution of one party to a contract by another party – is known as novation. As a result of novation, the clearing house has become the CCP – every other counterparty settles its obligations with the clearing house and not with each other.

The advantages to an exchange and its member firms in having a CCP include the following:

- **Post-trade anonymity – it is not necessary for the exchange to divulge the identity of Party A to Party B or vice versa, so there is no danger of one party learning the other party's commercial secrets as a result of discovering its trading pattern.**
- **Netting of positions – Party A may have carried out many trades in an identical futures or options contract. The CCP nets these into a single position.**
- **A reduction in credit risk – because Party A and Party B are unaware of each other, they are, by definition, unaware of each other's credit status. Once the CCP has novated the contract, Party A no longer has to worry about Party B's ability to meet its obligations throughout the life of the futures or options contract or during the settlement period for the cash equity. The CCP's ability to meet its obligations is monitored by the FCA. However, the CCP has to monitor the ability of its member firms to meet their obligations. It does this by requiring them to place collateral with the CCP to meet margin requirements.**

3.4.1 Margin and Collateral

It is beyond the scope of this workbook to give a comprehensive and accurate description of margin requirements; the following is a simplified example:

Example

1. On 1 February, Party A buys a futures contract that obliges it to take delivery of 1,000 shares in ABC plc on 30 March in return for payment by Party A of £10 per share. So, the total amount it has to pay to the CCP if it still holds the contract on 30 March would be £10,000.
2. However, by 7 February, the price of ABC plc shares is only £8 per share. Party A stands to lose
£2,000 if it still holds the position on 30 March. The CCP, therefore, requires Party A to make a margin payment of £2,000 to cover the CCP's risk.
3. If at some time between 8 February and 30 March, the price of ABC shares rises to £9 per share, then the CCP will refund £1,000 to Party A. If, however, it falls to £7 per share, then the CCP will demand another £1,000 from Party A.

To summarise, whenever a member firm's positions show potential losses, it must make a margin payment to the clearing house. In this way, the clearing house is protected against default by the member firm.

The actual calculations performed by the CCP are much more complicated than this and cover two aspects of margin – 'initial margin' and 'variation margin'. Most CCPs use a methodology known as SPAN (Standardised Portfolio Analysis of Risk) in order to calculate the initial margin. This is a leading margining system which has been adopted by most options and futures exchanges around the world. SPAN is based on a sophisticated set of algorithms that determine initial margin according to a global (total portfolio) assessment of the one-day risk for a trader's account.

Whereas variation margin calls must always be settled in cash, initial margin calls do not. As an alternative, the CCP accepts cash or the deposit of a wide variety of government bonds and other collateral as cover for initial margin. The cash or securities used to meet the call are known as collateral.

3.4.2 Multilateral Settlement Netting (MSN)

Clearing houses that act as central counterparties to securities trades are also in a position to provide Multilateral Settlement Netting (MSN). MSN was introduced in the UK markets, in 2002, as a secondary phase after LCH began offering this service to members of the LSE.

Prior to the introduction of the netting service, each trade at EUI settled individually. If Party A made 100 trades on a given day – each trade buying 100 shares of ABC plc from

100 different other parties – there would have been 100 settlements of ABC shares with Party A.

With the advent of the netting service, Party A now has only one settlement of its obligations in ABC plc shares; therefore, the CCP service provides the additional benefit of reduced settlement costs to member firms (see section 3.5.1 for a worked example of multilateral settlement netting).

3.4.3 Competition Between Clearing Houses

The different clearing houses compete with one another to win CCP business from the various exchanges and their member firms.

Other LCH Clearing Services
LCH also offers CCP services for OTC derivatives and repos. These services have been available for many years, but the use of such services for OTC derivatives has increased as a result of the Dodd-Frank Act in the US and EMIR in Europe. These legal changes were discussed in chapter 2.

On the LSE, competition has been progressively introduced by the exchange's initiative called 'competitive clearing'. LCH was the original single supplier of CCP services but SIX X-Clear (the Swiss Exchange CCP) and EuroCCP (now owned by CBOE) have also been added. There are, thus, three potential choices for LSE firms from which to select.

3.4.4 SwapClear

Swaps are not traded on exchanges, but on the OTC market. See chapter 1 for more information. SwapClear is LCH's service for centralised clearing of these instruments. SwapClear clears hundreds of interest rate products in 27 currencies, over tenors stretching from one month to 51 years, referencing dozens of different benchmark rates.

Launched in 1999, SwapClear initially cleared plain vanilla interest rate swaps in four major currencies. Today, it clears swaps in 27 currencies.

It also clears overnight index swaps (OISs) out to two years across many different currencies (https://www.lch.com/services/swapclear/what-we-clear).

Trading venues can connect to SwapClear via a middleware provider, such as MarkitWire and Traiana (now owned by CME Group), or through LCH's proprietary direct connectivity platform, ClearLink. Venues may opt to connect through multiple connections via ClearLink.

The trade is then 'given up' or 'novated' by both sides to the client's chosen SwapClear clearing member, who clears the trade through LCH.

The execution and subsequent give-up process are governed by the documents between the executing broker, client and SwapClear clearing member. All subsequent trade events, such as novations and partial novations, will be handled by the SwapClear clearing member without any involvement from the executing broker.

Other CCPs also offer clearing services for the OTC markets.

3.4.5 RepoClear

Repos – sale and repurchase agreements – are transactions where Party A lends money to Party B, providing that Party B provides Party A with collateral in the form of government bonds. The mechanism of the exchange of cash and collateral is that Party B 'sells' the securities to Party A under an agreement where A can repurchase them at a later date. The concept is examined in more detail in chapter 6.

Repos are not traded on an exchange; they are traded on the OTC market.

LCH operates a CCP service for repo trades, this is called RepoClear. The benefits to participants are as follows:

- **credit risk reduction**
- **balance sheet netting**
- **multilateral settlement netting, and**
- **post-trade anonymity.**

3.4.6 Types of Clearing House Membership

Not all ICE Futures Europe members are members of the ICE Clear clearing service. A firm may elect also to become a member of ICE Clear, or it may elect to have its trades cleared by another firm, known as a general clearing member (GCM).

When a firm has elected to have its trades cleared by a GCM, the GCM will manage the margin requirements of its clients in the same way that the clearing house manages the margin requirements of the GCM.

A firm that does not clear its own trades is known as a non-clearing member (NCM), or dealer member. An NCM needs connectivity to the exchange's systems, but not to the clearing house's systems; a GCM, however, needs connectivity to both entities' systems.

Sometimes, a firm may be a clearing member of one exchange, where it does a substantial volume of business, but a non-clearing member of another exchange. This may be because its trading volumes on the second exchange are lower, or because the second exchange is located overseas, perhaps in a different time zone, and the firm feels that its

clearing arrangements are better handled by a local agent. In other words, it has outsourced the clearing of trades on the second exchange.

3.4.7 Communicating with Central Counterparties

There are several package software applications dedicated to the futures and options market that contain all the necessary interfaces with the CCP's systems.

All the details of the interface specifications are available from clearing houses' websites.

3.5 Trade Flows from Exchange to Clearing House to Final Settlement

3.5.1 Equities Traded on SETS

Example

On 12 February, an investor placed an order to buy 5,000 ABC shares with Exchange Member A for £5 per share for value date 14 February. Exchange Member A placed this order on the SETS queue and it was matched with a sell order from another member.

Exchange Member A also placed four additional orders for ABC shares on the SETS queue on 12 February, all for value date 14 February, and all the orders were matched by other member firms. The summary for all five additional orders is, therefore, as follows:

Trade No	Operation	Share Quantity	Share Price £	Trade Value £
1 (described above)	Buy	+5,000	5.0	–25,000
2	Buy	+7,500	5.10	–38,250
3	Buy	+4,000	5.05	–20,200
4	Sell	–6,000	5.05	+30,300
5	Sell	–2,000	5.00	+10,000
Net Securities due to Member A		+8,500	Net Cash Payable by Member A	–43,150

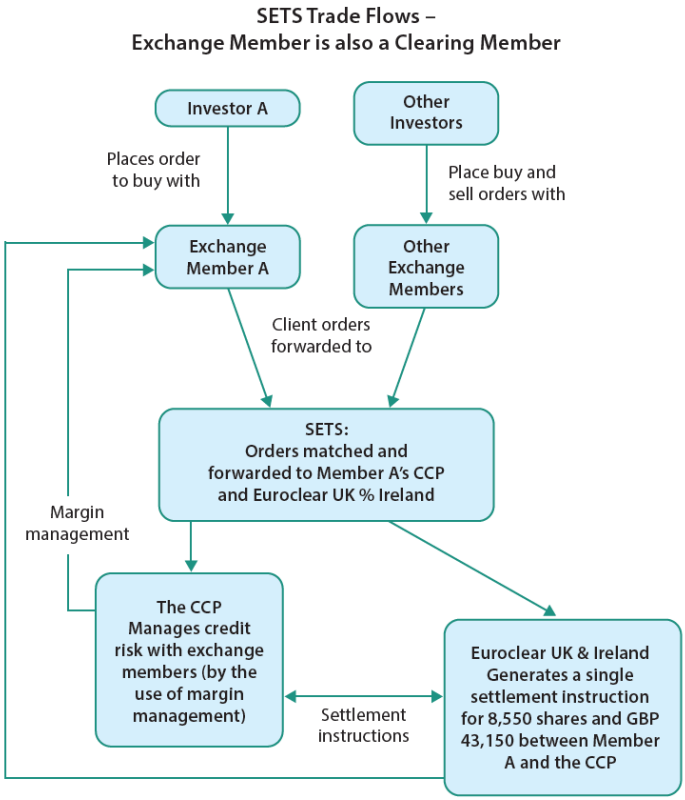
When the orders are matched, the SETS system reports them to Member A, to the CCP chosen by Member A, and to EUI. Remember from section 3.4.3 that Member A has the choice of nominating either LCH, SIX x-clear or EuroCCP as its chosen CCP.

EUI will then automatically generate settlement instructions on behalf of both Member A and the CCP in the early evening (after SETS has closed for the day, but before EUI closes) of 14 February – the contractual value date of all five trades. Providing that the CCP has 8,500 ABC shares to give to Member A, and Member A is in a position to pay £43,150.00, the five trades will settle as a single item.

Member A still has to arrange the settlement of the five individual trades with the client(s) concerned.

From 12 February until the final settlement, the CCP will monitor Member A's margin position. The average price of the 8,500 shares that the firm has to settle is approximately £5.08 per share. If the market price of ABC shares falls below this level at any time between 12 February and the date on which settlement occurs, the CCP will call Member A to deposit collateral to cover the difference.

Diagrammatically, the process can be represented in the following way:

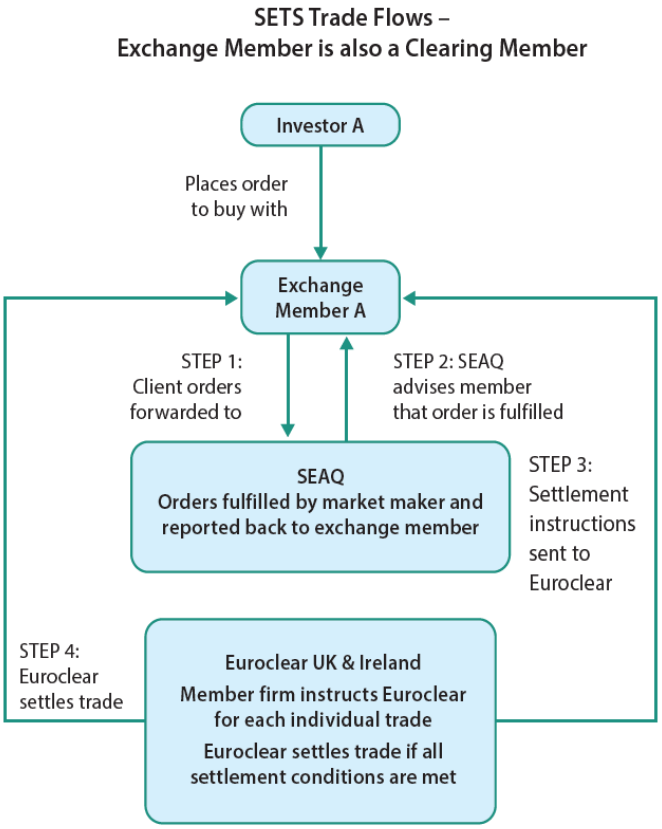


3.5.2 Equities Traded on SEAQ

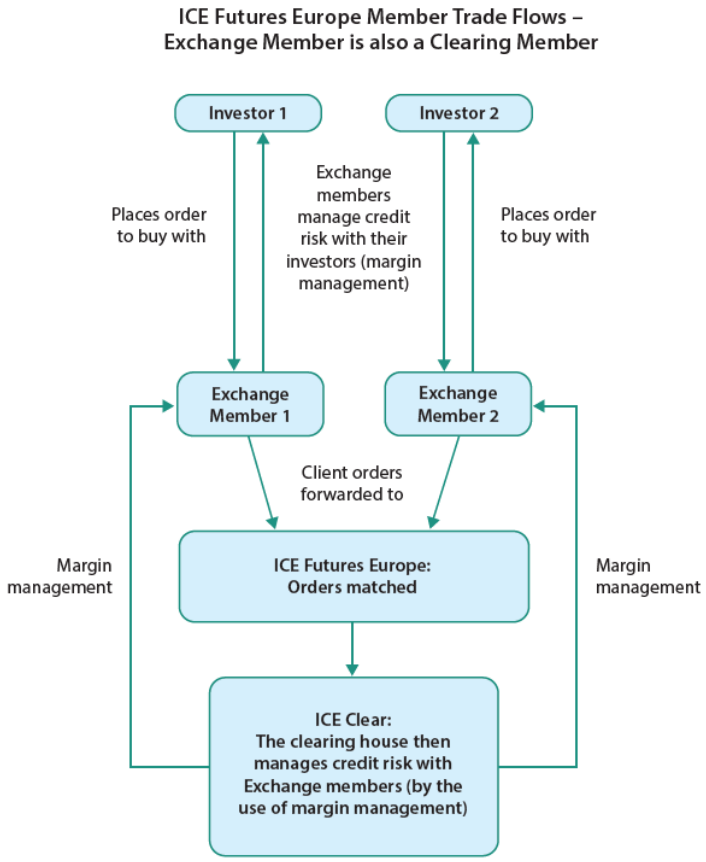
When equities are traded on SEAQ (a quote-driven market) the following process applies:

1. **There is no central counterparty and, therefore, novation and netting are not involved. No CCP is involved with the transaction.**
2. **When the exchange member receives a report from SEAQ, it is up to that member to send settlement instructions to EUI.**
3. **EUI will then settle the trades individually on the agreed value date, providing that:**
   a. both Exchange Member A and the relevant market maker have instructed EUI, and their settlement instructions agree with each other – this is covered in chapter 6.
   b. the buyer has the cash to pay for the securities, and the seller has the securities to deliver.

Diagrammatically, the trade flow may be expressed in the following manner:

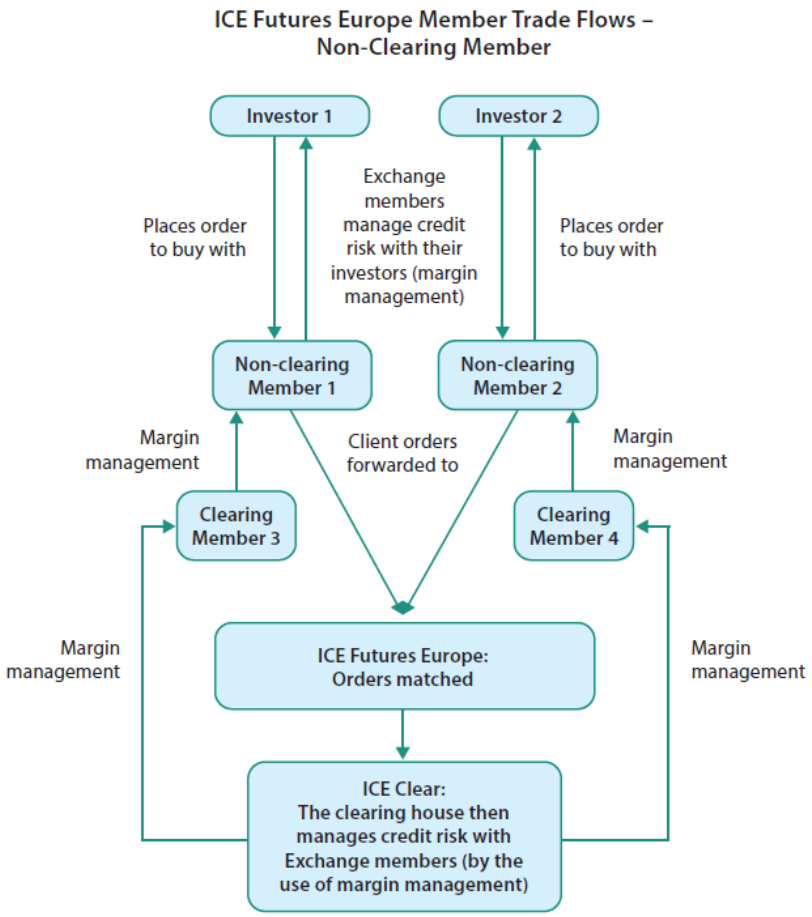


3.5.3 Futures or Options Traded on Web ICE Futures Europe



The above diagram shows the flow of client orders to exchange member firms that are also clearing members of the exchange. Once the ICE Futures Europe system has matched the orders, then the exchange reports the matched trades to ICE Clear and the transactions are novated.

The clearing house then manages its credit risk with the member firms by the use of margin management. If the member firm were not itself a clearing member, then two exchange members who are also clearing members would be involved and the diagram would then look like this:



3.6 Trade Repositories

3.3.1 Know the function and connectivity of trade repositories

A trade repository or swap data repository is an entity that centrally collects and maintains the records of OTC derivatives. These electronic platforms act as authoritative registries of key information regarding open OTC derivatives and, in Europe, open ETD trades.

The purpose of trade repositories is to provide regulators with visibility into the risk exposures of firms and counterparties. Repositories are supervised in Europe by ESMA under the EMIR regulations. Similar regulatory initiatives are conducted in the US where the Commodity Futures Trading Commission (CFTC) has implemented the Dodd-Frank Act regulation, under which swap data repositories are regulated. In Europe, it became compulsory to report OTC and ETD trades to repositories in February 2014.

As of August 2025, ESMA recognises the following repositories:

Trade Repository	Derivative Asset Class
DTCC Derivatives Repository ltd (DDRL)	All asset classes
Krajowy Depozyt Papierów Wartosciowych S.A. (KDPW)	All asset classes
Regis-TR S.A.	All asset classes
UnaVista Limited (part of the London Stock Exchange Group (LSEG))	All asset classes

All of these publish data exchange manuals specifying the inputs and outputs that are necessary to use their services.

4. Real-Time Information Sources

3.4.1Understand the functionality of external real-time information sources: pre-trade price and liquidity discovery; analytics; post-trade information dissemination; transaction reporting/ publication

4.1 Introduction

Securities industry firms depend on high-quality, fast and robust feeds of real-time information, covering market prices, company announcements and corporate actions, and economic and political events, in order to make investment decisions. Without accurate and up-to-date market information sources, the financial markets would be unable to trade in the volumes that they do, nor to trade in highly innovative and complex instruments.

This section describes the major services that are offered by the two market-leading suppliers of real- time market data – Refinitiv and Bloomberg – and also deals with some of the technology implications of using and distributing this data throughout the firm. Refinitiv was founded in 2018, having previously been known as Thomson Reuters. Blackstone Group and Thomson Reuters jointly owned the Refinitiv business. It is today a subsidiary of the London Stock Exchange Group (LSEG) having been acquired in January 2021.

The original missions of both Reuters, starting in the 1970s, and Bloomberg, in the early 1980s, were to deliver market data to securities professionals. Since then, both companies have expanded enormously and diversified widely, and they both offer a very wide range of information services, media content and packaged software that is far beyond their original scope. However, this section is limited to the primary functions of both information providers: providing market information to the securities industry. Reuters was acquired by Thomson Financial in 2007.

4.2 Functionality Provided by the Information Vendors

There are a number of information vendors available in the market, with Bloomberg and Refinitiv being two of the most popular and best-known. However, all facilities provided can be broken down into three groups – namely:

1. **Pre-trade – liquidity and price discovery – both vendors act as 'consolidators' of market information; and as a result a securities firm can use the vendors' screens to discover the best price across a number of exchanges and trading venues. In addition, both vendors display relevant data from the OTC and FX markets. Refinitiv supplies round-the-clock news and real-time prices from over 2,000 market makers and brokers, covering 175 currencies. Pre-built calculators allow for complex analysis. Refinitiv provides official daily market fixings for over 50 currencies.**
2. **Pre-trade – analytics – both vendors supply analytical tools to perform 'what if' scenario analysis and to price complex derivative instruments and strategies.**
3. **Trade execution and post-trade services – both firms provide facilities for conversational dealing (ie, dealing using instant-messenger type services) and also link traders, brokers, dealers and execution venues through an order-routing hub. Order-routing hubs are discussed in chapter 4. Refinitiv's Trade Notification Service (TNS) is a real-time messaging hub for confirming FX trade information back to counterparties.**

4.3 Transaction Reporting/Publication

This area consists of two main reporting obligations, Trade Reporting and Transaction Reporting. Trade Reporting is addressed by the MiFIR Post-Trade Reporting requirements. Transaction Reporting is required under three separate pieces of legislation, which are discussed below.

4.3.1 MiFIR Post-Trade Transparency

Under MiFIR, investment firms are obliged to report all price-forming off–exchange executions by eligible MiFID investment firms in MiFID-eligible instruments. This must be done on a real-time basis to an authorised publication arrangement (APA) to provide market price transparency (all on-exchange transactions are made public by the trading venues themselves).

The timelines for reporting are as follows:

- **RTS1 – shares, depositary receipts, exchange-traded funds, certificates, and other similar financial instruments and on transaction execution obligations in respect of certain shares on a trading venue or by a systematic internaliser – as near to real time as possible, but within one minute of execution.**
- **RTS2 – bonds, structured finance products, emission allowances, and derivatives – as near to real time as possible, but within five minutes of execution.**

The reports are single-sided, ie, only one counterparty makes a report, and reporting responsibility is determined by a hierarchy of each side's role in the market for the traded instrument. The data content focuses on trade economics (namely, trading date/time, instrument identification code, price, price currency and quantity).

4.3.2 MiFIR Transaction Reporting

Transaction reports are different from trade reports. Trade reports (see section 4.3.1) are for public dissemination, whereas transaction reports are private reports to the relevant regulator and their use is entirely different. The collecting of transaction reports by the regulator is a part of its goal to 'protect and enhance the integrity of the UK financial system' as well as helping the FCA meet its strategic objective of making investing in financial markets safe. The actual data reported is used to:

- **try and identify incidents of market abuse, and**
- **undertake market surveillance.**

Transaction reports are defined under RTS 22 of MiFIR. It basically states that investment firms which execute transactions in financial instruments must report complete and accurate details of these trades to the investment firm's national competent authority (NCA), either directly or (more commonly) via an approved reporting mechanism (ARM). For the UK, the NCA is the FCA. All reports must be made as soon as possible and no later than the close of the following working day (T+1).

The scope of the reporting is as follows:

- **financial instruments which are admitted to trading or traded on a trading venue or for which a request for admission to trading has been made**
- **financial instruments where the underlying is a financial instrument traded on a trading venue, and**
- **financial instruments where the underlying is an index or a basket composed of financial instruments traded on a trading venue.**

4.3.3 EMIR Transaction Reporting

This is an EU requirement developed by ESMA. The European Market Infrastructure Regulation (EMIR) is an EU regulation for the regulation of OTC derivatives, CCPs and trade repositories. It was originally adopted by the EU legislature on 4 July 2012 and came into force on 16 August 2012 in response to the lessons learned by markets and regulators during the economic crisis.

EMIR mandates the reporting of all derivatives to trade repositories (TRs). TRs centrally collect and maintain the records of all derivative contracts. They play a central role in enhancing the transparency of derivative markets and reducing risks to financial stability. Counterparty firms both must report to the TRs by the close of business on T+1 and the TRs must match and pair the two reporting sides.

EMIR reporting is an additional requirement to MiFIR transaction reporting and is different in its detail from the latter. It will not apply to all firms unless derivative transactions are executed.

In 2020, EMIR reporting requirements were amended following a review by ESMA under an exercise called the EMIR refit.

4.3.4 Securities Financing Transactions Regulation (SFTR) Reporting

The transparency of SFTR entered into force and started applying from 12 January 2016. However, there were a number of phase-in periods that applied, so that the obligations imposed by the SFTR did not all apply from that date.

The SFTR imposes new obligations in relation to three principal areas:

- **mandatory reporting of securities financing transactions to authorised or recognised TRs (the Reporting Obligation)**
- **documentary and operational requirements in respect of all collateral reuse arrangements (note that this is not just limited to those relating to securities financing transactions (the Collateral Reuse Requirements)), and**
- **transparency and disclosure requirements for managers of UCITS and alternative investment funds (AIFs) in respect of securities financing transactions and total return swaps (the Transparency to Fund Investors Requirements).**

It is worth noting that the SFTR is an EU Regulation, as opposed to an EU Directive, meaning that it has direct effect in each of the EU member states, without the need for further implementing national legislation.

The origin of the SFTR is linked back to the structural measures introduced by European regulatory reforms designed to strengthen the traditional banking sector. These included strengthened capital requirements, rules on improved governance and supervision and resolution regimes. Driven by a concern that such banking structural reforms would lead market participants to source credit from a less regulated, non-banking sector (so-called 'shadow banking'), the Financial Stability Board (FSB) and the European Commission (EC) sought to increase the transparency, oversight and monitoring of credit activity in the shadow banking sector. The SFTR is one piece of that larger regulatory picture.

Securities financing transactions (SFTs) are defined in the SFTR as the following products:

- **repurchase transactions**
- **securities or commodities lending or borrowing transactions**
- **buy-sell back or sell-buy back transactions, and**
- **margin lending transactions which are defined broadly to capture any extension of credit in connection with the purchase, sale, carrying or trading of securities.**

As with EMIR, SFTR reports are directed towards TRs, again by the close of business on T+1. The TRs, therefore, collect and match the reports and interface thereafter with the national regulators.

4.3.5 Summary of Reporting Commitments

The market has now practised MiFID reporting since 2007, then EMIR reporting arrived in 2012 followed by MiFIR reporting in 2018, with a culmination of an even more complex SFTR requirement in 2020. Reporting has become a formidable responsibility for firms on both the sell- and buy-side.

As indicated, therefore, practitioner firms and their technology groups have three major sets of reporting regimes to service. This has led to the implementation of different systems to meet the reporting and data requirements for each of the three. This has become a very large task for firms to undertake with success. The accent from the TRs and regulators is always to insist upon high-quality reports. Penalties from regulators, by way of fines, are substantial if quality standards are not considered to be sufficient.

The sheer granularity of the data requirements has expanded significantly as the reporting regimes have progressively been introduced by ESMA. With MiFIR there are 65 reportable fields. In SFTR, there are up to 155 data fields which may be required for inclusion in the reports.

As an additional practical point, the effect of Brexit has meant that UK reporting to the FCA will become a separate responsibility for practitioner firms from January 2021, as well as similar reporting requirements to European regulators for EU-based businesses. This has meant that the TRs have set up separate structures in both the UK and in the EU to enable this to be done effectively and discretely.

The reporting covers transactions in financial instruments irrespective of whether or not they have been performing on a trading venue.

The actual data reported covers the following areas:

- **the names and numbers of the financial instruments bought or sold**
- **the quantity**
- **the dates and times of execution**
- **the transaction prices**
- **a designation to identify the client, and**
- **a designation to identify the persons, the computer algorithms within the investment firm responsible for the investment decision and the execution of the transaction.**

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **Which type of investment exchange is based outside the UK but admits UK firms as members?**
   Answer Reference: Section 2.1

2. **Which three of the London Stock Exchange's trading systems are hybrid platforms?**
   Answer Reference: Section 2.4.1

3. **What is the technical term for 'the substitution of one party to a contract by another party'?**
   Answer Reference: Section 3.4

4. **What benefits does the use of a central counterparty provide to members of a derivatives exchange?**
   Answer Reference: Section 3.4

5. **What additional benefit (to those in Question 5) does the use of a central counterparty provide for members of a securities exchange?**
   Answer Reference: Section 3.4.2

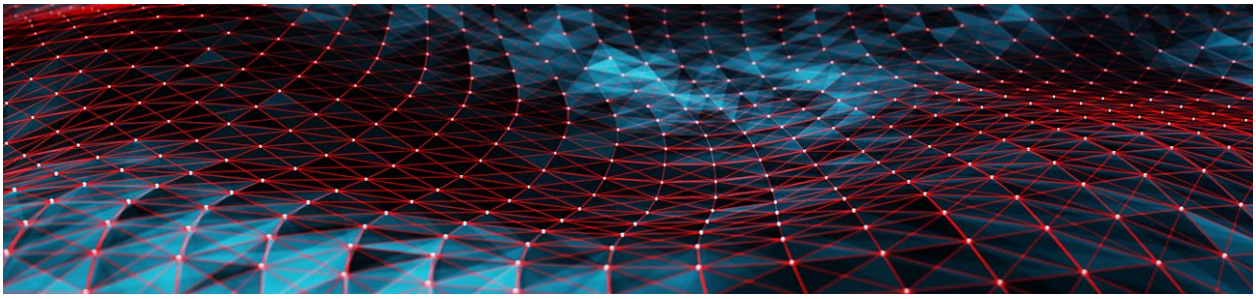
6. **Which regulator is responsible for the supervision of trade repositories serving the UK markets?**
   Answer Reference: Section 3.6

7. **What is the purpose of a trade repository and what are the main regulatory drivers behind it?**
   Answer Reference: Section 3.6

8. **What services does Refinitiv provide to FX traders?**
   Answer Reference: Section 4.2

9. **Give three examples of transaction reporting regulatory regimes.**
   Answer Reference: Section 4.3

10. **Where do MiFIR transaction reports need to be sent to?**
    Answer Reference: Section 4.3.2



Chapter Four
The Role of Technology in Trade Capture

Section 1 Introduction

Section 2 The Investment Decision Process

Section 3 The Technology Support Requirements of Order Placing and Filling

Section 4 Algorithmic Trading

Section 5 Investor Self-Servicing

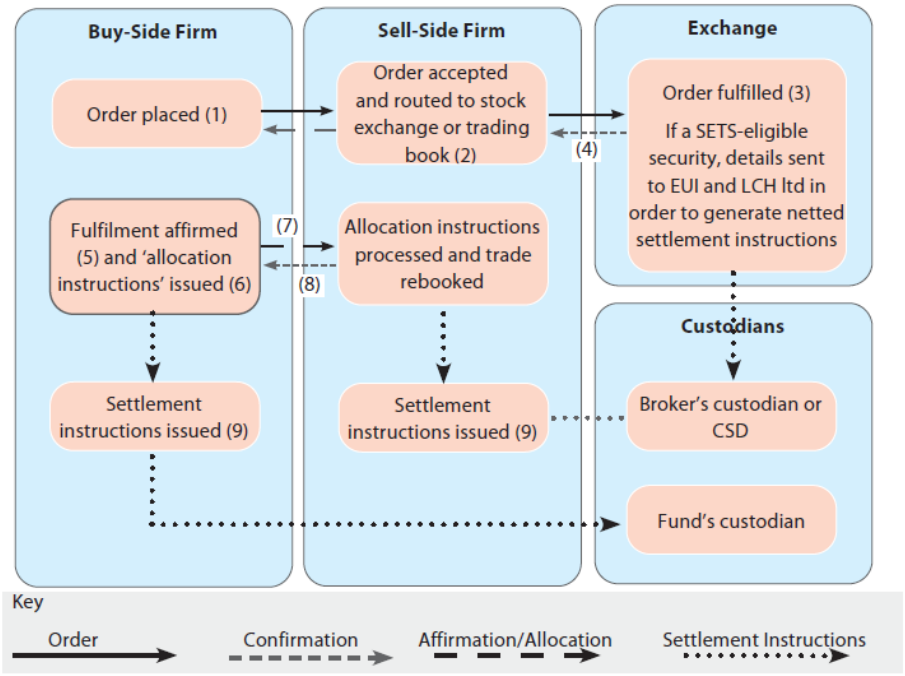
Section 6 Trade Capture and Risk Management for Trade Capture Functions

This syllabus area will provide approximately 4 of the 50 examination questions

1. Introduction

Chapter 4, together with chapters 5 and 6, follows the flow of a client order through the various stages of execution and settlement.

Using the STP principles that were described in chapter 1, the process from the issuance of an order, its subsequent execution and, finally, the issuance of the settlement instructions can be summarised in the following diagram:



The order flow steps are examined in more detail in section 3.3 of this chapter.

2. The Investment Decision Process

4.1.1 Understand the investment decision support process

4.2.1 Understand the implications of environmental, social and governance (ESG) investing

2.1The Investment Decision Process

Before an order to buy or sell securities is placed, there has, of course, to be a decision to buy or sell. This section explains the investment decision processes used by buy-side firms.

It is generally accepted that there are five stages to the portfolio management process:

1. **Determining and understanding the investment objectives of the client – it is important to establish and understand the objectives of the client prior to offering investment advice or investment management services.**
2. **Formulating an investment policy and strategies to meet those objectives – portfolio construction and management – this stage would include determining how much the client has to invest, how much income they require from the portfolio, over what timescale the client wishes to invest and any financial protection needed for any dependants.**
3. **Asset allocation – once the above has been understood, it would then be necessary to apportion the amount to be invested into the four broad asset classes – cash, equities, fixed income products and property – in accordance with the client's objectives.**
4. **Asset selection – once the asset allocation is confirmed, it is possible to determine what specific assets should be invested in. For example, which specific bonds or equities should be purchased and/or where these assets are held, such as in Europe, emerging markets or other areas.**
5. **Performance measurement – it is very important to review how the investments are performing on a regular basis and to make sure that they continue to meet the clients' objectives. Changes in the portfolio can be made should they be required.**
6. **Suitability – under MiFID II, when a firm provides portfolio management and/or investment advice, it needs to ensure that sufficient information is gathered (around the client's knowledge and experience, financial situation and investment objectives) to ensure that a suitable recommendation can be made. These suitability requirements apply both to professional and retail (non-professional) clients, although a firm is permitted to make certain assumptions for professional clients as long as the firm has previously classified the client as a professional investor.**

Using equities as an example, buy-side firms will generate buy orders under the following circumstances:

1. **if their clients have cash available for investment, and**
2. **they anticipate that the price of a given stock will rise, or**
3. **they anticipate that the price of stocks quoted on given exchanges will rise, or**
4. **they anticipate that the price of stocks issued by companies in a given sector, (eg, pharmaceuticals, motors) will rise, or**
5. **some combination of 2 to 5 above.**

Equally, they will generate sell orders if:

6. **their clients need to raise cash that is currently invested (for example, to pay pensioners or other liabilities), or**
7. **they anticipate that the price of a given stock will fall, or**
8. **they anticipate that the price of stocks quoted on given exchanges will fall, or**
9. **they anticipate that the price of stocks issued by companies in a given sector, (eg, pharmaceuticals, motors or banks) will fall, or**
10. **some combination of 7 to 9 above, or**
11. **the portfolio does not match the investment objectives and constraints (eg, it is too heavy in one particular sector) and needs to be adjusted.**

Often a buy-side firm will make a series of buys and sells to rebalance portfolios either:

- **at a regular point, each month or quarter, to bring portfolios back in line with a model or asset allocation, or**
- **as a result of a change in the firm's asset allocation, and investment strategy.**

In order to make these decisions, buy-side firms, therefore, need to have the following information to hand, and one of the roles of the technology department is to provide the applications and services that the investment decision-makers need.

- **Cash flow forecasts**
    - **predicted cash inflows (eg, from dividends) and outflows (eg, to pay liabilities like pensions)**
    - **cash that has been earmarked for a purpose – eg, for an alternative investment or as collateral**
    - **cash that is genuinely free which can be invested.**
- **Economic and financial forecasts and research recommendations – the decision-makers use these tools to decide which countries, sectors and individual companies have the highest growth potential or the highest potential to lose money. These types of data may be presented on paper, in person at conferences and briefings, or online on a variety of private and public websites.**

- **Market data – the trading systems of the various exchanges, as well as the applications provided by market data suppliers, such as Refinitiv and Bloomberg, supply information about current market prices and liquidity on the various exchanges where the instruments are listed. These facilities were discussed in more detail in chapter 3.**
- **Performance measurement software applications – these applications measure the performance of the firm's investment portfolios and usually:**
    - **compare the performance achieved to industry peer groups and market indices**
    - **attribute the performance to factors such as stock selection and currency selection.**

The investment manager would also have access to the various modelling ('what-if') tools to help shape their decisions, as well as details of their clients funds' investment restrictions, objectives and constraints to ensure they trade correctly.

2.2 The Growing Importance of Environmental, Social and Governance (ESG) in Investments

While the environment, social and governance (ESG) approach is definitely not new and has been around in some form for many years (if not decades), it is now becoming increasingly prominent and mainstream with clients demanding ESG-compliant investment products. Consequently, investment firms are incorporating ESG into their investment processes, product offerings and overall operating model. (Investing in ESG-compliant firms is often called responsible investing.)

The purpose of ESG is to measure the sustainability and societal impact of an organisation, and consists of three (non-financial) measures covering environmental, social and governance elements.

Environmental

- **The threat of climate change – eg, greenhouse emission and pollution.**
- **The ongoing depletion of natural resources (such as fossil fuels) and how sustainable (or reliant) an organisation is on using these natural resources currently and in the future.**

Therefore, if an organisation's activities cause climate change and they are very reliant on natural resources, then they will be marked down in this area.

Social
This wide area looks at how the organisation manages and treats its people:

- **Diversity – this focuses on the level of inclusion across the entire human management process covering recruitment, development and promotion. It is driven by the evidence that an organisation with a diverse set of employees will perform better.**
- **Human rights – this is ensuring that the organisation complies with all the human rights legislations (such as working conditions, child labour, slavery and health/safety). It is also important that the organisations ensure their suppliers also comply in this area.**
- **Consumer protection – organisations need to ensure they offer protection to their end-customers and do not treat their clients as 'cash cows'.**
- **Animal welfare – if organisations need to employ animals in their operating model then they need to have clear, monitored and enforced animal welfare processes. It is also important that the organisations ensure their suppliers also comply in this area.**
- **Local communities – organisations should actively look to fund projects that will support the poor and underserved communities.**

Consequently, if an organisation fails to meet these standards, then they will be 'marked down' (although, as per section 2.3 below, there is no single recognised method for assessing the scale of ESG compliance).

Governance
This area covers how the organisation polices or governs itself.

- **Management structure – what roles, responsibilities, processes and controls are in place to manage the organisation (in particular, between the chair, CEO and board)?**
- **Employee relations – how involved are employees (who are not management) in decision making?**
- **Executive compensation – what processes and controls are in place to decide what compensation senior executives receive?**
- **Employee compensation – similar to the above, what processes, controls and audits are in place to decide what compensation is set for the wider employee pool?**
- **Tax strategy – what is the tax strategy for the organisation? Are they channeling revenue to low-tax jurisdictions while channeling costs to high-tax countries?**
- **Donations and political lobbying – are there clear policies and notifications around this area?**
- **Corruption and bribery – are there clear policies and controls around this area?**

Consequently, if an organisation fails to meet these standards, then they will be 'marked down'.

2.3 The Challenges of Measuring ESG Ratings

As mentioned earlier, ESG is not a financial measure. Many of the variables with ESG are subjective, hard to obtain detailed data about, also hard to measure. Even if any data is available, then it can be unreliable, based on different assumptions and, therefore, hard to compare and consequently use pragmatically. For example, an organisation could have its human rights policy written and published, but it may be hard to understand how well the policy is followed and enforced. Consequently, it is very challenging to place an accurate and reliable statistical measure against the variables.

There are over 100 data providers who provide data on ESG assessments. Moreover, all these providers have different ratings, different models and different underlying assumptions. Therefore, many firms are now looking to consume different data sources and then develop their own models for comparison and decision-making.

3. The Technology Support Requirements of Order Placing and Filling

4.3.1Understand the technology support requirements of order placing and filling including: order entry (agency, principal and third-party orders); pre-trade compliance (including mandates); best execution; Treating Customers Fairly; transaction capture; client connectivity including Direct Market Access; communication via electronic media; pooling, allocation and aggregation of a single order across two or more investors/funds; dealing systems; charges, fees and expenses

3.1 Order Placing

3.1.1 Parties to an Order

The parties to an order consist of:

- **Investors and buy-side firms – most professional investors have delegated their investment decisions to fund managers or buy-side firms. Before the buy-side firm places an order on behalf of its customer, it needs to ensure that the order is compatible with the customer's investment objectives. These objectives are documented in an investment mandate. This document states the investment objective for the investor (eg, capital growth or income), their risk appetite, their**

ethical stance as well as any other investment constraints (eg, which markets not to invest in, percentage allocation across asset types). An investment firm cannot invest in anything that falls outside the rules in the mandate. This pre-checking process is known as 'pre-trade compliance'.

- Sell-side firms – buy-side firms place orders with banks and stock exchange member firms (sell-side firms), and the sell-side firms, in turn, fill those orders.

3.1.2 Contents of an Order

An order contains a number of features such as:

- Buy or sell – a specific quantity of a specific financial instrument, such as an equity, bond, currency or derivative, as well as a number of instructions relating to the price of that instrument, such as:
    - at best or at market – meaning buy or sell at the best available price the member firm can obtain at the time
    - limit – where a price is specified, meaning:
        - if selling, do not sell for a price lower than the limit price
        - if buying, do not pay more than the limit price.
    - stop loss – sell if and when the market price falls to this level.
- Time-related features:
    - good until cancelled or open order – there is no time limit on this order.
    - expiry date – if the order cannot be filled by this date then it should be treated as cancelled.
    - fill or kill – if the order is, say, to buy 10,000 shares of ABC plc, then either complete the order in full or reject it if the member firm can only obtain, say, 5,000 shares.

In addition to the above, under MiFID II, all parties to a trade need to provide three types of identifier:

- Client Identifier – If the client is a legal entity or structure (such as a company, charity or trust (excluding bare trusts)), then the firm will need the client's LEI before any orders can be submitted. In a similar vein, if the client is a natural person (which also includes sole traders and partnerships) then the firm will need their National Insurance number (or their local equivalent if they are not UK based) before any orders are submitted.
- Firm – The firm who is executing the trade (ie, the asset manager) will also need to provide their own LEI when submitting an order.
- Counterparty – The counterparty or broker with whom the trade is being executed with will also need to provide their LEI when submitting an order.

If the MiFID II rules are followed strictly, and if any of these three identifiers are not present, then the firm cannot process the order.

3.1.3 Client Connectivity

Orders may be placed by the buy-side (and, therefore, received at the sell-side) by a number of methods, including by:

- **telephone and/or fax**
- **entering the order details into a secure web page provided by the sell-side firm**
- **sending the sell-side firm a SWIFT message. SWIFT is covered more fully in chapter 6, section 5**
- **entering the order details directly into the sell-side firm's order management system. Typically, this would be facilitated by using a third-party 'hub and spoke' order-routing service. Providers of such services include:**
    - **DTCC/Omgeo, through its TradeSuite ID Product**
    - **Refinitiv, through its Autex and other products**
    - **Bloomberg, through its POMS and TOMS systems, and**
    - **many other package products and systems developed in-house by fund managers.**

Many of these systems, in turn, make use of the FIX protocol, a messaging standard developed specifically for the real-time electronic exchange of securities transactions. FIX is a public-domain specification owned and maintained by FIX Protocol ltd. FIX is covered more fully in chapter 6.

Also see section 4.3 for information on automated order-routing (direct market access).

3.2 Filling the Order

3.2.1 Agency Orders and Principal Orders

The sell-side firm has to decide whether to fill this order as an agent or as principal. It has to make its decision according to the MiFID II rules explained in chapter 2.

If it is filling the order as an agent, then it will forward the order to an investment exchange and charge the investor a commission.

If it is filling it as principal, then it will not forward the order to an exchange, but it will (assuming the order is to buy) sell the investor the required quantity of the instrument from its own 'book' or position, ie, it will sell the investor stock that is owned by the sell-side firm. The opposite is true if the order is to sell: the sell- side firm will buy the stock from the investor and add it to its own position or book. In the case of principal orders, the

sell-side firm's revenue consists of the difference between the buying price and the selling price, instead of a commission.

Whether the sell-side firms act as agent or principal when they fill customers' orders varies according to the type of financial instrument that is being traded. Here is a brief summary of the most usual market practices:

- **Bonds – usually, the sell-side firm acts as principal. Traditionally, the sell-side firm that received the order would contact several market makers (other sell-side firms that specialise in making a market in the given bond) by telephone to find the best price available to its client. In recent years, a number of internet-based trading systems have set up that provide a more formal market for these instruments.**
- **Futures and options – the sell-side firm always acts as agent. Futures and options are always traded on investment exchanges and each individual futures or options contract is unique to one exchange. Therefore, client orders are always submitted to an order queue.**
- **Foreign exchange – usually, the sell-side firm acts as principal. Traditionally, this has been a telephone market where the firm that received the order would phone other banks to establish the best rate. In recent years, a number of FX web portals have been developed. Refinitiv also offers an automated dealing service, Refinitiv FX Trading.**
- **OTC derivatives such as swaps – usually, the sell-side firm acts as principal. Traditionally, this has been a telephone market where the firm that received the order would phone other banks to establish the best rate. In recent years, a number of OTC web portals have been developed.**
- **Equities – the sell-side firm may act as agent or principal. Its activities are governed by the regulatory rules and also by individual client agreements.**

No matter whether the sell-side firm is acting as agent or principal, it has to fulfil obligations to its customer in terms of best execution (see section 3.2.2) and Treating Customers Fairly (TCF) (see section 3.2.3).

3.2.2 Best Execution

Investment firms have a duty under the MiFID II rules to provide their clients with best execution. Best execution rules have existed for many years, but their scope was extended as a result of the implementation of MiFID II in January 2018.

The FCA Conduct of Business Rule 11.2.1 defines best execution as follows:

> **'A firm must take all reasonable steps to obtain, when executing orders, the best possible result for its clients taking into account the execution factors'.**

The execution factors are then defined as:

'Price, costs, speed, likelihood of execution and settlement, size, nature or any other consideration relevant to the execution of an order'.

MiFID II Requirements
As stated in chapter 2, the MiFID regulations (Article 21) require firms that execute orders on behalf of clients to:

1. **establish an execution policy, which must contain information on the venues used to execute client orders – those venues must allow it to obtain consistently the best possible result for execution for their clients**
2. **disclose the policy to clients and obtain their consent to that policy**
3. **monitor the effectiveness of arrangements in order to identify and correct any deficiencies and review the appropriateness of the venues in its execution policy at least yearly, and**
4. **upon client request, be ready to demonstrate that the client's order has been executed in line with their execution policy.**

These MiFID II requirements have been implemented by the FCA within the Conduct of Business Sourcebook (COBS) 11.2.14 to 11.2.18 inclusive.

The practical implication of these rules is as follows:

1. **Firms must always execute orders from the same types of customers (eg, retail, professional or market counterparty) for the same type of instrument (such as equities, bonds, futures) in the same way, according to a predefined policy that the firm considers should provide the customer with best execution.**
2. **Firms must tell the customer what the policy is, and obtain their consent to it.**
3. **Firms must check that the policy they have defined is usually achieving best execution. If they find that, in certain circumstances it is not, then they must amend it. They must carry out these monitoring and (if necessary) amendment processes at least once each year.**

If the client requests it, the firm must provide the client with evidence that a particular order has been executed in line with its defined policy.

Practical Implications
Broadly speaking, best execution places an obligation on the sell-side firm to get the lowest available price for its customer when the customer is buying, and the highest available price when the customer is selling and to be able to evidence that it has done so.

If a financial instrument is quoted on only one investment exchange, and that exchange trades it on an order-driven system, then this obligation is usually fulfilled simply by placing an order on the order queue. The exchange's own systems will then match it with an opposite order appropriately.

There are situations, however, where the sell-side firm needs to take more care and use more skill in handling the order. For example:

1. **When the order is very large – if the order is to buy or sell a very large amount of stock, then simply placing the entire order on the order queue in one operation will have the effect of moving the price adversely. In such a situation, the sell-side firm has two alternatives.**
   a. It could split the order up into smaller parcels and feed it on to the order book over a few days. This may, however, delay execution.
   b. It could (if the order was to sell) purchase the stock from the investor as a principal transaction, and dispose of the stock that it now owns over a few days. If it does this, it needs to be able to prove that the price it charged the investor was not lower than the prevailing order book price at the time. If the order was to buy, then it could sell the stock to the investor as a principal transaction, and purchase the stock that it is now obliged to deliver over a few days. If it does this, it needs to be able to prove that the price paid by the investor was not higher than the prevailing order book price at the time.
2. **When the instrument is quoted on more than one exchange – the shares of large multinational and even some emerging market companies are often quoted on many stock exchanges and sometimes in different currencies. The main market for Sony Corporation shares, for example, is the Tokyo Stock Exchange (where Sony shares are priced in JPY), but Sony shares are also quoted on the LSE (both in JPY and GBP), the New York Stock Exchange (in USD) and on Deutsche Börse (in EUR). In such a case, a sell-side firm that has access to all of these exchanges should research the prevailing price levels on all of them to establish the most favourable price for the client. However, the two parties have also to take into account some other factors when deciding which exchange to route the order to.**
   a. Tokyo is the main market where most of the trades take place. There might be less liquidity in the other markets, meaning that:
      - **the less liquid markets do not usually offer the best prices, and**
      - **the order might take longer to fill on one of the less liquid markets.**

   b. On the other hand, say the investor is located in the US, and has requested execution today. By the start of the working day in the US, the Tokyo market has already closed and, therefore, execution today is not possible. The NYSE will be open, however; the European exchanges may also still be open.
   c. The customer might want to pay for Sony shares in JPY. Because Deutsche Börse prices Sony shares in EUR and the NYSE prices them in USD, there would be additional foreign exchange transaction costs and risk in trading in New York or Frankfurt.
   d. It is possible that the sell-side firm that receives the order is not, itself, a member of the exchange that is offering the best price and the most liquid market. For example, not all London-based firms are members of the Tokyo Stock Exchange. If this is the case, then a London firm might have to use another broker in Tokyo to

place the order on its behalf. This would involve two lots of brokers' commission, which could invalidate the price advantage if it was very slight to begin with.

3.2.3 Treating Customers Fairly (TCF)

The above examples show that there can be a practical conflict between best execution and execution at the best price. The final rule that the sell-side firm needs to take into account is Treating Customers Fairly (TCF). This rule exists because of the possibilities of conflict of interest between the sell-side firm and the investor.

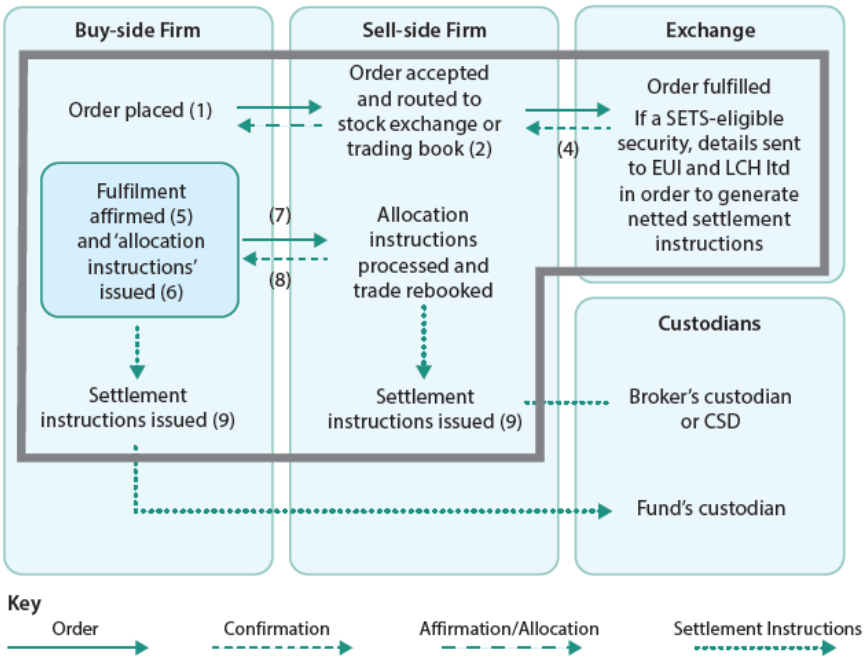
For example, a sell-side firm may wish to invest its own capital in purchasing Sony shares. At the same time, the firm has a client that wishes to sell a large quantity of Sony shares. If a large sell order hits the market before the buy orders, it could have the effect of moving the price in the sell-side firm's favour. The firm has to manage its order execution process paying special attention to two of the FCA's Principles for Businesses that were first examined in chapter 2:

- **Principle 6 (customers' interests) requires a firm to pay due regard to the interests of its customers and to treat them fairly.**
- **Principle 8 (conflicts of interest) requires a firm to manage conflicts of interest fairly.**

Note that the regulatory rules do not prescribe the method by which the sell-side firm manages conflicts of interest. How this, or any other, conflict of interest is managed is up to the firm concerned. However, the firm has to be able to demonstrate that it is managing this conflict in accordance with FCA Principles 6 and 8.

3.3 Pooling and Allocation

3.3.1 Order Flow Steps



The parts of this diagram that are covered in this chapter are highlighted in a box.)

1. **The fund manager sends the order to the sell-side firm.**
2. **The sell-side firm acknowledges it and makes a decision as to how to execute it, ie, whether to fill it by placing it with an investment exchange or MTF, which exchange to route it to if there is a choice of exchanges, or whether to fill it by buying and selling from its own book.**
3. **The sell-side firm then executes it, either as a single transaction or, if the order is for a large amount, by breaking it down into smaller amounts.**
4. **When the sell-side firm has completed the order, it sends a confirmation to the fund manager. The confirmation will include, inter alia, details of:**

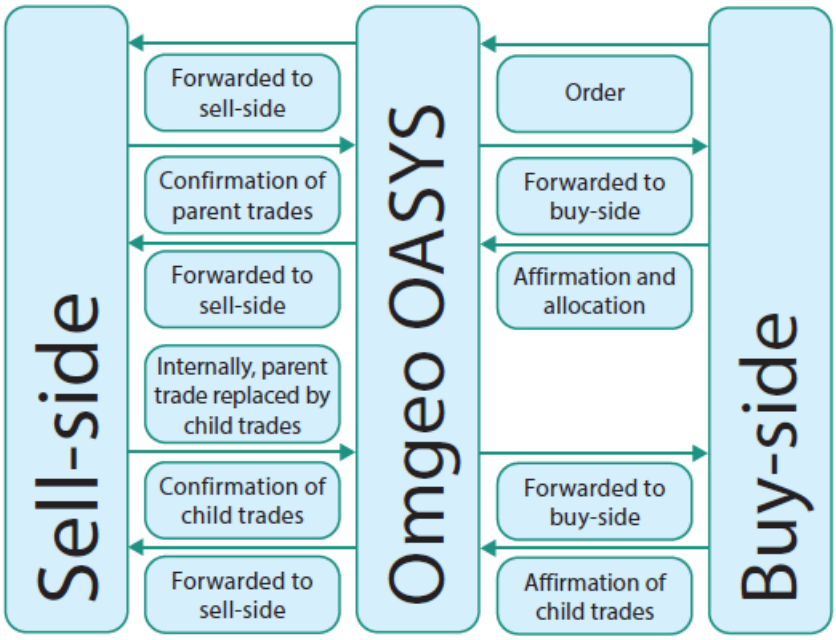
    - **the name of the client for whom the order was executed**
    - **the name of the stock and whether it was bought or sold**
    - **the trade date of the purchase or sale**
    - **the value date of the purchase or sale**
    - **the price of the trade – if the order was split into more than one order on an order queue this will be the average price of all the executed orders**
    - **the net amount to be paid or received by the investor, including any fees and charges and, for a bond sale, any amount of accrued interest on the deal**
    - **whether the firm acted as agent or principal, and**
    - **if it acted as agent, the name of the exchange that the deal was executed on.**

1. **The fund manager then checks the confirmation received from the sell-side firm. If it disagrees with the details, it takes the matter up with the sell-side firm, otherwise it is said to affirm the confirmation.**
2. **At the same time that the fund manager affirms, it also advises the sell-side firm of the allocation details of this order. The fund manager itself has placed this order on behalf of its own clients (or funds) – there may be just one of them or there may be many. At this stage, the fund manager notifies the sell-side firm of the details of who its clients are and how many shares are to be allocated to each client.**
3. **The sell-side firm then splits the parent trade into a number of child trades, one for each fund, and re-confirms the allocations to the fund manager. The confirmation repeats the information in the original confirmation of the 'parent' trade (point 4 above).**
4. **The fund manager then re-affirms each of the individual fund transactions.**
5. **Both the fund manager and the sell-side firm then issue settlement instructions to their custodians.**

All of these communications may be automated in the same way that the original order was automated, ie, the confirmations, affirmations and allocations may be transmitted by any of the following methods:

- **by telephone or fax**
- **by entering the information into a secure web page provided by the sell-side firm**
- **by exchanging SWIFT messages, or**
- **by entering the affirmation and allocation details directly into the sell-side firm's order management system. Typically, this would be facilitated by using a third-party 'hub and spoke' order routing service, which in turn probably involves exchanging FIX protocol messages.**

The following diagram shows how this is achieved using the Omgeo Central Trade Manager service provided by the Depository Trust & Clearing Corporation (DTCC). Omgeo is now wholly owned by DTCC:



One of the key components at the heart of most automation solutions in the financial markets is the ability to exchange trade information with counterparties electronically. This basic need has driven the development of a number of electronic trade confirmation (ETC) initiatives over the years. One of the most successful of these has been the Omgeo Central Trade Manager system, originally developed by Refinitiv, now known as 'Omgeo'. It was acquired by the DTCC in 2013, which maintains and supports its various services to the firm's clients. With several thousand installed users worldwide, Omgeo Central Trade Manager is at present the de facto standard for trade communication between broker and institution, making it a common element of integration and automation projects in the equity broking and fund management communities. The DTCC also offers other automated services both domestically in the US and cross-border.

3.3.2 Order Flow Examples

The following are examples of three executed orders. Each example shows:

1. **the trade computations**
2. **the data flows between the buy-side and sell-side firms, and where applicable the exchange, and**
3. **the decisions that the sell-side firm took to ensure best execution.**

Example – Simple Agency Trade

1. On 20 February, XYZ Fund Managers plc submits an order to ABC Investment Bank plc to sell 10,000 shares in HBOS plc 'at best'. This order is on behalf of XYZ's customer, the

QRS Pension Fund.

2. The main market for HBOS shares is the LSE; and on a typical LSE trading day the daily turnover in HBOS shares is over five million shares. ABC, therefore, decides that placing this order on the SETS queue will ensure best execution, and that there is no danger of a single order of this size affecting the SETS price.

3. SETS matches the order to sell at a price of £11.69 per share. ABC charges XYZ 0.75% commission on this deal. The amount that XYZ's investor will receive on value date 23 February is, therefore:

Principal Amount		
£11.69 x 10,000 shares		£116,900.00
Less ABC's commission	0.75% of principal amount	–£876.75
Net proceeds payable to investor		£116,023.25

4. The steps involved between XYZ and ABC are as follows – all events take place on 20 February:

a. XYZ submits the order

b. ABC places it on the SETS queue where it is matched and ABC is informed

c. ABC sends a confirmation to XYZ confirming that it has sold 10,000 HBOS plc on the London Stock Exchange at £11.69 per share, and giving details of the commission due and net proceeds payable to the investor on 22 February

d. XYZ affirms this trade, and gives allocation details to ABC disclosing the identity of the investor – the QRS Pension Fund

e. ABC re-books the trade in the name of QRS Pension Fund, and re-confirms to XYZ

f. XYZ re-affirms the child trade.

Example - More Complex Agency Trade

DEF Investment Managers invests in the Asia-Pacific markets on behalf of a number of clients. On 20 February, it submits an order to ABC Investment Bank plc to purchase one million shares in Sony Corporation at a maximum price of JPY6,725 per share: good till cancelled.

ABC Investment Bank is a member of all the world's major stock exchanges, including the Tokyo market. It investigates the prices available on the Tokyo exchange, LSE, NYSE and

Deutsche Börse, and decides that only Tokyo has enough liquidity to handle an order of this size, taking best execution into account.

ABC finds that the turnover on Sony shares on the Tokyo exchange the previous day was 3,205,700 shares. It, therefore, divides the order into ten parcels of 100,000 shares each, and feeds them on to the Tokyo exchange's order queue over two days.

The trades are matched on the TSE's order queue as follows:

Trade date of match	Value date	Qty of shares	Share price in JPY	Principal amount in JPY
20 February	22 February	100,000	6,250	625,000,000
20 February	22 February	100,000	6,500	650,000,000
20 February	22 February	100,000	6,600	660,000,000
20 February	22 February	100,000	6,400	640,000,000
20 February	22 February	100,000	6,500	650,000,000
Total fulfilment – trade date 20 February		500,000	(average) 6,450	3,225,000,000
21 February	23 February	100,000	6,725	672,500,000
21 February	23 February	100,000	6,720	672.000,000
21 February	23 February	100,000	6,600	660,000,000
21 February	23 February	100,000	6,650	665,000,000
21 February	23 February	100,000	6,725	672,500,000
Total fulfilment – trade date 20 February		500,000	(average) 6,684	3,342,000,000

The steps involved between DEF and ABC are, therefore, as follows:

a. 20 February – DEF submits the order.
b. 20 February – at various times throughout the day, ABC places five lots of 100,000 on the TSE queue, each of which is matched and ABC is informed.
c. 20 February – ABC sends a confirmation to DEF confirming that it has bought 500,000 Sony Corp on the Tokyo Stock Exchange at JPY6,450 per share, and giving details of the commission due and net proceeds payable by the investor on 22 February.
d. 20 February – DEF affirms this trade, and gives allocation details to ABC disclosing the identity of five investors, each of whom will receive and pay for 100,000 shares.

e. 20 February – ABC re-books the trade in the names of the five investors and re-confirms to DEF.
f. 20 February – DEF re-affirms the five child trades.
g. 21 February – ABC continues to 'work the order' at various times throughout the day; ABC places an additional five lots of 100,000 on the TSE queue, each of which is matched and ABC is informed.
h. 21 February – ABC sends a confirmation to DEF confirming that it has bought 500,000 Sony Corp on the Tokyo Stock Exchange at JPY 6,684 per share, and giving details of the commission due and net proceeds payable by the investor on 23 February.
i. 21 February – DEF affirms this trade, and gives allocation details to ABC disclosing the identity of five investors, each of whom will receive and pay for 100,000 shares.
j. 21 February – ABC re-books the trade in the names of the five investors and re-confirms to DEF.
k. 21 February – DEF re-affirms the five child trades of today.

Example - Principal Trade

Orders to buy and sell corporate bonds are usually handled by the receiver as principal trades. On 20 February, XYZ Fund Managers places an order with ABC Investment Bank to buy $1,000,000 nominal (face value) of Ford Motor Co 4% bond maturing 23 August 2025. ABC determines that the best price available is from Megabank plc. As there are no other relevant execution factors in this case, best execution is achieved as a result of best price. Megabank makes a market in this bond and is prepared to offer it to ABC at a price of 98% of face value. ABC accepts this offer and, in turn, sells it on to XYZ at 98.0625% of face value.

ABC issues confirmations to both Megabank and XYZ. The salient details of both confirmations are as follows:

ABC's confirmation to Megabank:

Trade date: 20 February
Value date: 22 February

We confirm our PURCHASE from you of:

USD 1,000,000 Ford Motor Co 4% 23-8-2025 @ 98%	980,000
182 days' accrued interest	20,222.22
Total amount	1,000,222.22

ABC's confirmation to XYZ:

Trade date: 20 February
Value date: 22 February

We confirm our SALE to you of:

USD 1,000,000 Ford Motor Co 4% 23-8-2025 @ 98.0625%	980,625
182 days' accrued interest	20,222.22
Total amount	1,000,847.22

ABC does not charge XYZ any commission on the deal. It receives the spread between the buying price of 98% and the selling price of 98.0625%: USD 625.00.

3.4 Dealing Systems

3.4.1 Introduction

Both the buy-side firm and the sell-side firm need to use dealing systems to manage the process of placing/taking orders, fulfilling them and dealing with the trade agreement, ie, the processes of confirmation, affirmation and allocation. Dealing systems are 'mission-critical systems' where high availability and the ability to handle occasional surges in volume without degraded response times and/ or other forms of system instability are essential requirements. If a dealing system is not available at times when markets are under pressure, then opportunities to deal may be lost, and the sell-side firm in particular may very well be unable to fulfil its obligations for best execution.

The usual settlement cycle (the difference between the trade date and value date) in the equity markets is two days. Sometimes equity deals are carried out with special value dates that involve shorter periods. In some government bond markets, the trade date and value date are often the same day or only one working day later. Therefore, the process of communication between the buy-side and sell-side firms needs to be highly automated. The dealing system is an essential part of both firms' automation strategy.

The functionality required of a dealing system by a buy-side firm is slightly different from that required of a sell-side firm. The buy-side firm is the customer, and the sell-side firm is the supplier.

Brokers compete on service levels. For simple agency trades, many brokers can deliver the best price, so the level of service that they offer in terms of speed and efficiency of notification of execution, and their ability to facilitate automation for their customers, is an important differentiator. This means that sell- side firms need to provide whatever forms of connectivity their customers require. As not all customers' requirements are the same, this means that they must offer a wide variety of connections, and this increases the complexity of the configuration.

3.4.2 Buy-Side Dealing Systems

The actual functions required of a dealing system by any one fund manager will depend on the size of the firm and the range of investments and markets it trades in. The main capabilities of a typical dealing system for firms of this type usually include:

1. **Automation compliance – the system design should observe the principles of automation that were dealt with in chapter 1.**
2. **MiFID II compliance – users need to be able to provide the system with details of execution policies for different combinations of instrument types and client types (see section 3.2), and the system then needs to use these policies to route orders to the appropriate execution venue.**
3. **Support for investment decision-taking – including portfolio modelling and 'what-if' scenario analysis: comparing portfolios to a model, generating proposed trades and examining their impact on portfolios and cash balances. This may involve the ability to integrate in-house data with external data supplied by Refinitiv, Bloomberg or others. Buy-side firms that deal with the private investor, in particular, need systems with facilities that can assess the impact of a particular potential trade on the client's income tax and capital gains tax liability.**
4. **Support for all security types in which the firm invests – this may include equities, bonds, futures, options and other derivatives, foreign exchange and money market instruments.**
5. **Multi-currency capabilities – the ability to track currencies at the system, portfolio and securities level, and to settle trades and report in any currency. Full European Monetary Union (EMU) support is required, plus automatic currency conversions when a fund that is denominated in one currency is settling trades in another currency.**
6. **Customer reporting – one of the ways that fund managers compete with one another when they are attracting business from large investing institutions is in the quality and flexibility of the reports that they can provide for these institutions. Many systems offer the ability to store, extract, calculate and present information in any way that clients or prospective clients need. Reports may be delivered on paper or via a web portal made available to the client, and firms usually require the ability to create their own report formats with TrueType fonts, define customised data fields, and specify unique calculations for reporting or analysis. Many firms will use dedicated report-writing applications to produce the reports themselves, but these**

applications have to extract the raw data from the dealing system. It is therefore important to be able to access the dealing system database using SQL (structured query language, see chapter 8, section 1.2.4) and web technologies.

7. Performance measurement – fund managers and their customers need to know how the fund has performed compared to benchmarks, and compared to prior periods. Most fund management systems will offer a comprehensive performance measurement suite with such features as daily performance, customised segmentation by portfolio, currency versus market performance and individual security level performance reports.
8. Income and capital gains tax computation facilities – firms that deal with private investors in particular need facilities that can perform these calculations for clients.
9. Broker connectivity and automation facilities – fund manager dealing systems need to be able to issue orders to sell-side firms, receive automated confirmations from the sell-side and respond to confirmations with automated affirmations and allocations. If the buy-side firm is considering buying these facilities off-the-shelf from software and 'store and forward' network vendors (see chapter 6, section 5.3.3), then there is a large number to choose from. For larger firms, automated connectivity between their dealing systems and the dealing systems of the sell-side firms that they deal with may be established in any of the following ways:a. by sending a SWIFT message to the firms concernedb. by sending a FIX protocol message to the firms concerned; often, this will be sent to a central trade order management system such as OASYS – refer to the diagram at the end of section 3.3.1.
10. Support for algorithmic trading – both by the firm on its own account, and also by its clients. Enabling clients to trade using these techniques may also imply providing them with direct market access. These terms are explained in section 4.
11. The ability to receive real-time market data feeds.

3.4.3 Sell-Side Dealing Systems

Again, the actual functions required of a dealing system by any one sell-side firm will depend on the size of the firm and the range of investments and markets it trades in. The main functions of a typical dealing system for firms that deal in equities and bonds usually include:

1. Automation compliance – the system design should observe the principles of automation that were addressed in chapter 1.
2. MiFID II compliance – users need to be able to provide the system with details of execution policies for different combinations of instrument types and client types (see section 3.2), and the system uses these policies to route orders to the appropriate execution venue.
3. Support for all security types in which the firm invests – this may include equities, bonds, futures, options and other derivatives, foreign exchange and money market instruments.

4. **Multi-currency capabilities – the ability to track currencies at the system, portfolio, and security level, and to settle trades and report in any currency. Full support is required, plus automatic currency conversions when a fund that is denominated in one currency is settling trades in another currency.**
5. **Connectivity to exchanges – the system needs to supply connectivity to the order-driven and quote-driven trading systems of all the exchanges of which the firm is a member.**
6. **Connectivity with buy-side clients – the system needs to offer customers many forms of connectivity to manage their order flow and deal with the various stages of trade agreement. This may mean offering a very large number of options – as many options as the customer base requires. The system needs to be able to communicate with customers using the FIX and SWIFT message protocols; it also needs to communicate with customers using order management networks such as Omgeo Central Trade Manager and Autex. Some large clients may demand communication via email (including Excel or other attachments), web browser and secure file transfer protocol (FTP).**
7. **Commission and charges calculation – the system needs to be able to calculate commissions and other charges. As you will see from section 3.5, there are many commission calculation methods, so the system requires considerable flexibility in this area. Once the commission has been calculated, firms need to be able to extract management information from the dealing system about their commission income, so that they can see who are their most/least profitable clients, exchanges, or instrument types.**
8. **Support for the trading book and ability to mark-to-market (MTM) (see section 6.2.1) – for firms that trade as principal, the system needs to be able to keep a record of the firm's position in each instrument and the historic prices of each transaction in each instrument, and to be able to calculate both the realised and unrealised profit and loss on each instrument. This activity is covered in more detail in section 6.2.**
9. **Support for algorithmic trading – if the firm's investment strategy employs this process. Algorithmic trading is the placing of buy or sell orders of a defined quantity into a quantitative model that automatically generates the timing of orders and the size of orders based on goals specified by the parameters and constraints of the algorithm. See section 4.**

3.5 Charges, Fees and Expenses

A more recent development in the banking sector has been the emergence of competitors to the traditional role of banks in the form of peer-to-peer lenders and crowdfunding.

3.5.1 Commission and Commission Calculation Methods

The common methods of calculating commissions are as follows:

- **Flat fee – this method is used by many 'execution-only' stockbrokers that serve the private investor. For each trade, there will be a fee of £x, no matter how large or small the value of the trade.**
- **Percentage – this method is used for many equity transactions involving professional investors. The fee is x% of the value of the trade.**
- **Basis points – this method is used in some bond and OTC derivative transactions. A basis point (bp) is a unit that is equal to 1/100th of 1%; in this context, the commission is expressed as x basis points per one million nominal of face value (of the underlying instrument in the case of a derivative). For example, if the client is buying or selling $1,000,000 nominal of a corporate bond, and the commission is expressed as 'five basis points per million', then the commission that applied to the trade would be 0.05% of the face value bought or sold, ie, $500.00.**
- **Per unit – this method is widely used for futures and options contracts. The exchange concerned specifies, for each contract, how many units of the underlying instrument are referenced to 'one lot' of the derivative. The commission is, therefore, expressed as '£x per lot'.**
- **Sliding scale – a sliding scale may be applied to commissions that are based on percentages or basis points. The percentage reduces according to the size of the individual order. For example:**
  - **commission = 1% on individual orders with value below £50,000**
  - **commission = 0.85% on individual orders with value between £50,001 and £100,000**
  - **commission = 0.75% on individual orders with value between £100,001 and £150,000.**

  Note that the size of the order, not the execution, determines the scale.
- **Reducing scale – again, the commission rate reduces for clients that place large amounts of business with the firm. However, using this method, the cumulative value of the orders that the client has placed over a period of time is added together, and the commission is calculated according to the commission rate that applies to the total value of orders executed during the period, which is then multiplied by the cumulative value of those orders.**
- **Exchange fees – these are fees charged by the exchange where the trade is executed.**

3.5.2 Commission Sharing

Under certain circumstances, commission may be charged by more than one broker. There are two reasons why this may be the case:

1. **Cross-border trading – in the case where a fund manager gives an order to a broker in one country and that broker decides that 'best execution' requires the order to be handled by an exchange in another country, if that broker is not a member of the overseas exchange, it might appoint a local broker to act on its behalf. In such a case, both brokers would charge commission.**
2. **Split services – research and execution – the services that the sell-side supplies to the buy-side can be divided into investment research (advising buy-side firms which sectors and individual securities to invest in/divest from); and execution (getting the best price for the investor). There are some sell-side 'research boutiques' that are able to provide the research services but which may not have the market presence to get best prices. In such a case, the buy-side firm may act on a research recommendation by one firm but place the order with another firm, instructing them to share the commission according to an agreed formula.**

3.5.3 Other Fees and Expenses

Depending on which country the trade was executed in, and what type of financial instrument is being traded, there may be other charges or taxes. In the UK equity markets, the following apply:

Stamp Duty Reserve Tax (SDRT)
SDRT is a tax payable by buyers (but not sellers) of most UK equity shares. The current rate is 0.5%. It is payable by any individual or corporation that is purchasing:

- **shares in a company that is incorporated in the UK**
- **shares in a foreign company that maintains a share register in the UK, or**
- **options to buy shares as defined above.**

Stamp Duty
Stamp duty is a tax that is paid by the final investor, so trades between stock exchange member firms are exempt from stamp duty. The dealing system database, therefore, needs to contain information about which individual:

- **instruments stamp duty applies to, and**
- **trade types and counterparties it applies to.**

In recent years, professional investors have successfully found many ways of gaining the benefits of investing in UK-listed equities without the need to pay stamp duty. They are able to do this by investing in derivative instruments that are themselves based on underlying equities.

In particular, investment in the following asset classes enables investors to gain some of the benefits of investment in the underlying instrument without a change of ownership:

- **Listed futures and options, both on individual equities and equity indexes, such as the FTSE 100 index.**
- **Contracts for difference (CFDs). A CFD is an agreement between two parties to exchange the difference between the opening (today) value and the closing (at a future date) value of a particular asset (normally a share). These are generally short-term contracts drawn up by both involved parties. The firm's exposure to default by its client is controlled by margin requirements and collateral deposits. A number of online stockbrokers offer CFD trading services both to professional investors and private individuals.**

Panel of Takeovers and Mergers (PTM) Levy
A charge automatically imposed on investors, and collected by their brokers, when they sell or buy shares in the UK market with an aggregate value in excess of £10,000. The charge is £1, and the money raised goes to the Panel of Takeovers and Mergers (PTM). The Panel writes and enforces the rules by which takeovers of companies listed on the LSE are conducted.

4. Algorithmic Trading

1.1.3 Know the role of investment distribution channels including: independent and restricted advice; execution only; robo-advice

4.1 Definition

Algorithmic trading is the collective name given to the use of computer programs for entering orders where the computer algorithm decides on aspects of the order such as the timing, price, or quantity, and in many cases initiates the order without human intervention. Algorithmic trading is widely used by fund managers to divide large trades into several smaller trades, in order to manage market impact and risk. Sell-side traders, and some hedge funds, provide liquidity to the market, generating and executing orders automatically.

A special class of algorithmic trading is high-frequency trading (HFT), in which computers make very rapid and complex decisions to initiate orders based on information that has been received and processed electronically, before human traders would have had the time to process this information. Some of these trades are processed within milliseconds. This has resulted in a dramatic change in the market behaviour, particularly in the way

liquidity is provided. Algorithmic trading may be used in any investment strategy, including market making, inter-market spreading, arbitrage, or pure speculation.

4.2 The Growth of Algorithmic Trading

A report from Fortune Business Insights estimates the global algorithmic trading market at US $2.36 billion in 2024, projecting growth to US $4.06 billion by 2032, with a compound annual growth rate (CAGR) of about 7.0%. But, Grand View Research forecasts a much stronger expansion: the global market is expected to soar to US $42.99 billion by 2030, growing at a 12.9% CAGR from 2025 to 2030.

This growth has been driven by the following variables:

- **The rise of AI, machine learning, and big data analytics is driving adoption of sophisticated, adaptive trading models.**
- **Automated trading minimizes human error, speeds execution, and lowers transaction costs.**
- **The availability of low-code platforms and cloud-based services is making algorithmic trading more accessible to retail investors and SMEs.**
- **Policies such as MiFID II in Europe and initiatives by SEC and other regulators are promoting transparency and enabling electronic trading growth.**
- **Growth in cryptocurrency trading, ETF rebalancing strategies, and expansion in Asia-Pacific markets further support market expansion.**

4.3 Problems and Concerns

While Algorithmic trading has transformed markets by increasing efficiency and liquidity but it also creates serious problems and risks. Namely:

- **Algorithms can react to each other in hostile feedback loops which can trigger chain reactions (e.g., the 2010 'Flash Crash,' when U.S. markets lost ca USD 1 trillion in minutes).**
- **Small news updates and/or price changes can be amplified by automated sell-offs.**
- **Algorithms can place and cancel large numbers of orders rapidly which gives a false sense of available liquidity.**
- **In stressed markets, algos may pull back or even stop which can leave investors unable to trade.**
- **Traders may use algorithms to place fake orders to move prices and then cancel them before execution.**
- **Flooding the market with rapid-fire orders slows down competitors' systems and distorts pricing.**

- **Like all technology, algos could have bugs, coding errors, design faults and/or infrastructure failures which can cause massive incorrect trades (eg, Knight Capital lost $440M in 45 minutes in 2012).**
- **Many firms use similar strategies so if one fails or has issues then the impact could cascade across markets.**
- **High-frequency traders with faster systems gain advantages over retail and slower institutional or retail investors.**
- **Algorithms might anticipate and trade ahead of large client orders therefore impact prices.**
- **Many trading algorithms (especially the newer AI/ML-based) are 'black boxes' which means it is hard to explain how decisions are made to clients. This can conflict with fair treatment expectations.**
- **Regulators struggle to oversee thousands of trades per second.**
- **Global markets mean algorithms can exploit regulatory gaps.**
- **Regulators often catch manipulative behavior only after the damage is done.**

4.4 Remedies

To address volatility, exchanges now use circuit breakers and trading halts, which pause trading during extreme price swings. Firms are also required to implement kill switches to shut down malfunctioning algorithms, while regulators demand stress testing to ensure systems can handle unusual market conditions. These safeguards reduce the likelihood of flash crashes and runaway trading.

Concerns about liquidity and manipulation are being tackled through tighter controls. Some markets impose minimum resting times to discourage rapid order cancellations, while market maker obligations ensure continuous liquidity. Rules under Dodd-Frank in the U.S. and MiFID II in Europe explicitly ban manipulative strategies such as spoofing and layering. At the same time, regulators employ real-time surveillance systems to detect suspicious behaviour and impose heavy fines on offenders.

Finally, fairness and operational risks are being remedied through best execution rules, requiring firms to secure the best available prices for clients, and audit trails that improve transparency. New market structures, such as IEX's "speed bump," also aim to level the playing field between high-frequency traders and ordinary investors. On a global scale, regulators now demand registration of algorithms and assign human accountability, while also strengthening cross-border cooperation.

4.5 How Sell-Side Firms Provide Algorithmic Trading to their Clients

The mechanism that is used is known as direct market access (DMA). DMA is defined as the automated process of routing a security order directly to an execution venue, thereby avoiding intervention by a third party. Execution venues include exchanges, alternative trading systems and electronic communication networks. To simplify, DMA enables the buy-side firm or investor to place orders directly on to the order queues of investment exchanges, avoiding the need to submit the order to an exchange member firm in the traditional manner.

If an investor is using algorithmic trading technology, then the timing of the order to the second is critical. Conventional order flow techniques are simply too slow to have the desired result. In addition, DMA is a more anonymous way of trading – it allows hedge funds, in particular, to offload large quantities of stock without adversely impacting the market price.

5. Investor Self-Servicing

4.5.1 Understand the features of investor self-servicing

5.1What is Investor Self-Servicing?

Self-servicing is becoming increasingly common across most industries (not just investment and asset management). Research completed by Nuance said that 67% of respondents preferred self-service to speaking to a 'human person'. This was supported by Coleman Parks who stated that 40% of people who actually contacted a call or contact centre have first tried to look for an answer on a self-service system.

This move to investor self-servicing is driven by a number of factors:

- **This move to investor self-servicing is driven by a number of factors, people are becoming more and more 'tech-savvy' and people would rather use an 'app' (or something similar) to process business activities and address any problems they have.**
- **Advances in technology have allowed self-servicing platforms to be developed.**
- **Customers want to discover and learn things themselves. They do not want to speak to a company employee regarding an issue or have to repeatedly explain a problem.**
- **Customers (and society in general) now demand that their problems are solved immediately and they feel that searching for the answer themselves is actually**

quicker than speaking to a person. This is particularly true for Millennials & Gen Z Investors.

- **Customers also want to raise issues at any time during the day or night; and they feel using a self- servicing facility is better for this. Firms are struggling to cost justify having a manned help line 24 hours a day.**
- **Self-servicing allows simple, repeatable activities (such as trading or reporting) to be processed automatically without the need to involve 'human' staff. This means that firms can free up their staff to focus on more complex or higher-value customer servicing activities**
- **Finally, self-servicing allows firms to monitor and (hopefully, further) understand customer behaviour so that their products, ongoing fees and supporting customer servicing capabilities are constantly fine- tuned.**

5.2 What are the Features of Investor Self-Servicing?

Successful self-servicing requires a firm to develop a facility to allow customers to resolve problems or process business activities without the need to speak to a person. Therefore, the focus needs to be on creating an understanding of the problem(s) or process(es) that their clients are likely to have and how they could be addressed via self-servicing capability. These activities tend to be repeatable or codified processes that can be driven by a set of clearly defined business rules. Any complex problem or issue resolution will still need to be performed by speaking to a person.

If self-servicing is implemented properly then it will offer a personalized service covering:

- **account opening, changes and closing.**
- **advice and recommendations.**
- **making payments.**
- **market news and research which can be supported by online blogs.**
- **trading – eg, buys, sells, switches and stop-losses**
- **reporting – eg, contract notes, valuations, statements and audit reports, and**
- **interactive customer supporting (coering FAQs and chatboxes).**

Self-servicing capabilities are delivered via a combination of the following:

- **a website**
- **a mobile phone or tablet application, or**
- **an automated telephone service with voice recognition.**

5.2 What are the Challenges of Self-Servicing?

A primary concern is the capability of investor because many lack sufficient financial literacy, which can lead to poor decisions, overconfidence, and exposure to inappropriate levels of risk. Furthermore behavioural biases, such as herd mentality or speculation, can further exaggerate these risks.

From a technology point of view, platforms must ensure reliability, scalability, and strong cybersecurity. Other factors such as system outages, slow execution, or hacking incidents can disrupt trading and harm investor confidence. Additionally, integrating multiple markets and products while managing large user volumes is also complex for firms.

Regulatory and ethical challenges are becoming increasingly important. Firms must ensure products are suitable, fees and risks are transparent, and customers are treated fairly. Unfortunately features such as gamification or conflicts of interest in order routing can compromise fairness, while cross-border operations complicate regulatory compliance.

Finally, firms face organisational challenges in balancing automation with support. Many firms struggle with adequate customer guidance, staff training, and hybrid support model especially for less tech-savvy investors.

6. Trade Capture and Risk Management for Trade Capture Functions

4.6.1 Understand the basic technology characteristics of risk mitigation for the following trade capture functions: risk management; transaction capture; best execution

6.1Risk Management

Fund managers (acting on behalf of investors), investors themselves and sell-side firms all have dealings with counterparties and clients, and all investors and some sell-side firms hold positions in financial instruments. As such, they are exposed to various forms of risk:

- **credit risk – also known as counterparty risk**
- **market risk – also known as position risk, and**
- **operational risk.**

In chapter 2, we learned that:

Capital ratio = Capital requirement / (Credit risk exposure + market risk exposure + operational risk exposure)

Operational risk was examined in chapter 2 and will also be further discussed in chapters 8 and 9. In this chapter, we shall now look at the first two risk elements – credit risk and market risk – more deeply in the context of technology in the trade capture.

6.1.1 Credit Risk

Credit risk is the risk associated with one party not fulfilling its contractual obligations to another party at a specific future date. In practical terms, this is likely to mean that there is the possibility of one or more of the following events occurring on a future date:

- **An investor client or a trading counterparty may not be in a position to pay for a security purchase by the client or deliver securities to fulfil its obligations, in respect of an agreed sale by the client on value date. This particular risk is normally mitigated by the central securities depository arranging simultaneous DvP settlement of the trade – refer to chapter 3, section 3. In addition, trades between exchange members (but not their clients) that are executed through an order-driven market are novated by a central counterparty.**
- **The counterparty for a futures, options or other derivative contract is unable to meet its obligations to make payments or deliveries under the terms of that contract at a future date. For exchange- traded derivatives, this risk is always mitigated by the presence of the central counterparty (CCP). For some OTC derivatives, there may be no central counterparty to the trades, so each party remains exposed to this risk. CCPs do now offer specialised services to novate OTC derivatives contracts, but not all potential parties will take advantage of these services and not all contracts can be centrally cleared.**
- **The issuer of a bond is unable to meet its obligations to pay interest or redemption proceeds on the due date. If such an event occurs, then the holder of the bond or equity concerned remains exposed to this risk.**

6.1.2 Market Risk

This is the risk that the value of the investments owned by the investor might decline. There are a number of reasons why this may occur, including:

1. **a general fall in the prices of most classes of instrument caused by global economic or political uncertainty**
2. **a fall in the prices of shares issued by companies in a particular industry, caused by a poor economic outlook for that particular industry, or a fall in the prices of shares**

listed in a particular country because of economic or political uncertainty in that country

3. **a rise in interest rates for a particular currency (or, indeed, all currencies). This would cause a fall in bond prices because, for fixed-income securities, market risk is closely tied to interest rate risk – as interest rates rise, bond prices decline, and vice versa, or**
4. **a fall in the exchange rate of a particular currency. This would cause a fall in the value of investments held in that currency when they were held by overseas investors who value in a different currency.**

There are a number of risk mitigation techniques that are routinely taken by investment professionals to mitigate market risk:

- **Diversification, simply defined as 'not putting all your eggs in one basket', means spreading the investment portfolio across a wide range of industries and countries. This protects against the possibility of losses due to poor performance in a particular sector or country.**
- **Hedging is the purchase or sale of a commodity, security or other financial instrument for the purpose of offsetting the profit or loss of another security or investment. Thus, any loss on the original investment will be hedged, or offset, by a corresponding profit from the hedging instrument. Usually, derivative instruments are used to hedge the underlying instruments (also known as cash instruments in this context). Some examples are:**
    - **an investor who is concerned about a fall in interest rates could sell a futures contract or buy a put option on the interest rates for that currency**
    - **an investor who is concerned about a fall in the exchange rate for a particular currency could sell a futures contract or buy a put option on that currency's exchange rate**
    - **an investor who is concerned about a fall in the levels of share prices for a particular market could sell a futures contract or buy a put option on a particular stock market index, eg, the FTSE 100 (UK) or DAX (Germany).**

There is a technology implication to hedging. In order for the dealers to hedge, the dealing and settlement systems that they use must be capable of trading, valuing and settling a wide range of both underlying and derivative instruments. Technology systems will also link the hedge against its position to monitor the risk position.

6.2 Measuring Market and Credit Risk

Systems employed by investment professionals need to have the capabilities to measure market and credit risk. Two techniques are described in this section: mark-to-market and value-at-risk (VaR).

6.2.1 Mark-to-Market (MTM)

Mark-to-market (MTM) is an accounting procedure by which assets are 'marked', or recorded, at their current market value. Its aim is to provide a realistic value of a portfolio's current financial situation. This current market value may be higher or lower than their purchase price, or their book value, and any differences will result in a performance impact and an adjustment to the unrealised profit/loss for the client. Firms will need systems to ensure they can calculate the MTM figures as and when required.

It is important to note that firms who handle investment on behalf of UK private clients need to be aware of the requirements to be able to provide an accurate calculation of the capital gains a client has made through the sale of any assets in line with the prevailing HMRC legislation. Many firms use a separate dedicated system to be able to accurately calculate capital gains tax (CGT) amounts, such as that supplied by the platform CGiX, which is supported by Financial Software ltd, and therefore as a minimum send a client an annual CGT statement.

When the firm is trading interest-bearing instruments, such as bonds, it also needs, as part of the MTM process, to accrue interest on these instruments. This aspect is discussed more fully in chapter 6.

6.2.2 Value-at-Risk (VaR)

Value-at-risk (VaR) is a measure of how the market value of an asset, or of a portfolio of assets, is likely to decrease over a certain time period (usually over one or ten days) under usual conditions. It is typically used by security houses or investment banks to measure the market risk of their asset portfolios (market value-at-risk), but is actually a very general concept that has broad application.

VaR is the maximum amount at risk to be lost from an investment (under 'normal' market conditions) over a given holding period, at a particular confidence level. As such, it is the converse of shortfall probability, in that it represents the amount to be lost with a given probability, rather than the probability of a given amount to be lost.

VaR has the following four parameters:

- **The time horizon (period) to be analysed (ie, the length of time over which one plans to hold the assets in the portfolio – the 'holding period'). The typical holding period is one day, although ten days are used, for example, to compute capital**

requirements under the European Capital Requirements Directive (CRD). For some problems, even a holding period of one year is appropriate.

- **The confidence level at which the estimate is made. If a firm wishes to use VaR as part of the Advanced**
- **Measurement Approach to calculating its Basel II capital requirements (see chapter 2), then this must be 99%. Other firms that only use VaR for internal measurements may set it as low as 95%.**
- **The volatility of the investments or, in other words, what is the risk of the prices increasing or decreasing.**
- **The unit of the currency which will be used to denominate the VaR.**

Limitations of VaR

The bankruptcy of Lehman Brothers in 2008, and the more recent Greek financial crisis, exposed some weaknesses in the VaR concept. In particular, 'VaR with a confidence factor of 99%' means that, in 1% of cases (that would be two–three trading days in a year with daily VaR), the loss is expected to be greater than the VaR amount. VaR does not say anything about the size of losses within this 1% of trading days, and by no means does it say anything about the maximum possible loss.

At the present time, some academics are working on successor algorithms, most notably CoVaR (meaning Contagion Value-at-Risk), which performs the VaR calculation and then asks how it changes if one particular entity such as Lehman's – or Greece – finds itself in distress.

The Technology Implications of VaR

In chapter 2, we learned that a VaR calculation is part of 'Pillar 1' of the Basel II Accord. Firms that have decided to use the Advanced Measurement Approach (AMA) to calculating their capital requirements will need to use techniques such as VaR to do so, and will need to be supplied with technology systems that can perform this calculation. The firm may choose to build its own VaR calculation software; alternatively, there are a very large number of packaged products and online services that will perform this calculation. Since the financial crisis of 2007, many firms have had to undergo rigorous stress tests at the request of regulators, and also make plans for events such as the break-up of the euro and the collapse of specific counterparties and securities issuers. This has led many firms to replace or enhance the software that they use for this aspect of risk management.

6.2.3 Risk – Conclusion

In designing, implementing and maintaining applications to control the various forms of risk, one of the bigger challenges is to provide these applications with fast, consistent, accurate and reliable data covering counterparties and positions. Some of these challenges are addressed in chapters 5 and 7.

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **Why is environment, social and governance (ESG) becoming more important when making investment decisions?**
   Answer Reference: Sections 2.2 and 2.3

2. **List the information that you would normally expect to see on an order to sell securities at a maximum price.**
   Answer Reference: Section 3.1.2

3. **What are the four steps that an investment firm must take to ensure compliance with Article 21 of MiFID II in the context of 'best execution'?**
   Answer Reference: Section 3.2.2

4. **List the information that you would expect a sell-side firm to include in the trade confirmation that it sends to a fund manager.**
   Answer Reference: Section 3.3.1

5. **What is the name of the process by which a fund manager advises a sell-side firm of the identities of the investors concerned with a particular order?**
   Answer Reference: Section 3.3.1

6. **What is the difference between a 'sliding scale' of commissions and a 'reducing scale' of commissions?**
   Answer Reference: Section 3.5.1

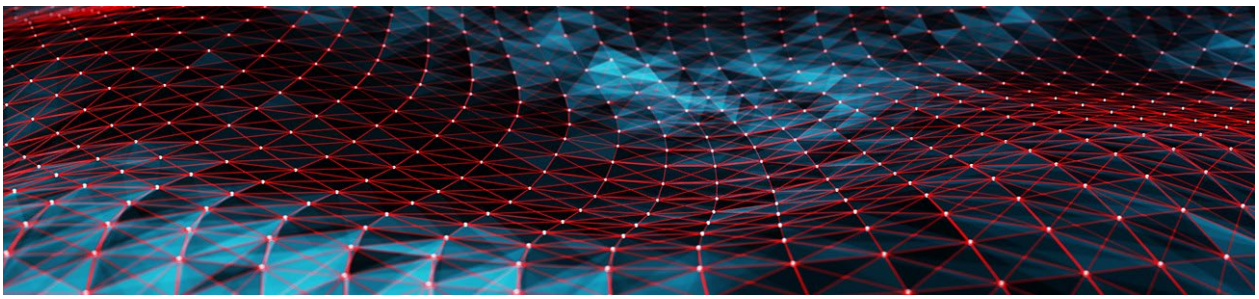
7. **What is the purpose of and what is the economic driver behind direct market access?**
   Answer Reference: Section 4.4

8. **What factors have driven the use of self-servicing?**
   Answer Reference: Section 5

9. **What is the name of the risk management technique that is designed to ensure that all investments are recorded in the dealing system at their current market value?**
   Answer Reference: Section 6.2.1

10. **Why is it necessary for certain firms to be able to calculate value-at-risk in order to meet their regulatory requirements connected with Basel II?**
    Answer Reference: Section 6.2.2

11. **What does a CoVaR calculation set out to do?**
    Answer Reference: Section 6.2.2



Chapter Five
The Role of Technology in the Pre-Settlement Phase

Section 1 Reference Information

Section 2 The Trade Agreement Process

Section 3 Reporting to Regulators

Section 4 Reporting to Customers

This syllabus area will provide approximately 5 of the 50 examination questions

1. Reference Information

5.1.1 Understand the technology alignment to pre-settlement phase key risk indicators including: reference data; standing settlement instructions; client and counterparty agreements

The accuracy of reference data, also known as static data, is a significant factor in achieving automation. Incorrect or incomplete reference information is a common cause of trade processing errors.

The reference data challenge for securities firms can be said to be to:

1. **gather the required data from disparate sources**
2. **store it securely**
3. **update it when necessary, and**
4. **utilise it appropriately.**

This section explores the most important items of reference data that need to be held for financial instruments, clients and counterparties: 'internal' entities – ie, reference data that is concerned with the structure of the firm itself – and 'external' entities such as countries, exchanges, clearing houses and custodians that have a role in the trade flow.

1.1 Reference Data Overview

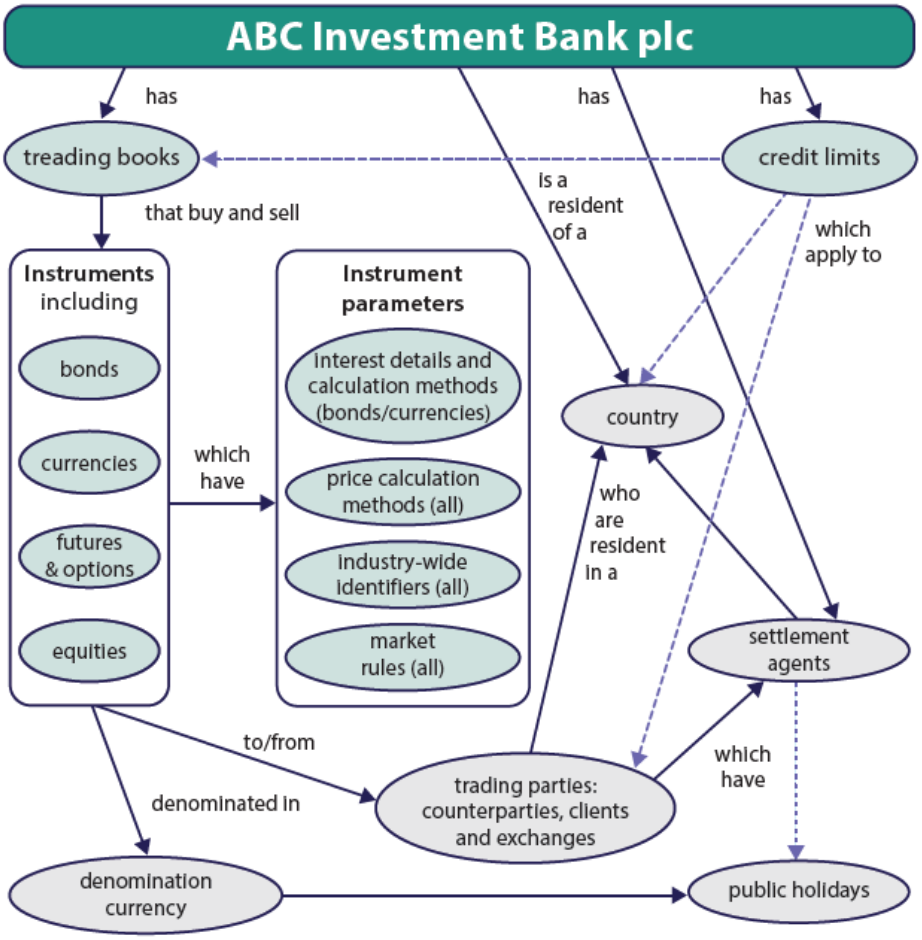
The description below refers to the diagram that follows (overleaf). ABC Investment Bank plc has a number of dealing teams or 'trading books'. The trading books buy and sell financial 'instruments' that include bonds, currencies, futures and options, and equities. The instruments in turn have parameters, including 'price calculation methods' – for all instruments – and 'interest rates' and 'interest calculation methods' – for bonds and currencies. There are also standard identifiers used throughout the industry to uniquely identify instruments, as well as rules that apply to the markets in which the instruments are traded.

In turn, all instruments are denominated in a currency; that is to say that bonds, equities, futures and options are normally traded and settled in a particular currency. There is a public holiday calendar associated with each currency, and on the public holidays for that currency no trades can settle, and investment exchanges are usually closed.

The instruments are bought from or sold to 'trading parties'. This term includes exchanges, counterparties and clients. Every one of these is resident in a particular country, as is ABC Investment Bank plc itself. All the trading parties, as well as ABC Investment Bank plc, have appointed settlement agents (this term includes central counterparties (CCPs), central securities depositories (CSDs) and custodians) to settle

trades in particular markets within a country. Settlement agents are unable to settle trades on a day which is a public holiday for the currency of the trade concerned.

ABC Investment Bank also has credit policies and credit limits that restrict the total amount of exposure that the firm is prepared to tolerate for particular trading books, trading parties, clients and countries.



The following reference data elements also need to be maintained and are not shown on the diagram for the sake of simplicity:

1. Standing settlement instructions (SSIs) – both ABC Investment Bank and its trading parties have standing settlement instructions. SSIs could be different for each of ABC's customers. These control the selection of which settlement agent settles trades in particular instruments for the two parties concerned. SSIs are examined in section 1.6.
2. Commission rates – when ABC is acting as agent, it will charge customers commission. Commission rates will vary according to client and instrument class. Commission structures were examined in chapter 4.

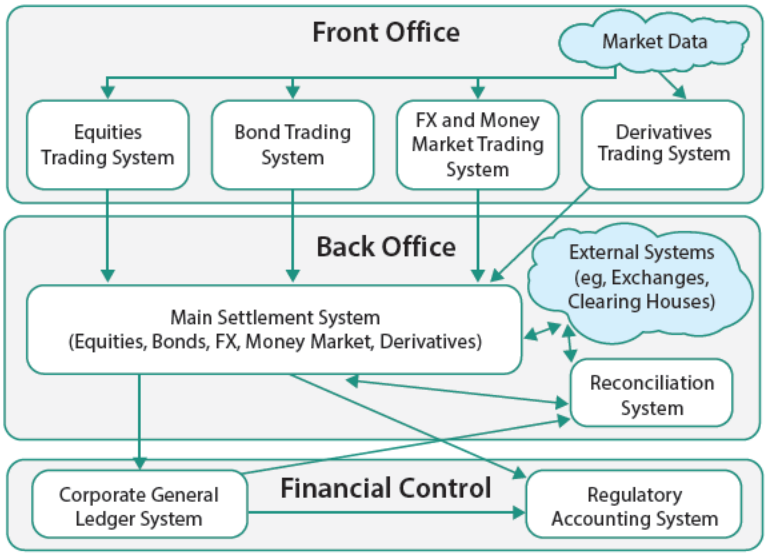
1.2 Reference Data and Automation

Automation is the ultimate aim of most securities firms. Accurate reference data is essential for automation to ensure everything flows smoothly. Accurate reference data is needed, in particular to:

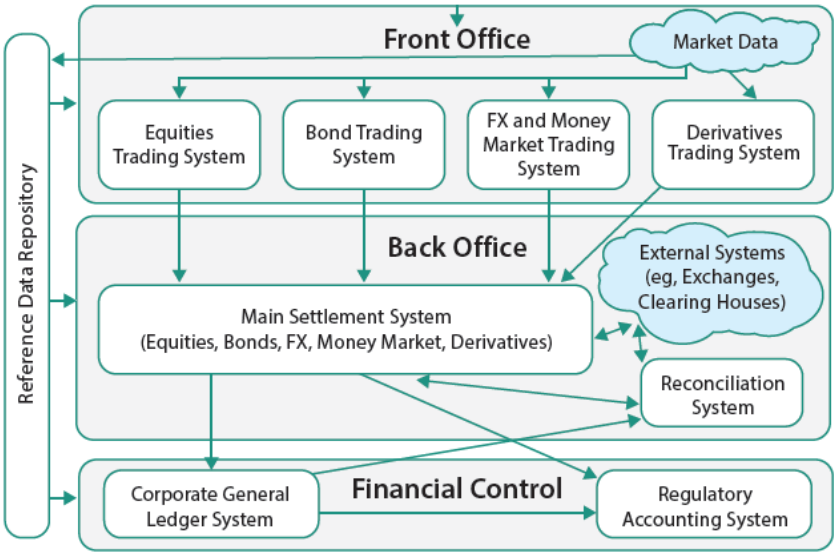
- **calculate trade amounts, including principal amounts, interest, commissions, fees and taxes accurately, and**
- **enrich trades with accurate information about intended value dates, settlement agents and account codes at the settlement agents.**

1.3 Duplication of Reference Data across Systems

One of the problems involved in managing the technology infrastructure of a large institution is that there may be a great number of individual business applications in the configuration, all of which hold some of this bulky amount of reference data, and some of the information may be duplicated across the different systems. Where there is duplication of reference data, there is a danger that errors or inconsistencies may arise – for example, the data about a particular instrument in one system might be different from that in another system. The following diagram – which is explored more thoroughly in chapter 7 – illustrates the problem. It is clear that, for example, every one of the systems in this configuration would need to hold details about all the currencies that the firm trades, so there is a danger that such data may become inconsistent between the systems.



To overcome these issues, some firms have built separate reference data repositories (RDRs) that take in data from reliable external sources (such as Bloomberg or Refinitiv), as well as data that has been updated manually internally, and then feed this to all the other systems in the configuration; so the diagram now looks like this.



The advantages and disadvantages of using a reference data repository (RDR) may be summarised as follows:

Reference Data Repositories	
Advantages	**Disadvantages**
Ensures consistency of reference data across all business applications.	**May be costly to build or buy the system. Furthermore, once the system is in place then it could be complex and costly to maintain on an ongoing basis.**
Some reference data elements may be fed from consistent and reliable external sources, eg, Bloomberg, Refinitiv, exchanges and clearing houses.	**All other systems in the configuration will also need to be enhanced to integrate with the RDR. This may be costly and complex, and in some cases may be impractical; usually, this is because the firm does not have the ability to amend the source code of a packaged application, which means these systems will need to be manually updated.**

Data is maintained by a dedicated data management team that has expertise in this area. Another advantage for larger firms is that they take in multiple market data feeds and use tech to compare prices in order to determine the 'best' price for an asset. This also helps them to identify errors in the data feed – if they rely on just one feed and there is a mistake in the pricing, this can cause major problems – valuation errors.	This team may be costly to recruit and maintain on an ongoing basis. It may also be hard to justify the cost of this team to senior management.

We shall now examine the most significant items of reference information that are held for each type of object in the diagram.

1.4 Instrument Reference Information

Reference data about financial instruments is publicly available and can be purchased from many sources. The data that needs to be maintained includes the items discussed in section 1.4.1 to section 1.4.5 inclusive.

1.4.1 Trading Markets and Market Rules

All instruments can be said to be traded on the market. This may be a formal market, such as the London Stock Exchange (LSE), or an over-the-counter market, such as 'the spot FX market' or 'the eurobond market'.

Market rules are used to determine, inter alia:

1. the default settlement date – for most securities markets, this is 'T+2', meaning that value date will be two working days after trade date, unless the trade parties agree otherwise, and
2. what fees and charges apply – for example, UK stamp duty and Panel of Takeovers and Mergers (PTM) levy both apply to qualifying trades executed on the LSE even though the charges are not levied by the LSE itself.

Some instruments are only traded on one market; others, like the Sony shares that were examined in chapter 4, are traded in many markets. Therefore, we also need to store:

3. the normal trade currency when this instrument is traded in this market, and
4. the normal settlement currency when this instrument is traded in this market.

Each instrument that is added to the instrument master file needs to have a 'market code'.

A 'markets table' needs to be set up to provide information about the default settlement period, the usual settlement currency and the fees and charges that apply.

1.4.2 Unique Instrument Identifiers

For currencies, the unique instrument identifier is the three-alphabetic-character 'ISO currency code', eg, USD, GBP and EUR.

For securities and listed derivatives, there are a number of coding schemes that attempt to identify instrument uniquely. These coding schemes will identify instruments in messages transmitted to counterparties, clients, exchanges and settlement agents.

These schemes include the following:

Name	Example	Description	Applies to Listed Futures and Options?
ISIN code	GB 1234567890	A code that represents, for example, Sony Corporation ordinary shares. If the security is listed on more than one exchange, there is only one International Securities Identification Number (ISIN) code. Most custodians and clearing houses identify securities by the ISIN code on messages.	Some coverage – not all the world's derivatives exchanges issue ISIN codes to the contracts that they list.
SEDOL code	12345F67	The coding system used by the LSE. However, Stock Exchange Daily Official List (SEDOL) codes are allocated for all commonly traded securities, whether listed on the LSE or not. If a security is traded on exchanges in four countries, the security would have four SEDOL codes.	Some coverage.

CUSIP code	A1234R56	Committee on Uniform Security Identification Procedures (CUSIP) is the coding system used by exchanges and clearing houses in the US and Canada.	North American markets only.
Ticker	IBM	A short security description used by stock exchange trading systems in the US and Canada. The UK equivalent is the EPIC code. Also used within the Bloomberg system.	Yes – Bloomberg allocates tickers to futures and options.
RIC code	IBM.N	The coding system used by Refinitiv. Refinitiv Instrument Code (RIC).	Yes – Refinitiv allocates RIC codes to listed futures and options.

Note that the table above is not a complete list of all the possible coding schemes that can apply to securities and derivatives. There are a number of other schemes used by individual countries and exchanges.

In addition, the firm itself has to choose a unique identifier across its own systems. If a firm trades the same instrument across many markets, then an ISIN number may not be the most appropriate code to use as a unique identifier.

As an individual instrument may have several codes, flexible facilities need to exist to support this one (instrument) to many (codes) relationship.

1.4.3 Price Calculation Methods

Normally, we think of multiplying the quantity of an instrument by its price to derive the trade's principal value. It is, however, a little more complex than that.

Some shares are traded in whole currency units, but some are traded in penny units. Hence, 'buy 100 @ 98' may mean either 98.00 or 0.98 per share.

A bond price is a percentage of face value, hence 'buy 1,000 @ 98' means buy 1,000 @ 98% of 1,000.

Futures and options prices are more complex still: the price may refer to some element of the underlying instrument. For example, US Treasury bill futures are based on an underlying amount of $1,000,000 of a US government Treasury bill, which is a 90-day (one quarter of a year) instrument. As a result, 'buy 100 @ 98' means: buy 100 lots of futures x

98 (the price) x 1,000,000 (face value) / 4 (periods in the year) / 100 (percentage price) = $24,500,000 (market exposure).

The following generic formula may be used in all of the above cases:

Principal amount = quantity traded x price x price multiplier/price divisor

Example

Instrument	Quantity	Price	Price Multiplier	Price Divisor	Principal Amount
Pound share	1,000	98	1	1	98,000
Bond	1,000,000	98	1	100	980,000
T-bond future	10	98	1,000,000	400	2,450,000

Therefore, the firm needs to store the necessary information to employ this formula, or an alternative formula that provides the same result, to extract the principal amount from a given quantity and price.

1.4.4 Interest Details and Accrued Interest Calculation Methods

See also chapter 6, section 4.1.1. In order to trade bonds, the firm needs to calculate interest. It, therefore, needs to store the following information:

1. The date from which interest becomes payable.
2. The date that the borrower will make the next interest payment. From 1 and 2, we can derive the number of days in the current interest period.
3. The date when interest ceases to become payable and the capital returned – usually this is the maturity date of the bond.
4. The rate of interest that will be paid.
5. The interest calculation method. There are a number of commonly used methods, include the following:• 30/360 – there are deemed to be 360 days in a year, and all months are deemed to be 30 days long.• Actual/360 – there are deemed to be 360 days in a year, and we follow the conventional calendar for determining the days in a month.• Actual/365 – we follow the actual calendar. Although this rule is usually expressed as 'over 365'; if there are 366 days in a year then 366 is used as the divisor.• Actual/Actual – the conventional calendar is used for all calculations.

Most bonds (other than US Treasury bonds) that were issued before the advent of the euro on 1 January 1999 used 30/360 or actual/360. Virtually all bonds that were issued since EMU use actual/actual. The formula for calculating interest using actual/actual is:

$$\text{Accrued interest} = t/s \times c/n$$

Where:

t = the actual number of calendar days from, and including, the last interest payment date to, and including, the value date.
s = the actual number of calendar days in the current interest period. c = the annual rate of interest.
n = the number of interest payments pa.

On the next coupon date, the buyer of a bond will receive the interest payment (also known as 'coupon payment') for the whole of the interest period that ends at the next interest payment (coupon payment) date. However, since the buyer has not owned the bonds for the entire period, it has to pay the accrued interest for the period to the seller, for which it did not own the bonds. Systems, therefore, need to use the appropriate formula to calculate the interest payable from the last coupon date to the intended value date of the trade – this is the amount of accrued interest that the buyer must pay the seller when the trade settles.

Example

The table below shows the calculations of accrued interest on a bond transaction for $1,000,000 face value of a bond paying a 5% coupon on 1 January and 1 July each year. The value date of the trade is 15 February. For the four different interest calculation methods, the results of the accrued interest calculation will be:

Calculation Method	No. of days from the last coupon (1 Jan) to value date (15 Feb)	No. of days in period (1 Jan to 30 June)	No. of interest payments per year	Accrued interest in USD (for period 1 Jan to 15 Feb)
30/360	44	360	Not used	6,111.11
Actual/360	45	360	Not used	6,250.00
Actual/365	45	365	Not used	6,164.38
Actual/ Actual	45	181	2	6,215.47

Note that currencies, as well as bonds, require accrued interest calculation methods so that interest may be calculated on money market loans and deposits, stock loans and repos.

The most common method of calculating interest on currencies in the wholesale markets is Actual/360. Nearly all currencies use this method; the exceptions are GBP and JPY which use Actual/365.

1.4.5 Other Information

Other information that needs to be stored for financial instruments includes:

- **name of the security**
- **date that it was issued**
- **date that it matures or expires (if any)**
- **default trading book**
- **minimum size of a trade**
- **number of shares/units in issue, and**
- **security issuer – as some issuers issue many securities, the firm may wish to apply a credit limit to the issuer as a whole.**

1.5 Client/Counterparty Reference Information

1.5.1 Unique Identifiers for Trading Parties

The firm has to choose a unique identifier for use in its own systems. Which identifier it uses will vary according to its own individual needs. There are now three – but soon to be four – external identifiers that it needs to hold, one of which – the BIC code – is used for professional trade parties. Another – the UK National Insurance Number – is necessary if the firm offers tax-sheltered investments, such as pensions and Individual Savings Accounts (ISAs), to UK private investors. The third is the International Bank Account Number (IBAN) code, which is increasingly being used to identify counterparties' bank and depot accounts in Europe. The fourth, and newest, trading party code is the Legal Entity Identifier (LEI) which only applies to non-natural persons.

BIC Codes
The BIC code is used on messages between trading parties, exchanges and settlement agents. The BIC code is a standard format of Bank Identifier Codes approved by the International Organization for Standardization (ISO). It is the unique identification code of a particular bank. The Society for Worldwide Interbank Financial Telecommunications (SWIFT) handles the registration of these codes. For this reason, BIC codes are often called

SWIFT addresses or codes. There are over 7,500 'live' codes (for partners actively connected to the SWIFT network) and an estimated 10,000 additional BIC codes which can be used for manual transactions.

The code is eight or eleven characters long, made up of:

- **four characters – bank code**
- **two characters – ISO 3166-1 alpha-2 country code**
- **two characters – location code, and**
- **three characters – branch code, optional ('XXX' for primary office).**

Where an eight-digit code is given, you may assume that it refers to the primary office. For example, Deutsche Bank is an international bank; its head office is based in Frankfurt, Germany. Its BIC code for its head office is DEUTDEFF:

- **DEUT identifies Deutsche Bank.**
- **DE is the country code for Germany.**
- **FF is the code for Frankfurt.**

Using an extended code of 11 digits (if the receiving bank has assigned branches or processing areas individual extended codes) allows the payment to be directed to a specific office. For example, DEUTDEFF500 would direct the payment to an office of Deutsche Bank in Bad Homburg.

IBAN Codes
Bank account numbers have traditionally been expressed in different forms in different countries, which has made the storage of depot and nostro account numbers in applications somewhat imprecise and complex.

As a result, in 2003 the European Union decided to adopt the IBAN code to overcome this problem. The IBAN was developed to facilitate payments within the European Union. The IBAN is not yet used as a standard in messaging, because the IBAN has not yet been widely adopted outside Europe. Adoption may take time, so it remains necessary to use the current ISO 9362 Bank Identifier Code system (BIC code) in conjunction with the Basic Bank Account Number (BBAN) or IBAN.

Currently, all European non-CIS countries, as well as some African, Caribbean and Middle Eastern countries and Turkey participate in the IBAN system, while, broadly speaking, the rest of the world (including the US) remains outside of it.

The IBAN consists of an ISO 3166-1 alpha-2 country code, followed by two check digits (represented by kk in the examples below), and up to thirty alphanumeric characters for the domestic bank account number, called the BBAN (Basic Bank Account Number). It is up

to each country's national banking community to decide on the length of the BBAN for accounts in that country, but its length must be fixed for any given country.

Example

Format: GBkk BBBB SSSS SSCC CCCC CC

Example GB65 LOYD 3000 0000 1195 87

Where:

GB is the country code for the UK

65 is a check digit

LOYD is the abbreviation for Lloyds TSB Bank

3000 00 is the branch at Lloyds TSB where the account is held

00 1195 87 is the account number concerned at that branch

The IBAN must not contain spaces when stored electronically. When printed on paper, however, the norm is to express it in groups of four characters, the last group being of variable length.

The Legal Entity Identifier (LEI)

The LEI for financial contracts is a universal standard for identifying parties to financial contracts. It is a new standard, which was created by G20 following the economic crisis (at a similar time to Dodd-Frank), and the standard is also backed by the European Securities and Markets Authority (ESMA) in Europe. The LEI initiative is designed to create a global reference data system that uniquely identifies every legal entity or structure, in any jurisdiction, that is party to a financial transaction. It is a key element in the broader effort to understand and monitor systemic risk across banks and capital markets.

The Legal Entity Identifier Regulatory Oversight Committee (LEI ROC), a coalition of financial regulators and central banks across the globe, is encouraging the expansion of the use of the LEI. There are a number of LEI issuers around the world that issue and maintain the identifiers and act as primary interfaces to the global directory, these are typically financial exchanges or financial data vendors. These are accredited by the Global Legal Entity Identifier Foundation (GLEIF) to issue LEIs. GLEIF maintains a comprehensive database of all issued LEI codes.

Its creation has had an impact throughout the financial markets at a fundamental level:

- **All firms need to obtain a LEI for each own legal entity as well as for all their subsidiaries.**
- **Application systems need to be enhanced to allow LEIs to be recorded for both the firm and all eligible counterparties that they interact with, which includes their clients.**
- **Messaging and reporting software need to be enhanced to include LEIs in their content.**

As a result of MiFID II, all firms subject to MiFID II transaction reporting obligations will have to report a client's LEI, if they are eligible to have one, or they will not be able to execute transactions on their behalf. Therefore, all legal entities or structures including companies, charities and trusts will be required to apply for an LEI. This brings transaction reporting in line with EMIR reporting, and will become the standard for all regulatory reporting; for example, one of the US regulators, the CFTC, is already demanding their use in regulatory trade reports.

To aid global allocation of LEIs, Local Operating Units (LOUs) have been formed and must be sponsored by local regulators to assign and maintain LEIs to firms on a cost-recovery basis. The LSE and the Depository Trust & Clearing Corporation (DTCC) are examples of authorised LOUs operating within the UK that can issue and administer an LEI.

The LEI is a unique 20-digit, alpha-numeric code based on the ISO 17442 standard developed by the ISO. The LEI is compiled as follows:

- **Characters 1 to 4 identify the LOU that issued the LEI.**
- **Characters 5 and 6 are reserved.**
- **Characters 7 to 18 are the unique alphanumeric string assigned to the organisation by the LOU.**
- **The final two characters are checksum digits.**

An LEI registrar will also record the following information:

- **legal entity identifier**
- **legal name**
- **legal address**
- **legal country/region**
- **business registry code**
- **registry's identifier**
- **jurisdiction country/region**
- **legal form**
- **entity status**
- **registration status, and**
- **last updated successor entity.**

Any trade could involve several LEIs, which will be encoded into the detailed transaction, such as: buyer, buyer's broker, seller, seller's broker, exchange where traded, clearing facility, and company that issued the security being traded. In addition, it is likely that any related 'infrastructure' firm involved in supporting that trade (deemed to be potentially systemically important) will also have its LEI encoded. The client may also be identified by an LEI. The concept is to pin down legal entities for every transaction, and for every securities position.

Keeping track of relationships linked through LEIs can be exceptionally challenging, raising issues and questions such as:

- each LEI itself needs to be kept absolutely up to date; this alone is a daunting task
- additional data will also be added to the register to link each LEI to its parent, subsidiaries and affiliate relationships, and
- it is the responsibility of each regulated firm to obtain LEIs for its unregulated clients as and when each regulator mandates the use of LEIs. This can be a formidable implementation task requiring extensive support from technology departments and change managers.

Note that the investment firm is responsible for ensuring that its own LEI(s) are up to date. They are not responsible for maintaining the clients' LEIs (some have offered to do so as part of their services to clients, but there is no legal obligation).

Example

Apple (UK) Limited – 549300QKDHYRRQH2MB86
Where:
- **the Local Operating Unit (LOU) is '5493'**
- **characters 5 and 6 are reserved as '00'**
- **the unique alphanumeric string assigned to the organisation by the LOU is 'QKDHYRRQH2MB', and**
- **the checksum digits are '86'.**

1.5.2 Other Party Information

For each trading party, the firm needs to keep a record of its Standing Settlement Instructions (SSIs) – these are examined in detail in section 1.6.

Apart from SSI information, the firm needs to record at least the following about each counterparty and client:

- full name and address
- any additional names and addresses to which trade confirmations should be sent
- country of incorporation or residence

- any credit limit granted to this party
- the commission scale that applies to this party
- type of party, eg, exchange, counterparty, professional investor, private investor, and
- contact details, such as names, telephone numbers and email addresses.

Depending on which party type it is, the firm will need to hold additional information for regulatory purposes. Such additional information will include the following:

- For professional investors:
- the date that they commenced dealing with this firm
- the date that a client agreement was sent to them
- the date that they signed and returned it, and
- which fund manager or financial adviser acts for them.
- For private investors, as for professional investors, plus in addition:
- the relationship held with them, eg, execution-only broker, advisory broker, discretionary broker
- their appetite for risk, and how it was assessed, and
- connected account details, eg, there is an account for Mr. John Smith and Mrs. Jane Smith, as well as a joint account for Mr. and Mrs. John Smith – they are connected because they are husband and wife; they have a number of different accounts with the firm because they want to take advantage of tax shelters such as ISAs and pensions that apply to individuals – but the firm manages the money of the family as a whole.

This type of data is of course 'Know Your Customer' data that was examined in chapter 2.

1.6 Standing Settlement Instructions (SSIs)

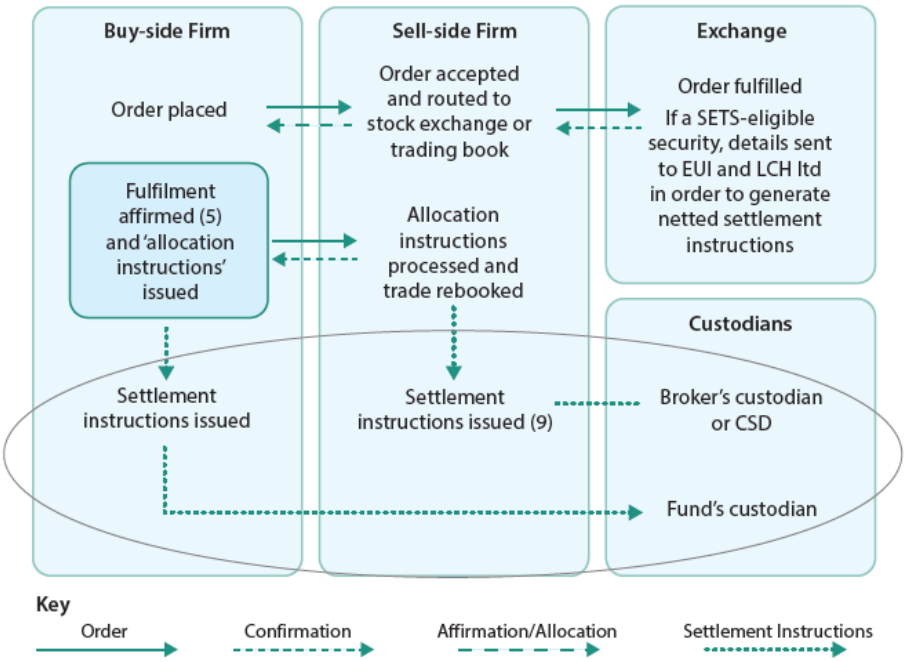
1.6.1 Overview

Standing settlement instructions (SSIs) are the main driver of the automation process from the point of trade agreement to the final settlement. SSIs provide details of which 'settlement agents' are going to be used to settle the trade by both the sell-side firm and the investors who use its services. SSIs are used by institutional clients only.

Both the cash side and the stock side of a securities trade will be settled – normally on a DvP basis – by the settlement agents chosen by the sell-side firm and the investor. Note that, where a fund manager is acting for a number of investors, it is the investors – not the fund manager – that choose their settlement agent. Settlement agents may be central

securities depositories (CSDs) such as Euroclear UK & Ireland (EUI), international central securities depositories (ICSDs) such as Euroclear Bank in Belgium, or custodian banks.

In chapter 4, we looked at the processes of confirmation, affirmation and allocation between sell-side and buy-side firms. Once these processes have been completed successfully, the next step is to send settlement instructions to the settlement agents, illustrated by the following diagram:



In order to generate instructions, both parties need to know who to send them to ('our' settlement agent) as well as details of the other party's ('their' settlement agent), and a firm needs to advise its agent of this information so that it can settle the trade. For this reason, the sell-side firm holds details of the SSIs of those investors with whom it deals regularly as reference data objects. SSIs are not usually added to or changed as a result of the confirmation/affirmation/allocation processes described in chapter 4. Conversely, the fund manager (acting on behalf of the investor) holds the SSIs of those brokers it trades with regularly as part of its reference data.

1.6.2 Examples of SSI Data

The table overleaf shows the SSI-related data held by ABC Investment Bank for itself, and also by two of its investor clients for three major asset classes:

- **UK-listed equities settled in GBP.**
- **Corporate bonds traded in London and settled in EUR, and**
- **Corporate bonds traded in London and settled in USD.**

Trading Party	Asset Class	Settlement Currency	Stock Depot	Depot Account Code	Cash Nostro	Nostro Account Code	Instruction Method
Ourselves	LSE listed equities	GBP	EUI	123456	EUI	654321	EUI
Ourselves	OTC Bonds London Desk	EUR	Euroclear	911222	Euroclear	466-911222-EUR	Euclid
Ourselves	OTC Bonds London Desk	USD	Euroclear	911222	Euroclear	457-911222-GBP	Euclid
Megacorp Pension Fund	LSE listed equities	GBP	State Street London	256879	State Street London	108-256879-GBP	SWIFT
Megacorp Pension Fund	OTC Bonds London Desk	EUR	State Street London	256879	State Street London	107-256879-EUR	SWIFT
Megacorp Pension Fund	OTC Bonds London Desk	USD	State Street London	256879	State Street New York	168-256789-USD	SWIFT
Minicorp Pension Fund	LSE listed equities	GBP	Société Générale Paris	104867	Société Générale London	0-0876554332	SWIFT
Minicorp Pension Fund	OTC Bonds London Desk	EUR	Société Générale Paris	104867	Société Générale Paris	0-0876554332	SWIFT
Minicorp Pension Fund	OTC Bonds London Desk	USD	Société Générale Paris	104867	Société Générale New York	0-0876554332	SWIFT

Here is a key to the columns in the table:

- **Trading party – identity of the party with which the firm is trading. The firm itself is also a trading party in this context.**
- **Asset class – identifies the type of asset concerned.**
- **Settlement currency – identifies the currency of settlement.**
- **Stock depot – identifies the settlement agent that will accept or make delivery of this type of asset on behalf of the trading party.**
- **Depot account code – identifies the relevant account number at the stock depot.**
- **Cash nostro – identifies the settlement agent that will accept or make payments for this type of asset on behalf of the trading party.**
- **Nostro account code – identifies the relevant account number of the cash nostro.**
- **Instruction method – the method that the trading party will use to send instructions to the settlement agent.**

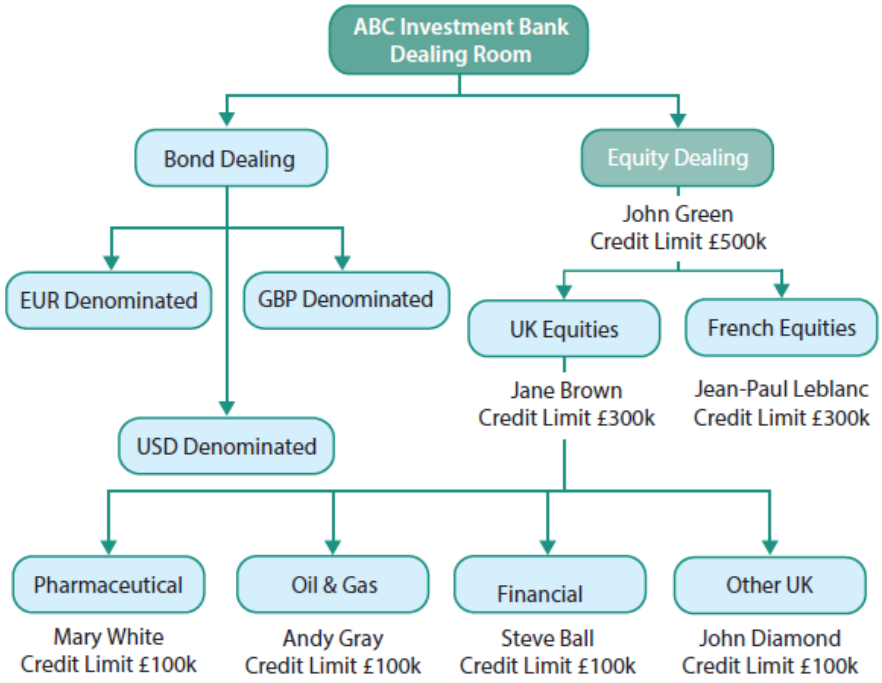
1.7 Other 'Internal' Reference Information

The firm also needs to set up a number of reference data elements that supply its business applications with information about the firm itself. These 'internal' data objects will include, but are not limited to the following:

- **Base currency – a firm that invests in securities denominated in many currencies will wish to value them in the currency in which it produces its profit & loss (P&L) account. Usually, but not exclusively, this means that a firm that is incorporated in the UK will have a base currency of GBP, whereas a firm incorporated in the US will choose USD.**
- **Commission rates and calculation methods – these were covered in chapter 4, section 3.5.**
- **Credit limits – any credit limits the firm wishes to apply to its trading parties or individual trades, trading books and countries in which trading parties are incorporated or resident need to be set up as reference data objects. Some firms also set up limits that apply to individual issuers of securities, and stock market sectors, eg, pharmaceuticals.**

Trading Book/Dealing Desk Structure
Sell-side firms usually organise their dealing teams and trading books into a hierarchical 'book structure' that corresponds to profit and loss attribution by business area.

A sample hierarchy might be:



For each 'node' in the hierarchy, the reference data that is held needs to include:

- **the identities of the manager of each team, and the authorised dealers in each team, and**
- **any credit limits that apply to the node concerned.**

1.8 Other 'External' Reference Information

This is reference data that relates to entities that are not part of the firm and are not themselves trading parties. It will include:

Country Information
The country in which the firm is incorporated, as well as those countries where the other parties involved in the trade life-cycle are incorporated. This needs to be set up in a table so that:

a. **the firm is able to calculate its total risk exposure to any one country**
b. **the firm may apply limits by country, and**
c. **the firm may comply with any rules and regulations that, for example, prevent it from offering certain kinds of investments to residents of a particular country.**

Countries are normally identified by a two-character ISO country code. For example, the code for the UK is GB and for France it is FR.

Bank Holidays and Working Days
A public holiday table needs to be set up so that dealing applications are able to validate and default value dates correctly. Trades cannot settle on a public holiday that applies to the countries concerned. Some countries – mainly in the Middle East – work on Saturdays or Sundays but not on Fridays. Firms that trade in such markets may need a 'working days' table in addition to a bank holidays table.

Other Parties Involved in the Trade Cycle
As well as setting up records for each of the firm's trading parties, it will need to set up records for settlement agents, so that SSIs can refer to them, and possibly securities issuers so that credit limits may be applied to them.

1.9 Summary of Key Risk Indicators

Clearly, accurate and consistent reference data is essential to the settlement, accounting and risk management processes. The following types of problems may indicate that there are problems in maintaining and using reference data correctly:

1. A high level of failed trades and unmatched instructions. Settlement instructions and failed trades are dealt with in detail in section 2 of chapter 6, but if a firm has an unusually high level of fails and unmatched, then this could be because the reference data used to calculate trade proceeds and/or determine the correct settlement agents is not accurate.
2. A high number of queries about realised and unrealised profits, and interest income. If reported trading P&L amounts (section 5.2 of chapter 4) and/or interest earnings (section 4.1.1 of chapter 6) are frequently queried or found to be erroneous, then this could be because the reference data used in trade calculations is inaccurate.

1.10 Client and Counterparty Agreements

1.10.1 Definitions

'Clients' are the customers of the sell-side firm. 'Counterparties' (sometimes known as 'market counterparties') are, broadly speaking, other sell-side firms with whom the firm does business, as well as (in the bond markets) central banks and governments. Financial

regulation is designed to give clients a higher level of protection than counterparties, as counterparties are treated as fellow professionals.

'Client agreements' are, therefore, agreements between a firm and its clients. 'Counterparty agreements' are agreements between fellow professionals.

1.10.2 Counterparty Agreements

Firm A may sign several counterparty agreements with Firm B, each one covering different business activities or asset classes. In the interests of simplicity and standardisation, individual agreements usually make reference to some industry-wide standards and protocols.

Here is an example:

- **If Firms A and B wish to trade swaps, or other OTC derivatives, with each other then their counterparty agreement will be based on the International Swaps and Derivatives Association (ISDA) Master Agreement. This is a standardised counterparty agreement for the OTC derivatives industry that is sponsored by ISDA. This means it contains general terms and conditions, but does not, by itself, include details of any specific derivatives transactions the parties may enter into. The ISDA Master Agreement is a pre-printed form which will not itself be amended (save for writing in the names of the parties on the front and signature pages). However, it also has a manually produced schedule in which the parties are required to select certain options; the parties may modify sections of the Master Agreement if desired.**
- **If Firms A and B wish to trade bonds with each other, then their counterparty agreement can refer to International Capital Market Association (ICMA)'s GMRA 2011 template. (Under English law, the GMRA 2011 can be used.)**

1.10.3 Client Agreements

The UK regulator defines client agreements as:

'terms of business which have been signed by the client or to which the client has consented in writing'. It then further defines 'terms of business' as 'a statement in a durable medium of the terms and conditions on which a firm will carry on a regulated activity with or for a client or retail customer'.

The essence of client agreements is, therefore, that:

1. **they accurately describe what services a firm will supply to its clients**

2. **they accurately describe how the firm will be remunerated (eg, commissions paid by the client, commissions paid to it by others, such as annual fees and performance-related fees)**
3. **they accurately describe what information (contract notes, statements) the firm will supply to its clients as evidence that the services have been performed**
4. **the client must agree to the terms of the agreement by signing it or indicating their consent on some other document that refers to it, and**
5. **they accurately describe the investment objectives of the client (eg, generate cash for pension fund liabilities) and any investment constraints (such as do not invest in organisations related to tobacco).**

The agreement must exist on a 'durable medium'. The UK regulator defines the term durable medium as:

1. **paper, or**
2. **any instrument which enables the recipient to store information addressed personally to them in a way accessible for future reference for a period of time adequate for the purposes of the information and which allows the unchanged reproduction of the information stored; this includes, in particular, CD-ROMs, DVDs and the hard drive of the recipient's computer on which the electronic mail is stored, but not internet websites unless they fulfil the criteria in this definition.**

2.The Trade Agreement Process

5.2.1 Understand the technology implications of the trade agreement process

In chapter 4, we looked at the process of a sell-side firm and a buy-side firm going through three stages of trade agreement – confirmation, affirmation and allocation. This three-stage process is how sell-side firms communicate with their 'professional investors' (ie, institutional clients) when equities are traded.

However, not all deals involve professional investors or equities; the trade agreement process is different in such cases. In summary, when the sell-side firm is dealing with a:

- **buy-side firm, the processes are confirmation, affirmation and allocation**
- **retail investor, the normal process is for the sell-side firm to send the investor a trade confirmation, but the trade confirmation is not normally responded to by the retail client (unless there is a problem), and**

- **market counterparty, there are two possible practices: mutual exchange of confirmations; or the use of a matching engine. These will be examined below.**

It is also worth noting that, if a firm has executed an order on behalf of a client (other than for portfolio management), then the firm is obliged (under MiFID II Article 59) to provide the client with a confirmation of the order, on a durable medium, no later than the first business day following the order execution.

2.1Mutual Exchange of Confirmations

'Mutual exchange of confirmations' means simply that Firm A sends Firm B a confirmation note that begins to the effect: 'We confirm our purchase from you of…', while Firm B sends Firm A a confirmation note that begins to the effect: 'We confirm our sale to you of...'

It is up to both parties to read the confirmation from the other party and check that their trade details agree with its trade details. If they agree, there is no need for any further communication between the parties; if they do not agree, then one party takes the matter up with the other party.

This method of trade agreement is used extensively in matching confirmations for foreign exchange and money market trades, as well as trades in OTC derivatives, such as swaps.

Until the late 1980s, using this method of trade agreement usually meant sending the confirmation by post, telex or fax, and employing people at both firms to read the messages and manually check them. From about 1990 onwards, it became the practice to send these confirmations in the form of 'SWIFT messages', and to use software applications to compare the incoming and outgoing messages with each other. Using a dedicated matching application, confirmations that match are automatically flagged as such, while confirmations that are missing, apparently sent in error or disagree are forwarded to a queue of unmatched items to be dealt with as 'exceptions'.

2.2 Matching Engines

5.3.1 Understand the role of matching engines

2.2.1 The Traditional Role of Matching Engines

Matching engines provide a further level of automation of the trade agreement process. They have been provided by investment exchanges and clearing houses for many years to automate the process of confirmation matching between member firms.

The principles behind the traditional matching engines provided by exchanges and clearing houses are as follows:

- **Both parties input their trade details to the matching engine in real time, as soon as possible after the trade has been struck. This is usually achieved by building a real-time interface from the firm's relevant business application to the matching engine.**
- **The matching engine then compares the two trade reports, and provides them to both parties in real time.**

An example of such matching engines was a system called TRAX, marketed by Xtrakter ltd, a MarketAxess subsidiary. This is now offered as part of MarketAxess Post Trade Solutions. It applies to bonds and repo transactions. The system compares the settlement instructions supplied by each party to the trade as part of the settlement process. Such systems then advise their members of any trades that cannot be matched. Most matching engines also facilitate trade reporting to regulators.

2.2.2 Newer Developments in the Use of Matching Engines

Traditional matching engines did not connect exchange member firms with non-member firms, nor did they support the confirmation/affirmation/allocation model, or store SSIs.

In 2002, Omgeo LLC launched the 'Central Trade Manager™ ', a central matching engine that involves the buy-side community and also supports block trades and allocations. This enables fund managers, brokers/ dealers and custodian banks to share accurate SSIs automatically worldwide. The functions of CTM are shown in the following diagram, which is reproduced by permission of DTCC ITP LLC.



2.3 The Technology Implications of Trade Agreement – Summary of Technology Requirements

This is a summary of the information that has been provided in sections 2.1 and 2.2 of this chapter for each type of firm:

Sell-Side Firms

1. **Need the technology to send confirmations for all asset classes in which they trade.**
2. **If they are involved in institutional equity sales, they will need the technology to support the confirmation/affirmation/allocation process. Institutional customers may require that they provide the facilities to communicate with them via central matching engines such as Omgeo.**
3. **If they are members of an investment exchange, they will need the technology to communicate with whatever matching engine is provided by those exchanges.**

4. **If they are active in the foreign exchange and money markets, they will need the technology automatically to match confirmations that are received via the 'mutual exchange' model of trade agreement.**
5. **The technology should be able to track the matching of confirmations and raise any errors as exceptions.**

Buy-Side Firms

1. **Need the technology to match confirmations for all asset classes in which they trade.**
2. **Need the technology to send affirmations and allocations to the sell-side.**
3. **The technology should be able to track the state of play of confirmations and trap any errors.**

3. Reporting to Regulators

5.4.1 Understand the technology requirements for reporting to regulators: wholesale vs. retail

3.1 Post-Trade Transparency

MiFIR Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments came into force on 3 January 2018.

Under Regulatory Technical Standards (RTS) 1 and RTS 2 of MiFIR, investment firms are obligated to report all price-forming off-exchange executions by eligible MiFID investment firms in MiFID-eligible instruments. Trade reports are near real-time broadcasts of trade data primarily aimed at providing market price transparency.

All on-exchange transactions are made public by the trading venues themselves and off-exchange transactions are reported to an APA (Approved Publication Arrangement). The reports are single sided, ie, only one counterparty makes a report and reporting responsibility is determined by a hierarchy of each side's role in the market for the traded instrument. The reporting timescale reflects the purpose of the report and varies by asset class.

- **RTS 1, Equity and Equity-like – as near to real time as possible, but within one minute of execution**

- **RTS2, Non-Equity – as near to real time as possible, but within 5 minutes of execution.**

The list of FCA-approved APAs from the FCA website is as follows:

- **Bloomberg Data Reporting Services ltd.**
- **Cboe Europe ltd.**
- **London Stock Exchange plc.**
- **Tradeweb Europe ltd.**
- **MarketAxess Post-Trade ltd.**

3.2 MiFIR Post-Trade Transaction Reporting

Transaction reports are significantly different from trade reports. Trade reports are for public dissemination, whereas transaction reports are for the private dissemination of data to the Regulator and their use is entirely different:

- **The collecting of transaction reports by the FCA is a fundamental part of achieving its goal to 'protect and enhance the integrity of the UK financial system' and it interrogates this data using sophisticated technology to identify incidents of market abuse.**

  'We use transaction reports primarily to identify potential market abuse and to undertake market surveillance. This helps us to achieve the FCA strategic objective to make investing in financial markets safe'.

Transaction reports are required under RTS 22 of MiFIR; investment firms which execute transactions in financial instruments shall report complete and accurate details of such transactions to the competent authority as quickly as possible, and no later than the close of the following working day. The obligation applies to transactions in financial instruments, irrespective of whether or not such transactions are carried out on the trading venue or whether the client is a retail or wregulholesale client.

The reports include details of: the names and numbers of the financial instruments bought or sold, the quantity, the dates and times of execution, the transaction prices, a designation to identify the client, a designation to identify the persons and the computer algorithms within the investment firm responsible for the investment decision and the execution of the transaction. Transaction reports may be made directly to the investments firm's national competent authority (NCA) or via an approved reporting mechanism (ARM).

The list of FCA-approved ARMs from the FCA website is as follows:

- **Bloomberg Data Reporting Services ltd.**
- **London Stock Exchange plc ('UnaVista').**
- **Xtrakter ltd.**

3.3 The Technology Implications of Regulatory Transaction Reporting

Firms need to build interfaces from their trade capture systems to the relevant APA and ARM systems to ensure that correct and accurate reporting is undertaken within the required timescales.

This covers four main areas:

- **Firstly, firms will need to ensure their trade capture systems record all the required data (such as trade details, decision-makers, traders and ISIN numbers).**
- **Secondly, systems will need to be enhanced to ensure that there are robust business rules in place to guarantee that the correct transactions are reported to the APA and ARM.**
- **Thirdly, technology integration is required between the firms and the APA/ARM to ensure that the required transaction reports can be sent automatically within the prescribed timelines.**
- **Finally, operational processes are required to ensure that all transactions are sent and received by the APA/ARM; and that any rejections or issues are trapped immediately and managed to closure.**

4. Reporting to Customers

5.5.1 Understand the technology requirements for reporting to customers: wholesale vs. retail

4.1 Legal and Regulatory Requirements

Precisely what information needs to be supplied to customers, at what frequency and by which media, will be governed by the client agreement or counterparty agreement (see section 1.10). These agreements will take into account the requirements of regulators and tax authorities.

Firms that serve the retail investor have more regulatory demands on them than firms that deal with wholesale or professional investors.

The relevant UK regulations are contained in Conduct of Business (COBS) Rules 16.3.1 through to 16.3.9, and the main provisions of these rules are as follows.

Rule 16.3.1 (together with COBS 16 Annex 2R) mandates the minimum contents of a periodic statement of account for a retail customer. These are as follows:

Periodic information (all cases):

1. **The name of the firm.**
2. **The name or other designation of the retail client's account.**
3. **A statement of the contents and the valuation of the portfolio, including details of:**
   a. **each designated investment held, its market value or fair value if the market value is unavailable**
   b. **the cash balance at the beginning and at the end of the reporting period, and**
   c. **the performance of the portfolio during the reporting period.**
4. **The total amount of fees and charges incurred during the reporting period, itemising at least total management fees and total costs associated with execution, and including, where relevant, a statement that a more detailed breakdown will be provided on request.**
5. **A comparison of performance during the period covered by the statement with the investment performance benchmark (if any) agreed between the firm and the client.**
6. **The total amount of dividends, interest and other payments received during the reporting period in relation to the client's portfolio.**
7. **Information about other corporate actions giving rights in relation to designated investments held in the portfolio.**

Rule 16.3.2 deals with the frequency of statements for retail customers. The rule mandates that:

- **statements must be sent to retail clients at least once every six months, but the client is entitled to insist on statements being sent every three months, and**
- **firms must inform retail clients that they have this right.**

It grants an exception when there are no transactions to report for the period – there is no need to send a six-monthly or three-monthly statement if this is the case, but the firm must still send an annual statement.

Rule 16.3.3 mandates the contents of a trade confirmation message to a retail client and where these are required, they must be issued by the close of the business day after the trade date. This can result in a daily requirement to pull data from systems and interface to a reporting solution either in real time or as a batch process with regulatory implications if it fails.

4.2 Commercial Requirements for Customer Reporting

While these rules mandate minimum standards, professional investors and high net worth individual customers will often demand certain reporting standards which the firm must adhere to in order to remain competitive.

Typically, these might include the following types of report:

- **List of and valuation of the holdings at the statement date – customers may demand that this report:**
- **Compares the performance of the fund to a 'benchmark'. For example, a fund that is entirely invested in UK equities might have its performance compared to the performance of the FTSE 100 index, while a fund that is wholly invested in German equities might have its performance compared to the performance of the DAX index. In the case of funds that are invested in many sectors, there will be the need to compare performance to many indices. This places an obligation on the technology department to provide both the interfaces required to source such information from the index providers, and the software that can make the comparisons.**
- **Makes an attempt at 'performance attribution' – performance attribution analysis attempts to explain why a portfolio had a certain return. It does so by breaking down the performance and attributing the results based on the decisions made by the fund manager on asset allocation, sector choice and security selection. There are a number of generally accepted mathematical formulae for this analysis and, if**

it is a requirement, then the technology department will need to provide software that can calculate these formulae.

- **Capital cash statement – showing the amount of cash in the customer's account at statement date, plus movements in and out.**
- **Income statement – showing all dividends, coupons, bank account interest and other income for the period covered by the statement.**
- **Corporate actions statements – showing the effect of any corporate actions on the portfolio during the period.**
- **Capital gains tax reports and tax vouchers (because these are private clients, tax becomes an issue in capturing transaction data in the right tax period).**

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **List the advantages and disadvantages of building and maintaining a reference data repository.**
   Answer Reference: Section 1.3

2. **What information about a security may be determined from the market in which it is traded?**
   Answer Reference: Section 1.4.1

3. **Which instrument coding system allocates a unique identifier to each combination of security and the country in which it is traded?**
   Answer Reference: Section 1.4.2

4. **List the reference data items that need to be held for a bond in order to calculate interest on bonds.**
   Answer Reference: Section 1.4.4

5. **What is the name of the unique identifier that is used by SWIFT to identify banks and other trading parties?**
   Answer Reference: Section 1.5.1

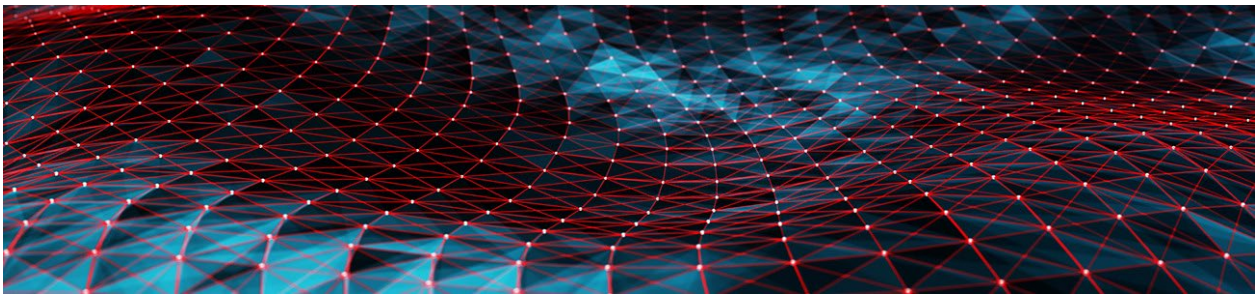
6. **What is the difference between a depot and a nostro account?**
   Answer Reference: Section 1.6.2

7. **What is the UK regulator's definition of a client agreement?**
   Answer Reference: Section 1.10.3

8. **For which asset classes can the trade agreement process be described as 'mutual exchange of confirmations'?**
   Answer Reference: Section 2.1

9. **List the technology requirements for the trade agreement process for a sell-side firm.**
   Answer Reference: Section 2.3

10. **Why does the UK regulator require firms to report trades in real time?**
    Answer Reference: Section 3.1



Chapter Six
The Role of Technology in the Settlement and Post-Settlement Phases

Section 1 The Technology Requirements of Transaction Instructions

Section 2 Stock Lending, Stock Borrowing and Repo Transactions

Section 3 Cash Funding

Section 4 The Function of Technology within the Settlement Process

Section 5 Messaging Standards

Section 6 Post-Settlement Reconciliation Procedures

Section 7 Post-Trade Compliance

This syllabus area will provide approximately 5 of the 50 examination questions

1. The Technology Requirements of Transaction Instructions

6.1.1 Understand the technology requirements for transaction settlement instructions

1.1Introduction

In chapter 5, we looked at the role of standing settlement instructions (SSIs). Once all the trade agreement processes are completed, the firm's settlement system needs to send settlement instruction messages to its settlement agents.

A settlement instruction is, as its name suggests, an instruction sent by a trading party to a settlement agent, instructing it to make or accept delivery of securities (usually) in exchange for receipt or payment of funds.

If the process of delivery of the securities is to be inextricably linked to the receipt of funds, it is said to be a delivery-versus-payment (DvP) instruction. If payment and delivery are not inextricably linked, then it is said to be a free of payment (FoP) instruction.

DvP is the norm in the securities markets, as sending FoP instructions creates credit risk (ie, one party may not receive their money or their securities). For this reason, most firms have very strict rules as to in what circumstances an FoP instruction may be issued.

This means that many application systems that automatically generate settlement instructions are usually designed to require a second level of authorisation before an FoP instruction can be sent out.

1.2 Contents of Settlement Instructions

Field Name	Explanation of Contents	Example Data
From	Identity of the firm sending the instruction (note 1).	ABC Investment Bank
To	Identity of the settlement agent receiving the instruction (note 1).	Euroclear Brussels
Value date	Earliest date on which the instruction should be carried out.	5 March 2020

Deliver/receive	**Whether securities are to be delivered or received.**	**Deliver**
Settlement basis	**Whether delivery-versus-payment or free of payment.**	**Versus payment**
Quantity of securities	**The number of shares (equity) or face value of bonds to be delivered.**	**1,000,000**
Security reference	**The ID of the security being delivered or received (note 2).**	**DEF plc 5% bond maturing 28 January 2022**
Settlement currency	**The currency of the cash to be paid or received.**	**EUR**
Net settlement value	**The amount of cash to be paid or received.**	**985,000.00**
Our depot account	**The firm's stock account number with the settlement agent.**	**123456789**
Our cash account	**The firm's cash account number with the settlement agent.**	**987654321**
Counterparty depot details	**Full details of the counterparty's stock settlement account, including account code (note 3).**	**Société Générale Paris, account no. 104867, in favour of Minicorp Pension Fund**
Counterparty nostro details	**Full details of the counterparty's cash settlement account, including account code (note 3).**	**Société Générale Paris, acct no. 0-0876554332, in favour of Minicorp Pension Fund**
Our reference	**Our reference for the instruction. We would expect the settlement agent to quote this on all subsequent communications with us about this instruction.**	**aa-111222333-1**
Transmission date time	**The date and time that the settlement instruction was sent.**	**03/03/2020 10:33:00**

Notes to Table

1. **The identity of the sender and receiver are usually represented by a BIC code – see chapter 5.**

2. **The identity of the security is usually represented by an ISIN code, SEDOL code, CUSIP code or some other standard identifier. The most widely used code in Europe is ISIN – see chapter 5.**
3. **The identity of both the other party and its settlement agent are usually represented either by BIC codes or central securities depository (CSD)/international central securities depository (ICSD) participant codes.**

1.3 Transmission of Settlement Instructions

Settlement instructions are usually transmitted in one of the following three ways:

- **In the form of SWIFT messages – refer to section 5 for more information about the SWIFT network and SWIFT standards.**
- **Using a proprietary standard message developed by the settlement agent, and transmitted using an interface or portal designed by that settlement agent. Most commercial custodians, as well as the CSDs and ICSDs, supply systems to their customers that provide for secure communication. Traditionally these were PC systems that required physical installation at the customer site but, increasingly now, these systems are web-based applications.**
- **By email, fax and telex – these traditional means of communication are being used less and less, as they do not lend themselves so readily to the automation concept as the other methods do. They have an operational risk associated with them which requires that cumbersome manual processes (like call-backs to confirm the faxes' details) need to be implemented.**

In a high-volume, automation-based environment, the firm's settlement system usually generates settlement instructions automatically, and communicates directly with the firm's chosen method of transmission.

1.4 Information Supplied by Settlement Agents between Receipt of Instruction and Actual Settlement Event

Between the time that the settlement agent receives the instruction and the date that the trade actually settles, settlement agents usually communicate the status of trades that are pending settlement to the firm. The format of such status messages will be similar to the following:

Field Name	Explanation of Contents	Example Data
From	Identity of the settlement agent sending the status message.	Euroclear Brussels
To	Identity of the firm receiving the status message.	ABC Investment Bank
Our trade reference	Euroclear's unique reference for the instruction.	Kkee4455tt
Your trade reference	The reference that ABC quoted on the original settlement instruction.	aa-111222333-1
Date and time of the message	The date and time that the message was sent.	03/03/2020 09:00:00
Brief details of the instruction	Action, security, security quantity, cash currency, cash amount.	DvP 1,000,000 DEF plc 5% bond maturing 28 January 2022 to Société Générale in favour of Minicorp for €985,000.00
Status code	A code to represent the status of the instruction.	See below

Status codes: Each settlement agent will issue its customers with a list of status codes and their meanings. The codes in the table below are purely illustrative.

Code	Meaning	Action to be taken by firm
UNM0	Unmatched – you have sent an instruction but your counterparty has not. Trade is not due to settle until T+1 or later.	Take up with trade party.
UNM1	Urgent unmatched – as above, but trade is due for settlement tomorrow or earlier.	Take up with trade party – as a matter of urgency.
CUNM	A trade party has alleged a trade against you; but you have not sent any instruction.	Investigate internally/take up with trade party.

USEC	Trade is matched, but you do not have any stock to deliver.	Ascertain why you have no stock. Try to borrow if necessary.
CSEC	Trade is matched, but the counterparty has no stock to deliver.	Take up with trade party.
COLL	Trade is matched, but you do not have sufficient credit in your account with the settlement agent to pay for the stock.	Investigate why. If the cash is held in a different bank account, transfer it, or else negotiate a line of credit.
OTH	Other reason why this instruction might not take effect – usually this means that the other party has insufficient cash or collateral in their account to pay for the stock.	Take up with trade party.
OK	The instruction is OK for future settlement.	No action is needed.

Most CSDs and ICSDs make this information available to participants in real time; it is up to business applications in the firm's configuration to access it. Some commercial custodians make it available in real time, but some send it in the form of a SWIFT message once each day, at the end of the day.

The status of a trade may change many times between the time that the instruction was received by the agent and the date and time that it actually settles. For example, the status history of this trade might be as follows:

Sequence	Date/time	Event	Status now
1	3 Mar 2022 10:33:00	ABC sends the instruction. XYZ has not yet sent its instruction.	UNM0
2	3 Mar 2022 12:14:00	XYZ sends its instruction, but ABC does not yet have the stock to deliver.	USEC
3	4 Mar 2022 07:00:00	As a result of the successful settlement of another instruction, ABC now has stock to deliver.	OK

4	4 Mar 2022 08:00:00	As a result of a processing error, ABC incorrectly cancels this instruction.	CUNM
5	4 Mar 2022 11:00:00	ABC corrects the error that resulted in (4).	OK

1.5 Information Supplied by Settlement Agents when the Trade Actually Settles

1.5.1 The Process of Settling the Trade – Settling within Tolerance

The settlement agent will settle the trade, provided that:

1. **the value date has been reached**
2. **the seller has the stock to deliver**
3. **the buyer has the cash or credit to pay for it, and**
4. **the seller's instructions match the buyer's instructions.**

In determining whether instructions match, the settlement agent usually has the ability to 'settle within tolerance'. That is to say that, if the instructions match in every respect apart from a minor difference in the cash consideration, then the agent will settle the trade using the cash figure supplied by the seller. What is considered to be a 'minor difference' varies from market to market; in the case of trades settling at Euroclear Bank, for example, the threshold is set at the equivalent of USD25.00.

1.5.2 Information Provided by the Agent when the Trade Settles

The settlement agent will provide the following information when the trade settles:

Field Name	Explanation of Contents	Example Data
From	Identity of the settlement agent sending the status message.	Euroclear Brussels
To	Identity of the firm receiving the status message.	ABC Investment Bank
Our trade reference	Euroclear's unique reference for the instruction.	Kkee4455tt

Your trade reference	**The reference that ABC quoted on the original settlement instruction.**	**aa-111222333-1**
Date and time of the message	**The date and time that the message was sent.**	**05/03/2020 09:00:00**
Deliver or receive	**Whether stock has been delivered or received.**	**Deliver**
Security reference	**The ID of the security being delivered or received.**	**ICI plc 5% bond maturing 28 January 2021**
Stock amount	**Amount of stock actually delivered or received.**	**1,000,000**
Settlement currency	**The currency of the cash that was received or paid.**	**EUR**
Settlement amount	**The amount of cash that was received or paid.**	**985,000.00**

1.6 The Significance of Instruction Reference Numbers

1.6.1 The Role of Instruction Reference Numbers in the Automation Process

When ABC sent the instruction, it provided its unique reference number (aa-111222333-1). Euroclear quoted this number on all the messages it sent back to ABC about the trade. The existence of this unique number facilitates automation, and also facilitates the update of the trade record in ABC's systems with the latest status of the instruction.

1.6.2 Instruction Reference Numbers and Trade Reference Numbers – Are They the Same Thing?

Some settlement systems quote the trade reference to the custodian. There are a number of reasons why this may not be the best idea, including the following:

1. **Some trade types, by definition, will generate two or more instructions. For example, a stock loan might generate the following:**
   a. **an initial DvP instruction to settle the start leg**
   b. **one or more (cash only) margin payments or refunds of margin payments as price movements create the need to increase or reduce collateral**
   c. **one or more (cash only) interim payments of fees if the loan crosses several month ends**

d. a final DvP instruction to close the transaction, returning the stock and the cash collateral.

2. Sometimes it may not be possible to settle the whole transaction in one operation. The parties may agree to accept partial delivery in return for partial payment.
3. The effect of settlement netting – several trades may be consolidated into a single settlement.
4. If errors are made in trade processing, then sometimes settlement instructions need to be cancelled and re-issued. Therefore, a single trade has gone through multiple trade versions, each one creating changed settlement instructions.

For these reasons, it is generally considered 'best practice', when designing a settlement system, to have a many (trades) to many (instructions) relationship between trades and settlement instructions.

2. Stock Lending, Stock Borrowing and Repo Transactions

6.2.1 Understand the purposes of stock lending and repos, their technology implications and the importance of asset segregation

2.1 Introduction

As well as being bought and sold, securities may be lent and borrowed, and also used as collateral for firms that need to borrow cash. There are two broad categories of transactions of this type – stock loans and repos. The word repo is short for sale and re-purchase agreement.

The term stock lending is usually used to describe a transaction where the motivation of the:

1. borrower (of stock) is to acquire a specific quantity of a given stock to meet a commitment to deliver, ie, they have short-sold some stock without owning it
2. lender (of stock) is to increase their return by loaning out stock for a fee. When a stock is loaned, collateral is required to protect against default.

A repo transaction, by contrast, is one where the motivation of the:

1. **lender (of stock) is to borrow cash at a better rate of interest than it would if it borrowed on an unsecured basis**
2. **borrower (of stock) is to lend cash on a secured basis.**

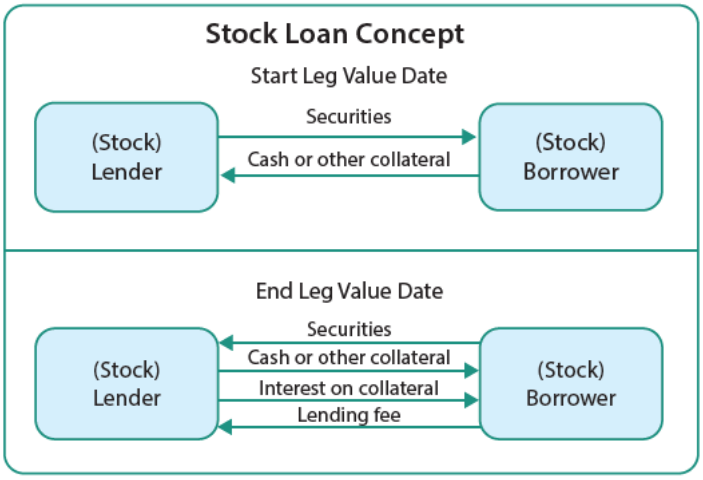
In other words, the business purpose of a stock loan is to enable one party to lend securities to another, and the business purpose of a repo is to allow one party to use securities as collateral for its cash borrowing.

In processing terms, the two transaction types share the following characteristics:

- **They both use collateral to reduce the lender's credit risk.**
- **They both employ the concepts of nominal ownership and beneficial ownership that preserve the lender's rights to any income or other benefits provided by ownership of the security being lent.**

2.1.1 The Essence of the Stock Lending/Borrowing Transaction

The following diagram explains the stock lending transaction:

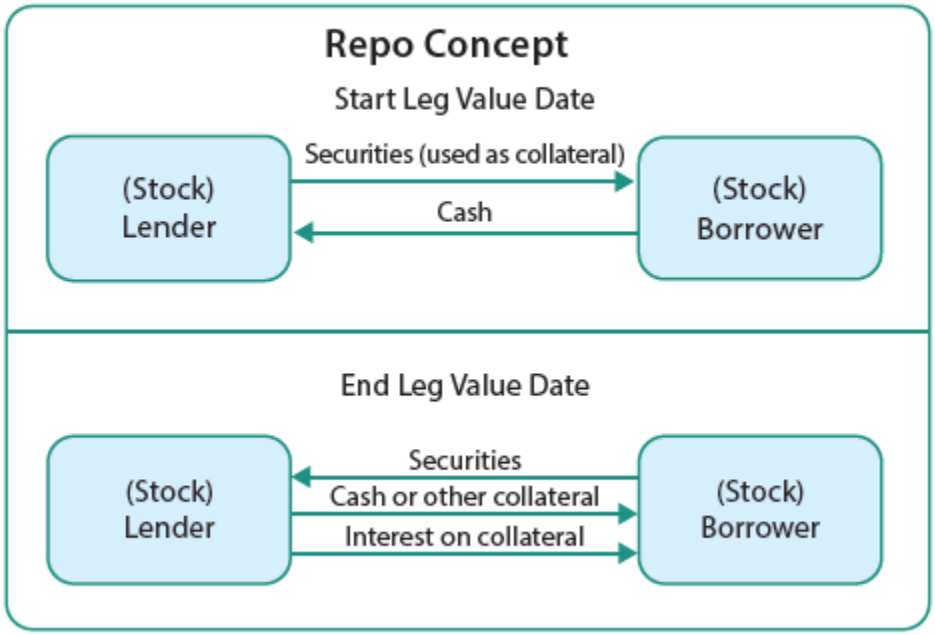


The transaction has a start leg and an end leg:

- **On the value date of the start leg, the lender delivers securities to the borrower in exchange for collateral. The purpose of the cash collateral is to provide the lender with security in case the borrower does not return the securities that were borrowed.**
- **On the value date of the end leg, the securities are returned to the lender and the collateral is returned to the borrower. At the same time, the lender is paid a lending fee, and the borrower is paid interest on the collateral.**

2.1.2 The Essence of the Repo Transaction

The repo also involves an exchange of cash for securities in both legs of the transaction, but this time the lender of cash is using the securities as collateral in case the borrower is unable to return the cash at the end of the loan period. The mechanism of the exchange of cash and collateral is that Party B 'sells' the securities to Party A under an agreement where A can repurchase them at a later date.



2.1.3 The Differences between the Two Types of Transaction

Stock loans and repos are very similar transactions that are often confused with each other. In chapter 3, we learned that repos – or sale and repurchase agreements – are:

> **'transactions where Party A lends money to Party B, provided that Party B provides Party A with collateral in the form of government bonds'.**

The two transactions are, therefore, very similar – Party A delivers stock and receives cash on the value date of the opening leg, and on the value date of the closing leg the stock is returned against payment of the cash collateral plus interest. Like stock loans, repos change nominal ownership but not beneficial ownership, and also the same specialised lending intermediaries (SLIs) (see section 2.3) are involved in providing intermediary services.

The differences between the two types of transaction are as follows:

- **Business purpose – the business purpose of the repo transaction is to lower the interest expenses of the seller (of stock), who is also the borrower (of cash). The way**

that this works is as follows: ABC Investment Bank has a credit rating of 'A'. As such, the lowest interest rate it could obtain as a commercial borrower is, say 5.5%. However, it has holdings of an AAA-rated government bond that it can offer as collateral. Because governments (usually) have higher credit ratings than banks, a lender will be prepared to offer ABC a loan at 5% provided that it provides government bonds as collateral. If ABC is unable to repay the loan, the lender will sell the government bonds.

- **Acceptable instruments – a large number of individual equities and bonds are acceptable instruments for stock loans, but only a small number of Organisation for Economic Co-operation and Development (OECD) government bonds are acceptable in repo transactions.**
- **No stock lending fee – in a stock loan transaction, there is both interest to be paid by the lender of stock on the collateral, and also a fee to be paid by the stock borrower for the use of the stock. In the case of repos, only the collateral interest is payable at the agreed repo rate.**

The scale of the securities-lending market is significant, providing liquidity to bond and equity markets globally. Lending grew rapidly in the decade until 2007, although values are estimated to have declined somewhat since the financial crisis as (a) investment banks and hedge funds reduce the size of their balance sheets, and (b) bad publicity around stock lending caused some asset owners, such as pension funds, to become nervous and decide not to allow their assets to be loaned out. The International Securities Lending Association (www.isla.co.uk) provides statistics on the availability of securities to be lent and the value of securities actually on loan. The size of the global securities lending industry (securities available for loan) is estimated to be in the region of €28.5 trillion as of the end of 2022.

2.1.4 Reasons Why Market Participants Carry Out These Transactions

There are a number of reasons why market participants may wish to lend or borrow securities.

Reasons for Borrowing Securities

- **Market makers and other sell-side firms often run short positions, ie, they have sold more stock than they have bought. They will, therefore, borrow stock in order to settle their sales on the correct value date.**
- **Any buy-side or sell-side firm may have a situation where securities that it has bought cannot be delivered for some reason. If they have, in turn, sold the stock to another party, then they, of course, will be unable to deliver what they have not received. They, therefore, borrow stock to cover for delivery failures.**
- **Hedge funds often sell stock short because they expect the price of the security concerned to fall in the future, when they will buy it back at a lower price. They too will borrow stock in order to settle these short sales on the correct value date.**

- **Hedge funds also use stock lending as part of strategies to influence the management of the company concerned, particularly in matters relating to mergers and acquisitions. If a hedge fund borrows stock, then it can vote on the borrowed stock at company meetings. This is explained in section 2.2.1 of this chapter.**

Reasons for Lending Securities

- **Traditional fund managers do not sell short; they are sometimes referred to as 'long only' fund managers in this context. They are prepared to lend stock because of the fee they receive for doing so, ie, they have a large number of assets and this helps generate an extra income from these fees. It is important to note that within the UK (per CASS 2.5.4), clients need to give consent to allow fund managers to lend out their assets.**

Reasons for Using Repos as Distinct from Unsecured Lending and Borrowing

- **Market makers, and other firms that deal as principal, have to finance their inventory of long positions. One of the ways that they can do this is to use these long positions in repo transactions as collateral for potential borrowers, and in return they receive cash, which they can use to fund their trading books. Because they have provided collateral, they will be charged a lower rate of interest than if they borrowed unsecured. This is because, in the event of the borrower being unable to meet its obligations, the lender of cash could seize the securities that were offered as collateral and sell them. In the reverse direction, interest is earned by the providers of cash made available through the repo market to those who wish to borrow funds.**

2.2 Other Factors Affecting Stock Lending Transactions

Stock loans are complex transactions. Some other factors that technology staff need to be aware of include the following.

2.2.1 Legal and Beneficial Ownership

Under UK law, the 'borrower' of the securities becomes the nominal owner (or legal owner) of them. The rights of the 'lender' are protected, however, as it remains the beneficial owner. What this means, in practice, is that the borrower receives all dividends, coupons and any other corporate action proceeds that are paid during the period of the loan. However, the borrower, in effect, holds the assets in trust for the lender, and has an obligation to repay any proceeds received of this kind to the lender. It also means that the borrower acquires (and, therefore, the lender loses) the right to vote at company

meetings, which is how hedge funds are able to use borrowed stock to influence the companies whose shares have been borrowed. If the lender wishes to vote, then they must recall the securities.

2.2.2 Non-Cash Collateral

In the simple examples in sections 2.1.1 and 2.1.2, the borrower of stock supplied the lender with cash collateral. The lender is free to invest this collateral, and from that, more than the lending fee, is where the lender acquires the majority of its additional income as a result of the transaction. However, some lenders will accept government bonds or other types of security, or letters of credit, as an alternative form of collateral.

2.3 The Use of Stock Lending Intermediaries (SLIs)

There are many securities firms that act as specialised intermediaries in the stock lending area. There are several reasons why their presence is required in order to create a liquid and efficient market.

A borrower could always borrow a relatively small number of shares for a short period from another fund manager (fund managers are the largest source of loans) if the borrower and the lender knew of each other's existence, but, for example, if the borrower wanted to borrow a very large quantity of shares for a long period – say seven months – and use government bonds as collateral, then it might run into some or all of these problems:

1. It cannot find a fund manager willing to lend such a large amount.
2. It cannot find a fund manager willing to lend for such a long period.
3. It cannot find a fund manager prepared to accept non-cash collateral.

In these circumstances, it can put the lending request to a stock lending intermediary (SLI), of which there are many. SLIs include the stock lending divisions of investment banks or custodians, as well as specialist niche firms. SLIs have a list of fund manager clients and will divide the large loan request into a number of smaller parcels, for shorter periods. If one of their clients need their stock back after, say, one month, then they will reassign that part of the loan to another client.

SLIs also deal with the problem that a borrower does not want to provide cash collateral, but the lenders insist on it. The SLI takes the government bond and does a repo transaction with it that provides the SLI with the cash to provide to the lenders.

SLIs usually act as principal in transactions, making a small margin on collateral interest rates and stock lending fees.

2.3.1 Tri-Party Repo Services

Tri-Party Repo and Delivery-by-Value (DBV)

In section 2.1.4, we learned that market makers need to fund their inventory and will lend stock in order to attract the cash collateral for this purpose. Their problem is determining which stock they can lend. They are obviously not in a position to lend stock that they need to deliver for their sales. Settlement agents, such as Euroclear, operate a special service for such firms. Internationally, this service is known as tri-party repo, but in the UK market it is called 'delivery-by-value' (DBV).

The way that DBV works is that the market maker and an SLI agree that the market maker needs to borrow, say, £10 million to finance its trading book 'overnight' (ie, for one day). Both parties input a special DBV transaction that just quotes this amount, and the collateral (say, £10.5 million) that the SLI needs. That evening Euroclear finds securities to the value of £10.5 million in the market maker's account that are not needed for delivery to clients and transfers them, against payment, to the SLI's account. The following day Euroclear returns the securities to the market maker, and the cash to the SLI. The market maker then re-evaluates its funding requirements for the next day and the process is repeated.

Other Custodian Services

CSDs, ICSDs and custody banks also offer automatic borrowing and lending services to those participants that require them. If Euroclear UK & Ireland (EUI) sees that Member A is unable to deliver 500 shares of a particular stock to meet a sale commitment, it will find another participant (Member B) that can lend the stock to Member A. Member A will be charged a fee by EUI, the majority of which will be paid to the other party. When EUI can see that Member A no longer needs the borrowing, it will automatically be repaid to Member B. Members A and B are unaware of each other and, in the event of the default of Member A, then EUI has to find the stock to return to B. For this reason, members that wish to participate in automated borrowing services have to 'pledge' their holdings at the CSD to that CSD.

2.4 Segregation of Client Assets

The existence of the stock lending and repo markets is one of the reasons that all regulators, the UK regulator included, have strict rules on the segregation of client assets.

In practice, what this means is that firms that hold client securities have to keep them in separate accounts at the CSD or custodian. In the UK, these separate accounts are often known as 'nominee accounts'. The use of nominee accounts makes it much easier to comply with the client reporting rules that were described in section 4 of chapter 5, and also makes it easier to ensure that client assets are not inadvertently used in collateral-based transactions.

The text of the UK regulator's rules on the subject of segregation, first set out in Principle 10, states:

> **'A firm must arrange adequate protection for clients' assets when it is responsible for them'.**

Client Assets Rule 6.4.1 expands this principle to state the following:

1. **A firm must not enter into arrangements for securities financing transactions in respect of safe custody assets held by it on behalf of a client or otherwise use such safe custody assets for its own account or the account of another client of the firm, unless:**
   a. the client has given express prior consent to the use of the safe custody assets on specified terms, and
   b. the use of that client's safe custody assets is restricted to the specified terms to which the client consents.
2. **A firm must not enter into arrangements for securities financing transactions in respect of safe custody assets held by it on behalf of a client in an omnibus account held by a third party, or otherwise use safe custody assets held in such an account for its own account or for the account of another client unless, in addition to the conditions set out in (1):**
   a. each client whose safe custody assets are held together in an omnibus account has given express prior consent in accordance with (1)(a), or
   b. the firm has in place systems and controls which ensure that only safe custody assets belonging to clients who have given express prior consent in accordance with the requirements of (1)(a) are used.
3. **For the purposes of obtaining the express prior consent of a retail client under this rule, the signature of the retail client or an equivalent alternative mechanism is required.**

The effect of these rules is that:

> **'client assets may not be used in stock lending or repo transactions without the express written agreement of the client concerned'.**

2.5 The Technology Implications of Stock Loans and Repos

Firms that have a business requirement to be active participants in the stock lending and repo markets need to have business applications that are able to:

- **manage collateral – that is to say that they have to be able to:**
- **revalue securities to ensure that the collateral placed or received is adequate**
- **send messages to, and receive messages from, counterparties about collateral requirement changes**
- **send the relevant instructions to settlement agents to settle the transactions**
- **calculate collateral interest charges and stock lending fees using the calculations in section 4.1.1**
- **identify securities that are available to be used in stock lending and repo transactions (see example below), and**
- **ensure that the investment and custody records correctly reflect which holdings are out on loan; this will ensure that holdings on loan are not sold accidentally and that client reporting accurately reflects this.**

Example

On 2 March, ABC Investment Bank was asked by an SLI whether it was in a position to lend 750,000 Megabank shares from its account at EUI from 5 March for an indefinite period. The position in the dealer's book is that they are long one million shares, so apparently ABC could lend 750K. However, a closer look at the dealer's book on a settled trades basis reveals that:

Date	Description	Number of shares available
2 March	Position in dealer's book	1,000,000
2 March	Less: expected receipts from counterparties for purchases value 1 March that have not been received	–500,000
2 March	Current position at the depot	500,000
5 March	Add: deliveries due from counterparties for purchases with value 5 March	100,000
5 March	Less: deliveries due to counterparties for sales with value 5 March	–400,000
5 March	Expected position in the depot on 5 March	Between 100,000 and 700,000

If all the deliveries and receipts that were due on 1 March and 5 March are made on 5 March, then ABC could lend 700,000 shares – not the 750,000 that was requested. The worst position that ABC could find itself in is that none of its expected receipts actually occur, but it still has to deliver out 100K shares on 5 March. In that case, it could only lend 100,000 shares.

The necessary technology infrastructure to carry out these activities is often to be found within the operations settlement system for equities and bonds. There are, however, a number of specialised stock lending and collateral management package systems on the market that interface with a firm's main settlement system to provide this type of functionality.

3. Cash Funding

6.3.1 Understand the technology requirements for cash funding (positioning)

3.1 Investment Banks

Once the instructions have been sent out, both parties have to ensure that they will have the cash available to pay for their purchases, and the stock available to deliver for their sales. Therefore, most settlement systems incorporate a cash flow projection module that shows them how much funding they need. Sometimes, this module is referred to as a maturity ladder or a cash ladder.

3.2 Example of a Maturity Ladder

3.2.1 Information Contained in the Maturity Ladder

The tables in this section show examples of a maturity ladder produced at the close of business on 5 March for ABC Investment Bank's USD bank account with Euroclear Brussels for the next three working days.

In the real world, the maturity ladder would show the expected cash movements for all the firm's bank accounts in all currencies (one page for each individual currency bank account) for the next five working days. The table shows only three days; the last two days have been omitted in this example in order to simplify it.

We can see the following information in the maturity ladder:

1. **The closing balance of the US$ account at Euroclear for today (5 March) is US$2 million.**
2. **The report, which is most likely to be a real-time online enquiry, then lists the numbers of trades and total net values of all the various trade types (security purchases, sales, stock lending transactions, FX transactions) that are due to settle on 6 March. Included among these are one overdue security purchase with a value of US$1 million, and one overdue unsettled security sale with a value of US$1.5 million. These trades should have settled on, or before, 5 March, but for some reason have not settled.**
3. **If you add the value of all the transactions that should settle on or before 6 March to the 5 March cash balance, then we have a projected balance on this account for 6 March of US$3,650,000.**
4. **The process is then repeated for 7 March, when the projected balance of the account is now US$8,350,000, and 8 March when it becomes US$7,850,000.**

3.2.2 What the Maturity Ladder Shows Us

The conclusions we can draw from looking at this maturity ladder are as follows:

1. **On 6 March, we have excess funds of US$3.65 million on this account.**
2. **On 7 March, we have a shortage of US$8.35 million on this account.**
3. **On 8 March, we have a shortage of US$7.85 million on this account.**

ABC Investment Bank plc - Maturity Ladder									
Nostro Name:		**Euroclear Brussels**			**Currency: USD**			**Date**	**05 March 2017**
Cash Balance on Account as at:		**05/03/17**	**2,000,000.00**		**06/03/17**	**3,650,000.00**		**07/03/17**	**-8,350,000.00**
Items Due For Settlement on:	nbr of txns	06/03/17		nbr of txns	07/03/17		nbr of txns	08/03/17	
Overdue security purchases	0		0.00	0		0	0		
Overdue security sales	1		500,000.00	0		0	0		
Security purchases	1		-1,000,000.00	6		-13,500,000.00	1		-1,250,000.00
Security sales	4		1,500,000.00	3		1,500,000.00	10		1,750,000.00
Stock lending open leg txns	2		750,000.00	0		0.00	0		0.00
Stock borrowing open leg txns	1		-250,000.00	0		0.00	0		0.00
Stock lending return leg txns	2		-400,000.00	0		0.00	0		0.00
Stock borrowing return leg leg txns	3		300,000.00	0		0.00	0		0.00
Repo open leg transactions	0		0.00	0		0	0		0.00
Repo closing leg transactions	0		0.00	0		0	0		0.00
Money market transactions	0		0.00	0		0.00	0		0.00
FX purchases	1		250,000.00	0		0.00	0		0.00
FX sales	0		0.00	0		0.00	0		0.00
Other cash movements	0		0.00	0		0.00	0		0.00
Cash Flow Projection For|		**06/03/17**	**3,650,000.00**		**07/03/17**	**-8,350,000.00**		**08/03/17**	**-7,850,000.00**

3.2.3 Possible Actions the Firm Could Take to Fund the Account Correctly

Excess Funds on 6 March

For 6 March, the firm's treasurer could put US$3 million on overnight deposit for 6 March, to earn a higher rate of interest than Euroclear pays on a nostro account. If we assume that the firm could earn 4% overnight, then the following day (when the deposit matures) US$3,000.333.33 will be paid back into the account (interest being calculated as 3,000,000 x 4% x 1 day/360 days in a year).

Inadequate Funds on 7 and 8 March

The firm may be able to resolve this issue by any one of the following means:

1. **Perhaps it has excess funds on another nostro that it could transfer into the account.**
2. **It could borrow US$8.5 million for two days on the money markets at, say, 5%, or borrow money via an overdraft facility at a bank.**
3. **If it has government bonds that it could use as collateral, it could borrow US$8.5 million indefinitely by using these bonds as collateral for a repo transaction, paying only 4% interest.**

If it takes the third option – the repo – then the maturity ladder now looks like the following illustration. The new transactions are highlighted. You will see that the treasurer has been able to keep the projected balances on this account at between US$0.15 million and US$0.65 million for the period, ensuring that the account is funded adequately for the period, and that any excess funds are swept into higher interest-bearing vehicles.

ABC Investment Bank plc - Maturity Ladder									
Nostro Name:		Euroclear Brussels			Currency: USD			Date	05 March 2017
Cash Balance on Account as at:		05/03/17	2,000,000.00		06/03/17	650,000.00		07/03/17	150,333.00
Items Due For Settlement on:	nbr of txns	06/03/17		nbr of txns	07/03/17		nbr of txns	08/03/17	
Overdue security purchases	0		0.00	0		0	0		
Overdue security sales	1		500,000.00	0		0	0		
Security purchases	1		-1,000,000.00	6		-13,500,000.00	1		-1,250,000.00
Security sales	4		1,500,000.00	3		1,500,000.00	10		1,750,000.00
Stock lending open leg txns	2		750,000.00	0		0.00	0		0.00
Stock borrowing open leg txns	1		-250,000.00	0		0.00	0		0.00
Stock lending return leg txns	2		-400,000.00	0		0.00	0		0.00
Stock borrowing return leg leg txns	3		300,000.00	0		0.00	0		0.00
Repo open leg transactions	0		0.00	1		8,500,000.00	0		0.00
Repo closing leg transactions	0		0.00	0		0	0		0.00
Money market transactions	1		-3,000,000.00	1		3,000,333.00	0		0.00
FX purchases	1		250,000.00	0		0.00	0		0.00
FX sales	0		0.00	0		0.00	0		0.00
Other cash movements	0		0.00	0		0.00	0		0.00
Cash Flow Projection For		06/03/17	650,000.00		07/03/17	150,333.00		08/03/17	650,333.00

4. The Function of Technology within the Settlement Process

6.4.1 Understand the function of technology within the settlement process: trade capture systems; operations systems; financial control systems

4.1 The Settlement System and its Place in the Architecture

Let us look again at the systems architecture diagram of a typical investment bank that we first saw in chapter 2, section 5.
In most firms, the main settlement system fits into the configuration in the following way:

1. **It holds much of the reference (static) data that was discussed in chapter 5.**
2. **It takes in real-time trade feeds from the various trade capture systems and enriches them with reference data such as:**
   - **SSIs for trading parties and the firm itself**
   - **rules and parameters used to calculate trade proceeds, trade interest, commissions, fees and expenses.**
3. **It then decides on the appropriate format and delivery method of settlement instruction messages and transmits those messages to settlement agents.**
4. **Between trade date and settlement date it receives status update messages from settlement agents, and updates its database with the latest trade statuses advised by the agents. It will then provide facilities for operations staff to monitor potential settlement failures which may arise because of missing or incorrect SSIs, incorrect or missing settlement instructions sent out, or shortages of stock to deliver, for example.**
5. **On settlement date, it receives messages from the settlement agents informing it which trades have either fully settled or partially settled, and updates its database with the outcome of these messages. It then provides the operations personnel with facilities to monitor and control actual settlement failures, ie, trades that have not been settled by the contractual value date.**
6. **It provides facilities for the firm to manage its funding by means of management reports, such as a maturity ladder.**
7. **The settlement system usually performs interest accruals – see below, section 4.1.1.**
8. **It feeds data to the corporate general ledger system and the regulatory accounting system – these will be discussed in chapter 7 – and the reconciliation system – this is discussed later in this chapter.**
9. **Depending on the configuration details at the individual firm, either the trade capture systems or the settlement system will handle regulatory trade reporting and central matching – these were dealt with in chapter 5.**

10. Many firms have added specific regulatory reporting hubs into their architectures to provide specialist applications for the management of their regulatory reporting obligations.
11. It will usually be the system that controls corporate actions, dividends and coupon processing, option expiry and exercise among others.
12. It is usually this system that controls the mark-to-market activity that was discussed in chapter 4, section 6.2.1.
13. It may also supply data to a system or service designed to calculate VaR (chapter 4, section 6.2.2).
14. It will also supply the firm's management with a wide variety of management information, such as statistics about settlement failures, their reasons and cost. These may be needed by asset class, trading book, settlement agent, or any combination of these entities.

4.1.1 Interest Accruals

When a firm enters into any of the following types of transactions:

- purchase or sale of bonds
- stock borrowing, lending and repos, or
- money market loans and deposits,

it needs to account for the interest that will be paid on the next coupon date of the bond or the termination date of the other types of contract. This process is known as 'interest accrual' and is part of the risk management process that was discussed in chapter 4. See also chapter 5, section 1.4.4.

Definitions

Accrual is an accounting term. It is defined as a method of accounting in which each item is entered as it is earned or incurred, regardless of when actual payments are received or made. Accrued interest is defined as the interest that has accumulated on a transaction since the last interest payment date or start date, up but not including the value date.

Example – Accrued Interest Calculation

On trade date 5 March, value date 7 March, ABC Investment Bank borrowed £1,000,000 for 30 days at 5% interest, calculated on the actual/actual basis (see chapter 5, section 1.4.4). The maturity date is therefore 6 April. On 6 April, ABC will repay the principal amount of £1,000,000 + 30 days' interest:

Repayment amount = 1,000,000 + (1,000,000 x 30/365 x 5%) = £1,004,109.59

However, as part of the mark-to-market process, ABC needs to account for this interest expense on each day that it occurs, not all in one amount at the end of the loan period.

The settlement system is, therefore, required to process the interest accrual amounts shown in the table on the following page on each working day between 6 March and 6 April so that the interest cost is recorded in the general ledger on the day that it is incurred.
Please note the following:

1. **It is the convention that no interest is payable or receivable on the start date of a transaction, but is payable at the end date.**
2. **The daily accrual convention is one day's interest on Mondays through to Thursdays, and three days' interest is to be accrued on Fridays, unless any or all of the days of the weekend following fall into the next month. If that is the case, the system should accrue to the month-end date – Saturday 31 March in this example. If there were a public holiday on the Monday following, then four days' interest would be accrued on the Friday, unless the Monday fell into the next calendar month.**
3. **If the firm has a financial month-end date of Saturday 31 March, then the firm would account for the total interest of £4,109.59 as:**
   - **24 days – £3,287.67 forming March expenses, and**
   - **six days – £821.92 forming April expenses.**

These matters are illustrated by the following table:

Day of the week	Date	No. of working days	Accrual to date	Accrual for the day
Wednesday	07-Mar	0	0.00	0.00
Thursday	08-Mar	1	136.99	136.99
Friday	09-Mar	4	547.95	410.96
Monday	12-Mar	5	684.93	136.99
Tuesday	13-Mar	6	821.92	136.99
Wednesday	14-Mar	7	958.90	136.99
Thursday	15-Mar	8	1,095.89	136.99
Friday	16-Mar	11	1,506.85	410.96
Monday	19-Mar	12	1,643.84	136.99

Tuesday	20-Mar	13	1,780.82	136.99
Wednesday	21-Mar	14	1,917.81	136.99
Thursday	22-Mar	15	2,054.79	136.99
Friday	23-Mar	18	2,465.75	410.96
Monday	26-Mar	19	2,602.74	136.99
Tuesday	27-Mar	20	2,739.73	136.99
Wednesday	28-Mar	21	2,876.71	136.99
Thursday	29-Mar	22	3,013.70	136.99
Friday	30-Mar	24	3,287.67	273.97
Monday	02-Apr	26	3,561.64	273.97
Tuesday	03-Apr	27	3,698.63	136.99
Wednesday	04-Apr	28	3,835.62	136.99
Thursday	05-Apr	29	3,972.60	136.99
Friday	06-Apr	30	4,109.59	136.99

5. Messaging Standards

6.5.1 Know the function of the following standards: SWIFT; FIX; FpML; XBRL

5.1Introduction

Up until the 1970s, securities firms, institutional investors and other market players generally communicated with their settlement agents by letter, fax or telex, and many deals were re-keyed into several separate systems manually. Because of the scope and scale of the financial markets and the complexity of newer financial instruments and trade types, and because the size of trades grew rapidly from about 1975 onwards, this method of working became untenable, and market players of all types began to look for more

automation. They began to move towards what came to be known as straight-through processing (STP), which is now referred to as automation. The first step in this direction was the founding of SWIFT.

5.2 An Introduction to SWIFT

The Society for Worldwide Interbank Financial Telecommunication (SWIFT) was founded in 1973, with the mission of creating a shared worldwide data processing and communications link, together with a common language for international financial transactions. This was an ambitious project that had the backing of 239 banks in 15 countries.

The next few years were spent defining message standards and building a secure store and forward telecommunications network. The first SWIFT message was sent in 1977.

Originally, SWIFT services were available only to firms that were regulated as banks, and the message standards related only to foreign exchange, money markets and interbank transfers. The first securities-related message standards were introduced in 1987, and membership was not offered to investment firms and fund managers until 1992.

Today, there are SWIFT member firms in over 200 countries, exchanging over nine billion messages annually, which is nine times the volume exchanged in 1999.

We are concerned with two aspects of the SWIFT services in this workbook, namely:

- the secure store and forward communications network, and
- the SWIFT message standards.

5.3 SWIFT Connectivity

SWIFT connectivity is based on the presence of:

- a secure IP-based network
- SWIFTNet Link software that provides security and ensures interoperability between users, and
- the store and forward principle.

5.3.1 The Secure IP-Based Network

This is a highly secure telecommunications network that, since 2005, has been based on the IP protocol, which in turn is the set of communications protocols that implement the protocol stack on which the internet runs. It is sometimes called the TCP/IP protocol suite, after the two most important protocols in it: the Transmission Control Protocol (TCP) and the Internet Protocol (IP), which were also the first two defined.

SWIFT member firms usually access the network by means of a resilient permanent connection consisting of a leased line with another leased line as back-up. For each access port speed, SWIFT has calculated a throughput value in terms of Transactions per Second (TPS). These throughput calculations are based on an expected Committed Data Rate (CDR) that is 70% of the nominal quoted bandwidth.

SWIFT publishes a list of network partners; these are telecoms utilities that offer access to the SWIFT network. The list includes household names such as AT&T and BT.

Member firms may also outsource SWIFT connectivity to a third party. Three forms of outsourcing are recognised by SWIFT:

a. **Firms may connect via another customer; this is called a shared connection.**
b. **Firms may outsource the day-to-day operation of their connection to a third-party, called a service bureau.**
c. **In addition to the technical connectivity, firms may turn to a member/concentrator that provides additional business services such as taking care of SWIFT administration and invoicing on their behalf.**

5.3.2 SWIFTNet Link

SWIFTNet Link is a suite of software products that ensures technical interoperability between users by providing the functionality required to communicate over these services. It is licensed both to SWIFT member firms directly, and also to software vendors who are able to embed it in their own products. When SWIFT supplies it directly, it is embedded in a packaged software application called SWIFTAlliance™.

Both Windows and UNIX platforms are supported by SWIFTNet Link. SWIFTAlliance and the third-party products that compete with it are often referred to as SWIFT Gateways.

SWIFTNet Link incorporates a set of XML-based Application Programming Interfaces (APIs) which provide:

- **customer application to access SWIFTNet services**
- **local application to communicate with a remote application**

- **local and remote applications to establish end-to-end integrity, authentication and confidentiality**
- **local and remote applications to retrieve the current date and time from SWIFT's 'trusted time' service**
- **local and remote applications to support features such as load balancing, which are specifically designed for high-availability and high-throughput environments, and**
- **local and remote applications to communicate securely using SWIFTNet PKI.**

SWIFTNet PKI

SWIFTNet PKI provides the security layer that is essential in the SWIFT environment. When a firm agrees with another firm that they will send and/or receive SWIFT messages with one another, the first thing that they do is to exchange authenticator keys, using the SWIFT network for this purpose. Authenticator keys encrypt the outgoing message and ensure that only the recipient for whom it was intended is able to decrypt it.
SWIFTNet PKI uses digital certificates to provide the highest levels of authentication of institutions, end-users and servers. Digital certificates convey the trust between institutions and SWIFT as the trusted third party. SWIFTNet PKI is additional to the network security provided on the protocol and the connection level.

Key-exchange ensures the following:

- **Authenticity – correspondents are guaranteed the identity of the originator of any instruction, statement, query or response. By verifying the signature, the receiver of a message can confirm that the sender specified in the header of the message owns the private key used for signing the message.**
- **Integrity – correspondents are guaranteed that the data they receive exactly matches the original as produced by the sender. By verifying the signature, the receiver of a message can confirm that the message content has not been changed during transmission.**
- **Non-repudiation – correspondents are able to prove that the claimed originator has effectively signed the message, as it can be proved that the originator is the sole owner of the unique signing key needed to produce the digital signature.**
- **Confidentiality – the message-level encryption guarantees that only the intended recipient can read and interpret the data as it can be proved that the originator is the sole owner of the unique decryption key.**
- **Access control – the access for an individual to their private key, stored in a smart card, is controlled through a private password.**

5.3.3 The Store and Forward Principle

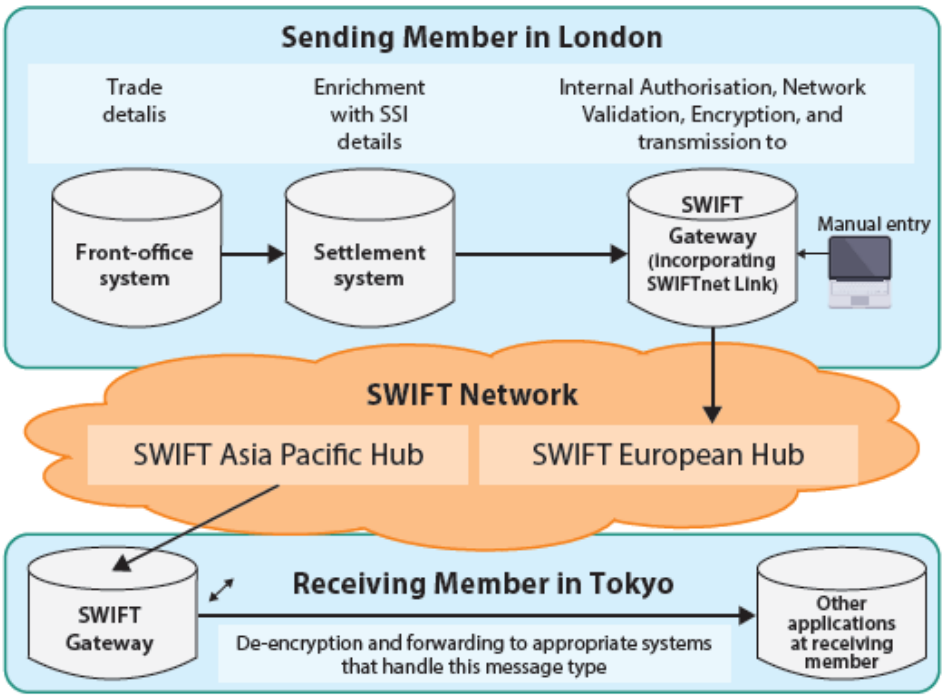
SWIFT connectivity is based on the store and forward principle. This is a communications technique in which messages are sent to an intermediate station where they are kept and

sent at a later time to the final destination or to another intermediate station. Reasons for using this method include the following:

- Origin and destination stations may not be available for communications at the same time. This, in turn, could be because of:
    - time zone differences between the sender and the recipient
    - the sender's country and the recipient's country have different working days and/or public holidays
    - the recipient's systems are not working due to hardware or software failure, or 'disasters' such as earthquake or civil unrest.
- One or more circuits may not have enough capacity for peak traffic and there is a need to give priority to certain messages, without losing the others.

5.3.4 Interaction of the Firm's Systems with the SWIFT Network

The following diagram shows the interaction between the sending firm's systems, the SWIFT network and the receiving firm's systems. The assumptions are that the sending firm is based in London and is generating settlement instructions to be sent to a settlement agent in Tokyo. Tokyo is, of course, in a different time zone and uses a different public holiday calendar from London.



At the Sending Firm

1. Trades are captured in the relevant trade capture system and forwarded to the firm's settlement system.

2. **The settlement system enriches the trade with SSI details, and any other relevant reference data, and formats a settlement instruction message. This, in turn, is forwarded to the firm's SWIFT Gateway application, where:**
   a. The Gateway product validates the trade according to SWIFT's network validation rules, which deal with field specifications (eg, whether alpha or numeric content is required, or whether fields are mandatory or optional). If a message fails validation, then it is sent to a repair queue.
   b. The Gateway product provides facilities for manual authorisation of this instruction before it is sent out. In section 1.1 of this chapter, we learned that the firm may require more levels of authorisation for FoP instructions than it does for DvP instructions. The firm is able to set up business rules in the Gateway product to control these policies.
   c. The Gateway product allows direct input through a user interface (shown in the diagram). This allows users to set up business rules in the Gateway product, manually authorise transactions and repair transactions when necessary.
   d. Once the message has been validated and authorised, it is then encrypted and sent to SWIFT. The message will, in fact, be received at one of SWIFT's European hubs (there is more than one of these for business resilience reasons), but this fact is transparent to the sender.

At SWIFT

1. **The message is received at the European hub, and time-stamped with the date and time of receipt.**
2. **It is then network-validated. If network validation is successful, SWIFT sends an 'ACK' (meaning acknowledged) message back to the sender confirming that it is able to process the message. If the message fails network validation, then SWIFT sends a 'NACK' (not acknowledged) message back to the sender. This process is known as the ACK/NACK protocol.**
3. **Once the ACK is received, SWIFT identifies that this message is destined for a firm in Tokyo, so it forwards it to one of its Asia Pacific hubs in real time.**
4. **The Asia Pacific hub then verifies whether the Tokyo firm is online to SWIFT. If it is, it forwards it to the member; if the member is not online, it stores the message until it detects that the member has come online.**

At the Receiving Firm

1. **The message is received at this member firm's gateway system and decrypted.**
2. **The Gateway system then uses business rules that have been set up in this system to tell it what to do with the message. For example, if it is a settlement instruction message sent by one of the firm's custody clients, it may need to be forwarded to one business application; if it is an FX trade confirmation, sent by a counterparty, it may need to be forwarded to another business application.**

3. **There will be some messages where the identity of the destination system will not be clear to the gateway system. This may be due to the quality of the data in the incoming message, lack of clarity and coverage in the business rules entered into the gateway system, or for some other reason. For this reason, gateway systems provide a human interface that incorporates the ability to display messages held in a repair queue and manually direct them, as well as the ability to input the business rules in the first place.**

5.4 SWIFT Message Standards

The second function of SWIFT is to devise agreed standards for the content, sequence and validation rules for the messages that are used by its members. It does this through a process of consultation with its member firms, and the various trade associations that they belong to. Once SWIFT has confirmed a standard, this standard is then adopted by the International Organization for Standardization (ISO), which is a United Nations-sponsored organisation that sets international standards that can be used in any type of business and are accepted around the world as proof that a business can provide assured quality. ISO has appointed SWIFT as the 'registration authority' of standards for financial services messages.

5.4.1 Introduction to FIN Messages (also known as MT Messages)

The range of SWIFT messages that were developed before 2000 are known as FIN messages. They are represented as tagged data and cover a wide range of financial transactions.

Each FIN message is assigned a message identifier code, such as MT300, which is a foreign exchange trade confirmation message. For this reason, FIN messages are often referred to as MT messages.

There are 224 different business-related MT messages (as well as some system management messages), and there are two ISO standards that govern the content of these messages. The scope of the MT message series is summarised by the following table:

Series	No. of individual messages in series	Purpose of the series	Examples	Relevant ISO standard

MT100	**19**	**Customer payments and cheques**	**MT111 – Request to stop payment of a cheque**	**ISO 7775**
MT200	**18**	**Financial institution transfers**	**MT202 – General financial institution transfer**	**ISO 7775**
MT300	**27**	**Foreign exchange, money markets and derivatives**	**MT300 – Foreign exchange confirmation** **MT360 – interest rate swap confirmation**	**ISO 7775**
MT400	**17**	**Collections and cash letters**	**MT400 – Advice of payment**	**ISO 7775**
MT500	**60**	**Securities markets**	**MT502 – Order to buy or sell MT514 – Trade allocation instruction** **MT543 – Instruction to deliver against payment** **MT547 – Confirmation that DvP instruction has settled**	**ISO 15022**
MT600	**27**	**Precious metals**	**MT600 – Trade confirmation**	**ISO 7775**
MT700	**29**	**Documentary credits and guarantees**	**M700 – Issue of a documentary credit**	**ISO 7775**
MT800	**11**	**Traveller's cheques**	**MT810 – Traveller's cheque refund request**	**ISO 7775**
MT900	**21**	**Cash management and customer status**	**MT950 – Statement message**	**ISO 7775**

The messages that will commonly be used by securities firms will be found in the MT100, 200,300 and 900 series (for managing firms' cash activities) and the MT500 series (for managing firms' securities business).

5.4.2 Underlying ISO Standards for MT Messages

The ISO standard that governs all the series, except for the MT500 series, is 'ISO 7775'. This standard was developed during the 1980s and applied to all the messages that were developed up to 1997, including the then current MT500 series securities messages.

In the late 1990s, SWIFT and its members realised that the original ISO 7775 messages were too restrictive, did not reflect the full complexity of modern trading instruments, and were still too ambiguous to ensure that full automation could be achieved.

Thus was born the 'ISO 15022' standard, based on a data dictionary approach. Initially, in 1997, ISO 15022 was applied to the securities message category as this represented the fastest-growing usage of the SWIFT network. Old message types were replaced and many new ones introduced. ISO 15022 trade initiation and confirmation messages were introduced in 1997, and settlement and reconciliation in 1998. There was no standards release in 1999 due to Y2K distractions, and the old MT500 series ISO 7775 standard message types were removed from the network in 2002.

5.4.3 Example of a FIN Message

The next picture is an example of a FIN message. It is an MT950, which is a statement of a bank account sent by the account operator to the account holder, which could be a securities firm. This is how the message would look if it were opened in an application, such as Microsoft Notepad. Note that SWIFT Gateway applications contain software that will display and print FIN messages in a more user-friendly form.

{ 1:F01WELAGB2XAXXX4802160443} { 2:O9500131981202NWBKGB2LCXXX024039002898 12020231N} { 4:
:20:6000010089597099
:25:6000010000895970
:28C:01499/001
:60F:C050701GBP360335,86
:61:050704D39745,03NCHK018348
:61:050704D240,NCHK018349
:61:050704D4095,03NCHK018435
:61:050704D54,NCHK018447
:61:050704D114,47NCHK018452
:61:050704D472,50NCHK018464

:61:050704D550,03NCHK018470
:61:050704D402,96NCHK018472
:61:050704D110,60NCHK018478
:61:050704D117,50NCHK018518
:61:050704D7815,26NCHK018522
:61:050704D1464,50NCHK018524
:61:050704D94,NCHK018532
:61:050704D2222,51NCHK018537
:61:050704D239,85NCHK018541
:61:050704D2812,11NCHK018544
:61:050704D104,58NCHK018549
:61:050704D78,NCHK018566
:61:050704D5634,07NCHK018574
:61:050704D2402,86NCHK018590
:61:050704D641,84NCHK018592
:61:050704D60,NCHK018611
:61:050704D281,29NCHK018615
:61:050704D472,50NCHK018618
:61:050704D50042,26NCHK018643
:61:050704D325,NSTOCLER MED UL PRM
:61:050704D1198,75NSTOSKANDIA PREMIUM
:61:050704D15751,41NSTOL B WEST
:61:050704D1225,NSTOCARR SHEPPARDSP
:61:050704D4488,81NSTOUNUM LIMITED
:62M:C050704GBP217079,14
-} { 5:{ CHK:4ADDAB891385} { DWS766I MESSAGE NOT TO BE AUTHENTICATED} }

The Header Line
The message begins with a header line, (ie, the first line in the picture):

{ 1:F01WELAGB2XAXXX4802160443} { 2:O9500131981202NWBKGB2LCXXX024039002898 12020231N} { 4:

Within the header line, we can now see:

- **the BIC code of the receiver – WELAGB2X**
- **the fact that this is an MT950 – 2:O950, and**
- **the BIC code of the sender – NWBKGB2L.**

Header lines are standard for all MT messages, if this message was not an MT950 but an MT535 – statement of securities holdings – then the string 2:O950 would change to 2:O535.

The header line is then followed by a number of lines of tagged data:

MT950 Detailed Tags

:25:6000010000895970
Tag 25 tells you that this is the statement for account number 6000010000895970 that this firm holds with NatWest – the owner of BIC code NWBKGB2L.

:28C:01499/001
Tag 28C tells you that this is page one of statement number 1499 for this account.

:60F:C050701GBP360335,86
Tag 60F tells you the opening balance for this account on this page of this statement. The firm has a credit balance (C) of GBP360,335.86, which was brought forward from the closing balance on July 1 2005.

:61:050704D39745,03NCHK018348
Tag 61 is repeated many times. There is one instance for each entry that has been posted to this account on statement number 1499. This particular entry tells us that on 4 July 2007 the account was Debited (D) with GBP39,745.03. If it had been credited then 'D' would be replaced by 'C'. The description of the entry is 'NCHK018348; this means that cheque number 018348 is being debited to the account. Note that the tag 61 entry does not include the ISO currency code; this is implied from Tag 60F.

:62M:C050704GBP217079,14
Tag 62M shows the closing balance of Page 1 of statement number 1499. It is a credit balance (C) for the date of 4 July 2005 of GBP217,079.14. If you were to add up the values of Tag 60F and all the individual values of the Tag 61 items it would come to this amount.

Any FIN message may be interpreted in a similar way to this one. SWIFT distributes the SWIFT Standards Guide to all its members; this provides the rules for interpretation of an incoming message and the population of an outgoing message, as well as the network validation rules that apply to the message type.

5.5 New SWIFT Initiatives in the 21st Century

5.5.1 XML and ISO 20022

The tagged data structure of the MT message series has served the investment community well for many years, but many aspects of it are now somewhat dated. One of the main drivers for change is the growth of the use of Extensible Markup Language (XML), throughout industry and commerce.

XML is a flexible way to create common information formats and share both the format and the data on the internet, intranets, and elsewhere. XML is a formal recommendation from the World Wide Web Consortium (W3C) similar to the language of today's web pages, the Hypertext Markup Language (HTML).

With the evolution of XML technology in the late 1990s, work began on what was called ISO 15022 2nd Edition (also known as 'SWIFTML'). This evolved into the first early implementations of ISO 20022 using an enhanced approach to standards based on business entity interaction behavioural models and XML schema-based message data models for the transactional messages supporting these models.

SWIFT's first implementation of XML and the new standard was in a series of messages designed for players in the mutual funds industry in 2003. This was followed by a new real-time cash management offering in 2006. The ISO 20022 standard has further evolved to incorporate lessons from the first implementations of ISO 20022 funds messages, and to converge with other standards such as FpML, FIX, TWIST, ACCORD and successful examples of market-specific best practice such as SMPG (Securities Market Practice Group) rules.

In 2004, a significant increase in scope was agreed for ISO 20022, expanding from securities and related financial instruments to the broader scope of all financial services. All SWIFT messages developed since 2004 have been based on ISO 20022. These messages are known as 'MX' messages and are in XML form. ISO 20022 uses a data dictionary (see chapter 3, section 2.5.1) for all messages. So far, the new MX messages have only been used for new products, but it is hoped that eventually MX messages will replace the MT message series. However there has been a period of 'dual operation' of both the MT and MX message series which has been running for several years.

5.5.2 Closed User Groups

SWIFT membership was originally available only to banks, so at that time the service could be used only to communicate between banks, not between banks and their customers. Securities firms and investment funds were admitted as members in 1992, but there was no method by which a SWIFT member firm could use the SWIFT network to communicate with its (mainly corporate and government departments in this context) clients that did not themselves qualify for membership. The rules were changed in 2002; it is now possible for banks and their corporate customers to communicate using SWIFT in two ways:

1. The Standardised Corporate Environment (SCORE) – SCORE is based on a closed user group, administered by SWIFT, where corporates can interact with financial institutions. To be eligible for SCORE, corporates must be listed on a regulated stock exchange of a country which is a member of the Financial Action Task Force (FATF). Subsidiaries can also join SCORE if they are majority-owned by an eligible company (ie, listed in one of the FATF countries), duly incorporated, in good financial

standing and subject to regular audits by an independent audit firm in accordance with internationally recognised accounting standards.

2. Member-Administered Closed User Groups (MA-CUG) – companies not eligible for the SCORE model can join SWIFT by registering in a closed user group set-up and being managed by their financial institution (ie, the financial institution decides which customers can participate). Within the MA-CUG, a corporate can communicate only with its bank, which decides which kinds of messages and files (payments, treasury, reporting and securities) can be exchanged. If a corporate wishes to communicate with several banks it can register in multiple MA-CUGs, resulting in similar multi-banking capabilities to SCORE. Participants that use SCORE may only send and receive messages that conform to SWIFT standards and are therefore capable of being network validated. Participants in an MA-CUG may send and receive any data they care to, but SWIFT will not, and cannot, network-validate the messages.

5.5.3 SWIFTNet FileAct

This is SWIFT's interactive communications service that is utilised for the sending of files between parties and, in effect, will supersede the existing FIN service, for example, providing support for the transmission of mass payments or reporting information. Although it is file-based, the initiator of the file transfer will always send a request first and wait for the response across the IP network before sending the file and waiting for the subsequent acknowledgement.

5.5.4 SWIFTNet InterAct

This is SWIFT's interactive communications service that is based on the exchange of request and response messages between two parties. The exchange of messages can be either synchronous or asynchronous. Effectively, this means that it can be used either for direct application-to-application transactional messaging, as is the case of CLS Bank which is based on this service; or it can be utilised in a 'push' architecture to provide real-time status and other information. This will also form the basis of the successor to the FIN service.

5.6 Financial Information eXchange (FIX) Protocol

The Financial Information eXchange (FIX) protocol was initiated in 1992 by a group of institutions and brokers interested in streamlining their trading processes. It is an open message standard, controlled by no single entity, that can be structured to match the business requirements of each firm. At the time that the FIX protocol was founded, institutions and brokers that were not banks had only recently become eligible to join

SWIFT, and the founding firms were not satisfied with the ISO 7775 securities messages that were then available on the SWIFT network.

FIX does not impose a single type of carrier (eg, it will work with leased lines, private networks, internet), nor a single security protocol. It is, however, important to note that FIX is not a network in itself and that communication is made directly between each broker/institution pair by prior bilateral agreement. Thus, a fund management institution may have 50 or 60 connections to brokers worldwide, some via the internet, others via direct dial or leased connections, and still others connected via private networks such as Omgeo or Autex.

In summary, each broker/institution connection can be thought of as a two-way conversational link taking place between applications at each end. These applications are often referred to as 'FIX engines' and can operate either as stand-alone or fully integrated solutions.

The structure of the organisation is based around a series of committees comprised of interested parties within the broking and institutional communities. These committees are focused on business, technical and regional issues, with working groups examining the impact of new technology, such as XML, and the potential expansion of the protocol to cover other users, such as exchanges and Electronic Crossing Networks (ECN).

The protocol is defined at two levels: session and application. The session level is concerned with the delivery of data, while the application level defines business-related data content.

Broadly, business messages cover the communication between brokers and institutions of the following information:

- **Indications of interest.**
- **Orders and order acknowledgment.**
- **Fills.**
- **Account allocations.**
- **News, email, program trading lists.**
- **Administrative messages.**

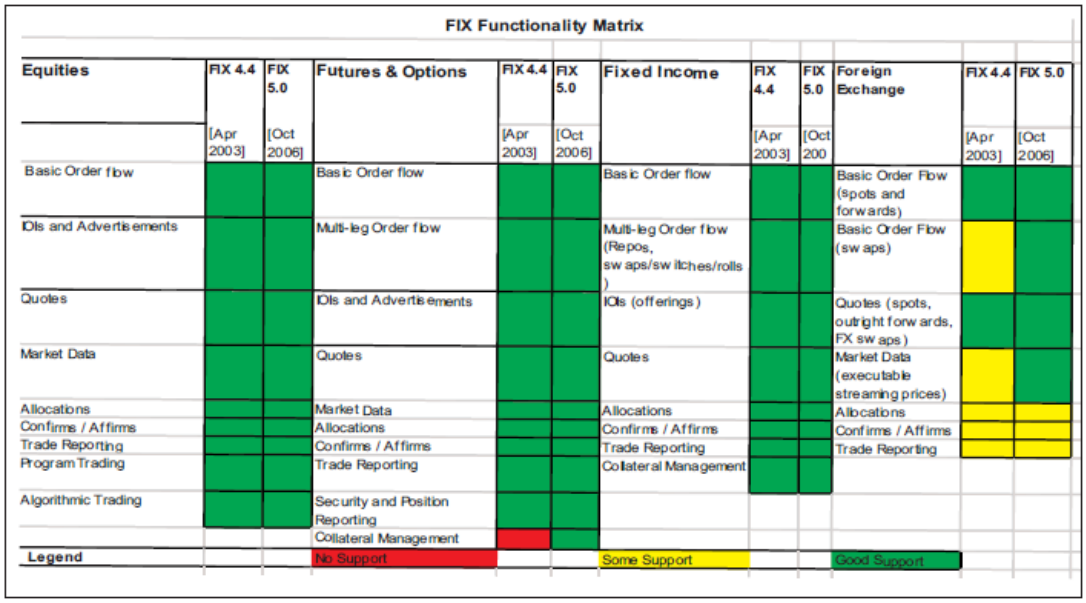
The protocol has been deliberately designed to support both domestic and cross-border trading in a varied spread of instrument and security types, such as:

- **equities**
- **bonds**
- **depositary receipts**
- **derivatives**
- **futures, and**

- **foreign exchange-trading.**

Because the FIX standards are 'open source', they may be downloaded from the FIX protocol website (www.fixprotocol.org).

The current version of the FIX protocol is version 5.0, Service Pack 2. This was originally released in 2009, but a large number of extension packs have been created since then.



FIX Functionality Matrix

Equities	FIX 4.4 [Apr 2003]	FIX 5.0 [Oct 2006]	Futures & Options	FIX 4.4 [Apr 2003]	FIX 5.0 [Oct 2006]	Fixed Income	FIX 4.4 [Apr 2003]	FIX 5.0 [Oct 200	Foreign Exchange	FIX 4.4 [Apr 2003]	FIX 5.0 [Oct 2006]
Basic Order flow			Basic Order flow			Basic Order flow			Basic Order Flow (spots and forwards)		
IOIs and Advertisements			Multi-leg Order flow			Multi-leg Order flow (Repos, swaps/switches/rolls)			Basic Order Flow (swaps)		
Quotes			IOIs and Advertisements			IOIs (offerings)			Quotes (spots, outright forwards, FX swaps)		
Market Data			Quotes			Quotes			Market Data (executable streaming prices)		
Allocations			Market Data			Allocations			Allocations		
Confirms / Affirms			Allocations			Confirms / Affirms			Confirms / Affirms		
Trade Reporting			Confirms / Affirms			Trade Reporting			Trade Reporting		
Program Trading			Trade Reporting			Collateral Management					
Algorithmic Trading			Security and Position Reporting								
			Collateral Management								
Legend			No Support			Some Support			Good Support		

5.7 FpML – Financial Products Markup Language

FpML (Financial products Markup Language) is an XML message standard for the OTC derivatives industry. The FpML standard was first published by JP Morgan and PricewaterhouseCoopers on 9 June 1999 in a paper titled 'Introducing FpML: A New Standard for E-commerce'. As a result, the FpML Standards Committee was founded.

All categories of privately negotiated derivatives will eventually be included within the standard. The standard is managed by the ISDA on behalf of a community of investment banks that make a market in OTC derivatives. The standard is freely licensed, so any firm that trades the instruments that it supports may use it in their own software.

The current version is FpML 5.13 (issued August 2024) but this version is currently in active working draft status. Therefore, FpML 5.12 (issued September 2021) remains the most recent officially recommended version. This core scope include the products of Foreign Exchange (FX) Swaps and Options, Interest Rate Swaps, Inflation Swaps, Asset Swaps,

Swaptions, Credit Default Swaps, Credit Default Swap Indices, Credit Default Swap Baskets, Tranches on Credit Default Swap Indices, Equity Options, Equity Swaps, Total Return Swaps, and many others. The core processes include trading, valuation, confirmation, novations, increases, amendments, terminations, allocations, position reporting, cash flow matching, a formal definition of party roles, as well as trade notification between asset managers and custodians.

FpML is distinct from similar financial standards such as SWIFT because it provides no network or specification of a transport mechanism.

5.8 XBRL

XBRL is an acronym for Extensible Business Reporting Language. This is an XML message standard for exchanging information about corporate data such as balance sheets and profit and loss accounts between the company concerned and its auditors, regulators, customers, research analysts and other interested parties. XBRL standards are compatible with ISO 20022.

Historically, the standard has been used only to transmit accounting data, but there are now moves to adopt it as a standard for the company concerned to announce corporate action data to the securities markets.

6. Post-Settlement Reconciliation Procedures

6.6.1 Understand the function of technology within reconciliation procedures including: reconciliation requirements and record-keeping; ensuring cash and stock movements are recorded; journal movements; corporate actions (including dividends, bonus issues and rights issues)

6.1 Introduction

All firms need to reconcile data held in their business application systems to ensure its integrity. In this context, 'data' includes:

1. **cash amounts connected with all types of transaction**
2. **cash balances that arise from all types of transaction**

3. **stock and derivative quantities connected with all types of transaction, and**
4. **stock and derivative balances (positions) that arise from all types of transaction.**

Data needs to be reconciled externally as well as internally. Owing to the size of the data to be reconciled, computer systems are needed for this task.

External reconciliation is the act of reconciling data, such as cash movements on nostro accounts and stock movements on depot accounts, with the settlement agents that operate those accounts on the firm's behalf.

Internal reconciliation is the act of reconciling data held in one of the firm's business applications (such as its settlement system) with data held on one or more of its other business application systems.

6.2 External Reconciliation

If the firm holds client money or assets, then it is a UK regulatory requirement to reconcile them. For example, if a private client broker holds stock belonging to its clients in a segregated account at EUI, it must reconcile the settled holdings that it reports to clients on the statements it sends them to the holdings reported by EUI to the firm.

6.2.1 Reconciliation of Clients' Securities

The rules about the reconciliation of clients' securities are covered by Section 6.5 of the Client Asset (CASS) Rules, which state:

CASS 6.5.4
Carrying out internal reconciliations of the safe custody assets held for each client with the safe custody assets held by the firm and third parties is an important step in the discharge of the firm's obligations.

A firm should perform such internal reconciliations:

a. **as often as is necessary**
b. **as soon as reasonably practicable after the date to which the reconciliation relates, and**
c. **to ensure the accuracy of the firm's records and accounts.**

Reconciliation methods which can be adopted for these purposes include the 'total count method', which requires that all safe custody assets be counted and reconciled on the same date.

If a firm chooses to use an alternative reconciliation method (for example, the 'rolling stock' method), it needs to ensure that:

- **all of a particular safe custody asset are counted and reconciled as at the same date, and**
- **all safe custody assets are counted and reconciled during a period of six months.**

CASS 6.5.4 (4)
A firm that uses an alternative reconciliation method must first send a written confirmation to the UK regulator from the firm's auditor that the firm has in place systems and controls which are adequate to enable it to use the method effectively.

CASS 6.5.6
A firm must conduct, on a regular basis, reconciliations between its internal accounts and records and those of any third parties by whom those safe custody assets are held.

CASS 6.5.7
Where a firm deposits safe custody assets belonging to a client with a third party, in complying with the requirements of CASS 6.5.6, the firm should seek to ensure that the third party will deliver to the firm a statement as at a date, or dates specified by the firm which details the description and amounts of all the safe custody assets credited to the account, and that this statement is delivered in adequate time to allow the firm to carry out the periodic reconciliations required in CASS 6.5.6.

CASS 6.5.7 A
If a firm acting as trustee or depositary of an AIF that is an authorised AIF deposits safe custody assets belonging to a client with a third party, under Article 89(1)(c) (Safekeeping duties with regard to assets held in custody) of the AIFMD level 2 regulation, the firm should seek to ensure that the third party will deliver to the firm a statement as at a date or dates specified by the firm which details the description and amounts of all the safe custody assets credited to the account.

This statement is then delivered in adequate time to allow the firm to carry out the periodic reconciliations required under Article 89(1)(c) (Safekeeping duties with regard to assets held in custody) of the AIFMD level 2 regulation.

CASS 6.5.8
A firm should perform the reconciliation required by CASS 6.5.6:

- **as regularly as is necessary**
- **as soon as reasonably practicable after the date to which the reconciliation relates, and**
- **to ensure the accuracy of its internal accounts and records against those of third parties by whom safe custody assets are held.**

CASS 6.5.8 A
A firm acting as trustee or depositary of an AIF that is an authorised AIF should perform the reconciliation under Article 89(1)(c) (Safekeeping duties with regard to assets held in custody) of the AIFMD level 2 regulation:

1. **as regularly as is necessary, and**
2. **as soon as reasonably practicable after the date to which the reconciliation relates, to ensure the accuracy of its internal accounts and records against those of third parties by whom safe custody assets are held.**

CASS 6.5.9
Whenever possible, a firm should ensure that reconciliations are carried out by a person (for example, an employee of the firm) who is independent of the production or maintenance of the records to be reconciled.

CASS 6.5.10
A firm must promptly correct any discrepancies which are revealed in the reconciliations envisaged by this section, and make good, or provide the equivalent of, any unreconciled shortfall for which there are reasonable grounds for concluding that the firm is responsible.

CASS 6.5.11
Items recorded or held within a suspense or error account fall within the scope of discrepancies.

CASS 6.5.12
A firm may, where justified, conclude that another person is responsible for an irreconcilable shortfall despite the existence of a dispute with that other person about the unreconciled item. In those circumstances, the firm is not required to make good the shortfall but is expected to take reasonable steps to resolve the position with the other person.

CASS 6.5.13
A firm must inform the FCA in writing without delay:

1. **if it has not complied with, or is unable, in any material respect, to comply with the requirements in CASS 6.5.1 R, CASS 6.5.2 R or CASS 6.5.6 R 1A if it is a firm acting as trustee or depositary of an AIF and has not complied with, or is materially unable to comply with, the requirements in CASS 6.5.1 R and/or Articles 89(1)(b) or 89(1)(c) (Safekeeping duties with regard to assets held in custody) of the AIFMD level 2 regulation, or**
2. **if, having carried out a reconciliation, it has not complied with, or is unable, in any material respect, to comply with CASS 6.5.10 R.**

CASS 6.5.14
Firms are reminded that the auditor of the firm has to confirm in the report submitted to the FCA under SUP 3.10 (Duties of auditors: notification and report on client assets) that the firm has maintained systems adequate to enable it to comply with the custody rules.

CASS 6.5.15
Firms that use an alternative reconciliation method are reminded that the firm's auditor must confirm to the FCA in writing that the firm has in place systems and controls which are adequate to enable it to use another method effectively (see CASS 6.5.5 R).

6.2.2Reconciliation of Client Money

The rules about the reconciliation of client money are covered by section 7.6 of the Client Money Rules. Rule 7.6.2 states that:

> **'A firm must maintain its records and accounts in a way that ensures their accuracy, and in particular their correspondence to the client money held for clients'.**

And Rule 7.6.6 explains the role that reconciliation plays in meeting these requirements:

> **'Carrying out internal reconciliations of records and accounts of the entitlement of each client for whom the firm holds client money with the records and accounts of the client money the firm holds in client bank accounts and client transaction accounts should be one of the steps a firm takes to satisfy its obligations under CASS 7.6.2 R, and where relevant SYSC 4.1.1 R and SYSC 6.1.1 R'.**

A firm should perform such internal reconciliations:

a. **as often as is necessary, and**
b. **as soon as reasonably practicable after the date to which the reconciliation relates to ensure the accuracy of the firm's records and accounts.**

The standard method of internal client money reconciliation sets out a method of reconciliation of client money balances that the FCA believes should be one of the steps that a firm takes when carrying out internal reconciliations of client money.

Rules 7.6.13, 7.6.14 and 7.6.15 set out what the firm's obligations are if it finds a discrepancy in such reconciliation.

Rule 7.6.13 states:

'When any discrepancy arises as a result of a firm's internal reconciliations, the firm must identify the reason for the discrepancy and ensure that:

1. **any shortfall is paid into a client bank account by the close of business on the day that the reconciliation is performed, or**
2. **any excess is withdrawn within the same time period (but see CASS 7.4.20 G and CASS 7.4.21 R)'.**

Rule 7.6.14 states:

'When any discrepancy arises as a result of the reconciliation between a firm's internal records and those of third parties that hold client money, the firm must identify the reason for the discrepancy and correct it as soon as possible, unless the discrepancy arises solely as a result of timing differences between the accounting systems of the party providing the statement or confirmation and that of the firm'.

And Rule 7.6.15 states:

'While a firm is unable to resolve a difference arising from a reconciliation between a firm's internal records and those of third parties that hold client money, and one record or a set of records examined by the firm during its reconciliation indicates that there is a need to have a greater amount of client money or approved collateral than is, in fact, the case, the firm must assume, until the matter is finally resolved, that the record or set of records is accurate and pay its own money into a relevant account'.

6.2.3 Good Business Practice – Avoidance of Losses

Even if the FCA did not mandate rules about external reconciliation, it is an essential part of the control process and, unless it is done regularly and accurately, the firm is exposed to the risk of losses caused by:

- **fraudulent activity by its employees or others – this is the reason that the FCA recommends, that: 'whenever possible, a firm should ensure that reconciliations are carried out by a person (for example, an employee of the firm) who is independent of the production or maintenance of the records to be reconciled'**
- **processing errors made within the firm, or**
- **processing errors made outside the firm, eg, by settlement agents and trading parties.**

Consider the following example of the losses that can arise as a result of processing errors.

Example
ABC Investment Bank's client John Smith purchased 1,000 shares in Maxicorp at £10 per share for settlement on 1 March. ABC is holding them in custody for him at EUI. For some reason, the shares were never delivered to ABC's EUI account, but the EUI depot balance was updated in ABC's system as if they had been delivered. ABC is regularly sending John Smith statements that tell him ABC have the 1,000 shares, but it does not have them – they are still with the party who sold them.

The potential losses that could arise from this processing problem – unless it was detected and resolved in time – could include:

- **Dividend payments – on 1 April, Maxicorp pays a dividend of £0.50 per share. John Smith, therefore, expects ABC to pay him £500.00. If the stock were in ABC's EUI account, then EUI would pay ABC and ABC would pay John Smith. Because ABC does not have the shares, ABC makes a loss of £500.00 when it pays Smith.**
- **Corporate actions – on 1 May, Megacorp offers to take over Maxicorp for £15 per share. Mr. John Smith wishes to accept the offer. As ABC does not have the shares to sell, it will have to pay John Smith the proceeds, and will lose £15,000.**

6.2.4 Other Issues Relating to Reconciliation

Journal Vouchers, Bank Charges and Interest
Banks and other settlement agents charge the firm fees for using its services, and interest on overdrawn balances, and they usually pay interest on credit balances on the nostro account. The first that the firm knows about these is when they appear on the bank statement; therefore, these charges are identified by the reconciliation process. When such postings are identified, they need to be posted into the general ledger by means of a journal voucher.

6.2.5 How is External Reconciliation Usually Achieved?

Most large firms reconcile their settlement agents' bank statements on a daily basis. The settlement agents provide the necessary information in a number of ways, including SWIFT messages and information in other forms that may be supplied on their electronic banking systems. The relevant SWIFT messages are:

Message no.	Message Description	Usage
MT950	Statement Message	To reconcile nostro balances and transactions.
MT940	Customer Statement Message	To reconcile nostro balances and transactions.

MT535	Statement of Holdings	To reconcile the balances of each security at the depot.
MT536	Statement of Transactions	To reconcile the actual settlements of stock that have taken place at the depot.

Note that the firm may use either the MT950 or the MT940 to reconcile the bank account – they are two alternative messages that fulfil the same purpose; the difference is that there are additional 'narrative' tags on the MT940 that do not appear on the MT950.

The MT940, MT950 and MT536 messages will include the unique instruction reference number that was described in section 1.4.2 of chapter 5.

The relevant messages are usually downloaded into a dedicated reconciliation application, which is likely to be a packaged product, or it may be developed in-house. The technology department then needs to organise a feed of the equivalent data from its internal systems. The reconciliation application then compares the transactions and balances reported by the agent with those reported by the internal system, matches items which appear in both systems, and provides a user interface for the reconciliation team to investigate and resolve items that are missing from one or other system, duplicated in one or other system, or have discrepancies between the systems.

These applications allow the users to construct business rules that define what is or is not a 'good match'. These business rules need to take into account some of the factors that we identified in section 1 of this chapter, namely the following:

1. The importance of the unique, common instruction reference number that was quoted on the original instruction, and which the agent should return to us on all messages about this instruction – the reconciliation application will try to find this in order to match items.
2. The fact that the agent has the authority to 'settle within tolerance'. This means that there may be a small difference between the cash proceeds expected to pay for a purchase, and the amount that the agent reports on the bank statement. This will need to be written off by a journal voucher.
3. The fact that the feed from the settlement system needs to contain equivalent information to that which arrives from the settlement agent so that the two records can be compared, and relevant business rules for transaction matching can be applied.

6.3 Internal Reconciliation

6.3.1 Why Is Internal Reconciliation Required?

Example
If ABC Investment Bank buys (as principal) 1,000 shares in Shell at £10.00 each on 5 March for value date 8 March from XYZ Fund Managers for settlement at EUI UK, then the following records will be created on 6 March:

Trade Dated Position in Trader's Book	**1,000 shares**
Value Dated Position in Trader's Book	**0 shares**
Settled Position at EUI	**0 shares**
Cost of Trade Dated Position	**£10,000.00**
Cost of Value Dated Position	**£0**
Bank Account Balance	**£0**
P&L in Trader's Book	**£0**

If the trade then settles in full on 8 March as intended, and the position in Shell is marked-to-market at £10.50 per share, then the records that were created on 6 March would be updated as follows:

Trade Dated Position in Trader's Book	**1,000 shares**
Value Dated Position in Trader's Book	**1,000 shares**
Settled Position at EUI	**1,000 shares**
Cost of Trade Dated Position	**£10,000.00**
Cost of Value Dated Position	**£10,500.00**
Bank Account Balance	**–£10,000.00**
P&L in Trader's Book	**£500.00**

The reason why internal reconciliation is required is that, as the trade in the example flows through the trade cycle, records may need to be created and updated in multiple business systems.

If the firm's configuration diagram were similar to the picture above, then all the systems that are shaded would need to be updated by this trade. There are many reasons why these updates may not be made consistently in all the systems in the configuration (some of these reasons are explored in greater depth in chapter 7); but the point is that the firm needs proactively to reconcile the data between systems in the configuration in order to identify and resolve problem trades and positions.

6.3.2How is Internal Reconciliation Usually Achieved?

The same applications that support external reconciliation also support internal reconciliation. The main difference between the two types of reconciliation is that there are no external feeds involved. If, for example, it was required to reconcile the trade dated positions (and also the trades of the day) between the trade capture equity trading system and the main settlement system, then the technology department would need to develop:

- **a feed from the trade capture system containing close-of-business trade dated positions**
- **a feed from the main settlement system containing close-of-business trade dated positions**
- **a feed from the trade capture system containing the trades of the day, and any trades of previous days that were cancelled or corrected today, and**
- **a feed from the main settlement system containing the trades of the day, and any trades of previous days that were cancelled or corrected today.**

The users would then need to create business rules in the reconciliation application that enable that system to compare the sets of records and highlight items that required attention. In order to do this, the feeds from the trade capture system and those from the settlement system need to have sufficient common data for the application to be able to apply the business rules.

7. Investment Distribution Channels

7.6.1 Understand the technology implications of post-trade compliance

7.1 What is Post-Trade Compliance?

Post-trade compliance is essential to ensure the portfolio does not veer (either purposively or accidentally) from the pre-agreed portfolio constraints. It involves regularly checking the positions held against a predefined set of rules to ensure they are compliant with the portfolio's investment mandate.

These rules can be created in two ways:

1. **In conjunction with the client as part of their client mandate document – the client agrees a set of rules that need to be monitored on a pre-agreed frequency. These rules will typically reflect the investment objectives and constraints agreed when the client is taken on. For example, that the portfolio should be split 10% cash and 90% invested, or not to invest in companies that are associated with landmines or tobacco.**
2. **Driven by regulation – necessary where there are strict rules regarding what investments are or are not allowed for certain products. For example, the Undertakings for Collective Investment in Transferable Securities (UCITS) regulations have strict rules around what investments are allowed to be held in a UCITS fund, and the use of cash overdrafts and derivatives.**

If any rule is broken (or breached), then this needs to be reported immediately to the fund manager so it can be addressed urgently. Breaches can be split into two main groups:

1. **Active breaches – where a fund manager trades (hopefully accidentally) into the wrong investment. For example, they invest into an organisation which is associated with tobacco where the client has clearly stated that they do not want to invest in this area. These breaches need to be resolved as soon as possible (obviously taking into account the best interests of the client).**
2. **Passive breaches – where a breach occurs that is caused by market conditions outside the control of the manager or investor. For example, a client would like a 90% vs 10% split between investments and cash but a market movement has inadvertently moved this split to 88% vs 12%. These breaches need to be resolved quickly but not normally as quickly as active breaches. Again, any resolution needs to take into account the best interests of the client.**

7.2 The IT Implications of Post-Trade Compliance

As detailed in section 7.1 above, post-trade compliance is a critical function, and needs technological support because it would be impossible to perform this function manually due to the complex nature of the post-trade compliance rules, the investments held and the required market data.

Therefore, systems need to be developed to support this function. These systems need the following capabilities:

- **Firstly, the ability to create and maintain the often complex, multi-layered and multi-tiered business rules.**
- **Secondly, good clean data is required. This covers details of the clients' investments (eg, securities, derivatives and cash) as well as market data (such as stock classifications, prices, corporate actions, income details and exchange rates). If the data has any deficiencies (such as wrong classifications) then the rules will either miss genuine breaches or report invalid breaches.**
- **A process or scheduler needs to be available to allow the manager to determine when the post-trade compliance rules are run. At one end of the extreme, the rules could be run every time the manager trades or, at the other extreme, the rules may be run once a month. Most firms will run them on a regular basis, such as each night as part of the end-of-day (EOD) process or each morning before the next day's trading can commence.**
- **Linked to the point above, once the rules are run then a process is required to:**
  1. **highlight any breaches and what has caused them, and**
  2. **ensure they are forwarded to the relevant party for resolution and track the progress of these resolutions to ensure they are actually fixed and not just forgotten, and**
  3. **finally, the application will require:**
     a. **detailed access controls to ensure only authorised people can create, amend rules and run the rules, and**
     b. **full auditing to ensure any changes are clearly logged.**

Traditionally, managers developed their own in-house systems for post-trade compliance.

However, as the rules, timescales, data needs and criticality are becoming increasingly more demanding, managers now typically use the various third-party applications available. These systems will have the necessary market data feeds, the capability for building the complex rules, the ability to schedule the running of the rules, as well as full audit details. All the manager has to do is to provide the required investment holding data as and when required.

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **List the circumstances under which a settlement agent will settle a trade.**
   Answer Reference: Section 1.5.1

2. **What is the significance of an instruction reference number in the automation process?**
   Answer Reference: Section 1.6

3. **What is the business purpose of a repo and how does it differ from the business purpose of a stock loan?**
   Answer Reference: Section 2.1

4. **What is the business purpose of a maturity ladder?**
   Answer Reference: Section 3

5. **List the usual business functions of a settlement system.**
   Answer Reference: Section 4.1

6. **List the main components of SWIFTNet Link.**
   Answer Reference: Section 5.3.2

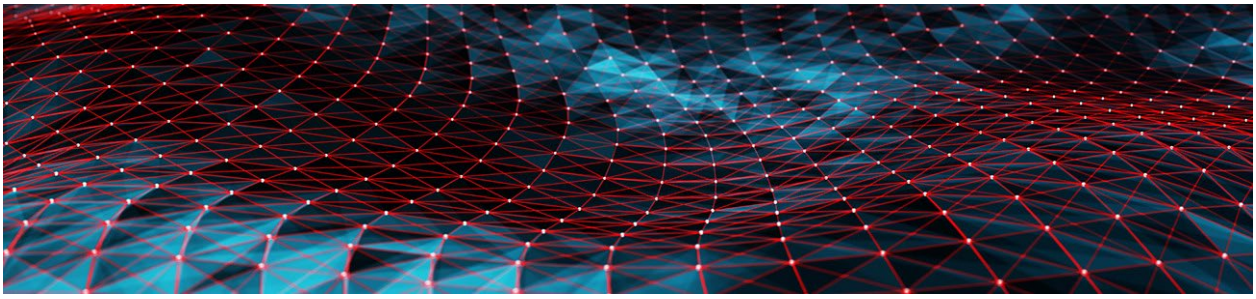
7. **What five benefits are provided to SWIFT members through key exchange?**
   Answer Reference: Section 5.3.2

8. **Which of the FIN message series conforms to ISO standard 15022?**
   Answer Reference: Section 5.4.1

9. **What is the current version of the FIX protocol, when was it released and which ISO standard does it conform to?**
   Answer Reference: Section 5.6

10. **Which SWIFT FIN messages are used to reconcile stock balances and positions with custodians?**
    Answer Reference: Section 6.2.5

11. **Why is post-trade compliance an important area?**
    Answer Reference: Section 7.1



Chapter Seven
The Impact of Technology on Financial Control

Section 1 The Role of the Financial Control Department (FCD)

Section 2 The Technology Impact of the Financial Control Function

Section 3 The Technology Requirements of General Ledger Accounts

Section 4 The Stock Record

This syllabus area will provide approximately 5 of the 50 examination questions

1. The Role of the Financial Control Department (FCD)

7.1.1 Know the role of the financial control function

The core function of the financial control department (FCD) of a securities industry firm is to manage the financial resources of the business. Within the FCD, there are likely to be the following sub-departments or sections specialising in different activities:

- **Management accounting, also known as 'product control' – this section produces the profit and loss (P&L) accounts and balance sheets for individual business units (and their underlying products), and works closely with the managers of those business units to ensure that the income and expenditure of the units is correctly recorded, and that any financial risks are measured and appropriately contained.**
- **Statutory reporting – this section produces the firm's balance sheet and P&L account, which are then subject to both internal and external audit.**
- **Regulatory reporting – this section produces the financial and statistical returns demanded by the firm's regulator.**
- **Tax management – this section will be concerned with organising the firm's activities so that its tax liabilities are (legally) minimised.**
- **Financial operations (sometimes called accounts or accounts payable/receivable) – makes payments for costs such as suppliers' invoices and staff expenses.**

2. The Technology Impact of the Financial Control Function

7.2.1 Understand the relationship between trade capture, settlement operations and the financial control function

2.1 Financial Control Department (FCD) Systems

Financial control is one of the departments that the technology department supports. The FCD will have its own dedicated technology applications which include:

- **A corporate general ledger system (see section 3 for more information about the general ledger). This system will record all the assets, liabilities, income and expenditure of the firm, and is likely to include specialist modules which:**
    - **enable the FCD to compare this year's P&L to the previous year's P&L, and to the budgeted P&L.**
    - **assist the FCD in allocating expenses across departments. For example:**
      - If the firm occupies a single building and 25% of the space in that building is occupied by the settlements department, then the settlements department needs to be charged with 25% of the rent, electricity, gas, water and property taxes.
      - The cost of the technology department itself needs to be re-charged to those business units that benefit from it. The FCD may need to use a number of bases for making this re-charge. If, for example, there are five developers all working on an application used only by the settlements department, then the direct costs of these employees might be recharged directly to settlements. However, other individuals in the technology department manage resources such as help desks, networks and desktop installations, from which all business units benefit; the cost of these individuals may be re-charged according to headcount, so, if settlements employs 35% of all the firm's staff, it would be re-charged 35% of all these 'general' technology costs.
    - **manage the firm's purchase ledger.**
- **A regulatory accounting system – this system will be used to calculate the financial and statistical information that the firm needs to send to its regulator.**

However, most of the individual amounts that are posted to the general ledger are likely to be computed by other systems used by other business units. 'Computed', in this context, means the following:

- **the calculation of the money amount concerned, and**
- **the decision as to which account in the general ledger the calculated amount is to be posted.**

The technology department also supports the systems that perform these computations, and any problems encountered by these other systems may have an impact on the quality or the timeliness of the figures posted to the general ledger.

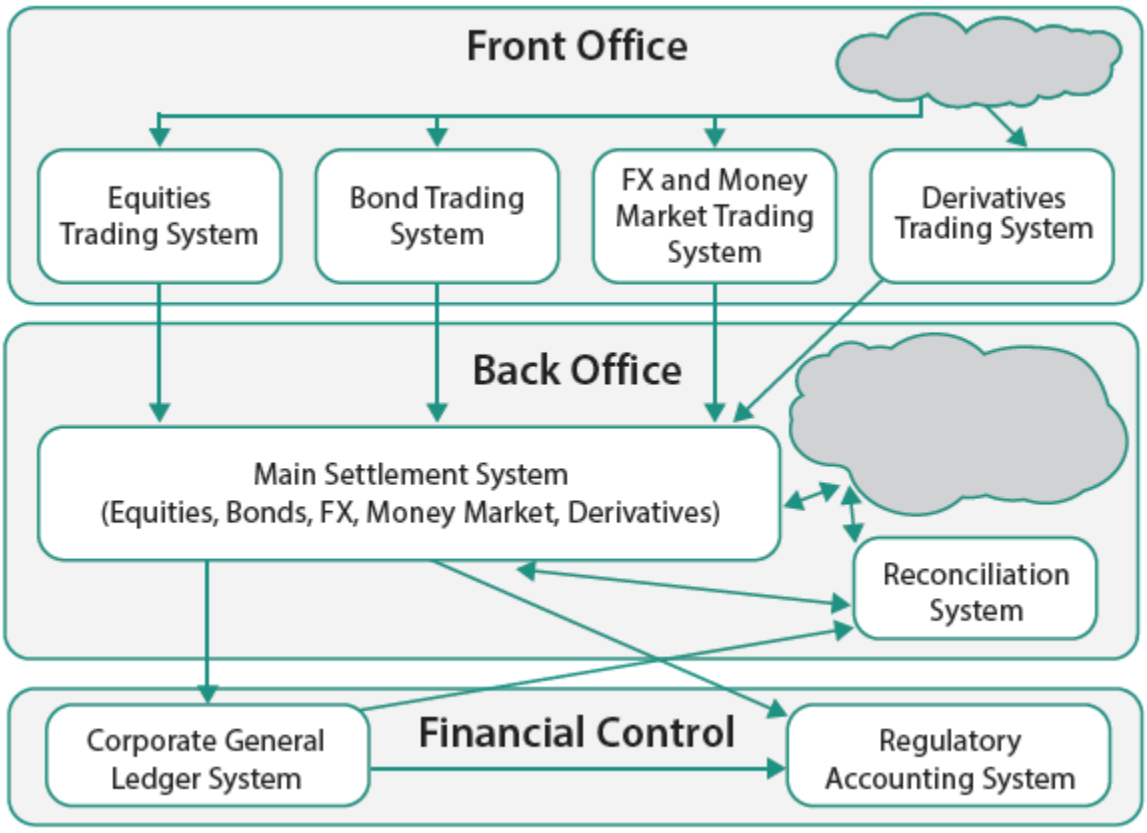
Section 2.2 shows a typical systems configuration diagram for a mid-sized investment bank operating from a single location and describes the accounting calculations made by each of the systems in the configuration. Note that this is a simplified diagram; the actual configuration diagram for most investment banks is usually much more complicated than this one, but it will generally follow this pattern.

2.2 System Architecture – A Typical Investment Firm

2.2.1 Trade Capture Systems

This bank has four trading systems, each one specialising in processing orders placed by customers in different asset classes. Each of the four systems is linked to sources of market data that enable the dealer to 'see the market' – in other words, to be able to see the current levels of market prices, interest rates and exchange rates, economic and political news stories that may affect these rates and prices, and corporate announcements, such as company results, and also merger and acquisition activity that may affect the share price of just one company.

Some of this data will also be fed into the individual trade capture systems, where it will be used in either automated or manual trading decision support. Suppliers of market data include Refinitiv, Bloomberg and the major stock exchanges.



Equities Trading System
The equities trading system processes orders and transactions in individual equities, most of which are traded on one or more stock exchanges.

When trades are executed, details of the trade are then forwarded – usually electronically and in real time – to the main settlement system.

System Impact on Financial Control:

1. **The equities trading system may be responsible for calculating commissions to be paid by clients for performing this service, as well as fees levied by stock exchanges and regulatory bodies that need to be passed on to the client.**
2. **Trade processing errors – if errors are made in trade processing, then incorrect trade details will be forwarded to the settlements system, and then to the general ledger. Trade-processing inaccuracies may be of two kinds – human error and technical error.**
   - **Common human errors include buying a given stock instead of selling it, or buying the wrong stock – instead of buying the stock that the customer ordered, the dealer buys a stock with a similar name.**
   - **Technical errors include problems with the interface between this system and the settlement system that might cause trades to be forwarded later than required, not at all, more than once, or with incorrect details.**

Bond Trading System
The bond trading system fulfils a similar role to the equities trading system albeit for a different instrument class – bonds. They may be bought and sold in the same way that equities are bought and sold. They also pay interest to the person or organisation that has purchased them.

Again, when trades are executed, they are forwarded – usually electronically and in real time – to the main settlement system.
System Impact on Financial Control:

1. **This system is usually responsible for calculating the interest that is due to the holder.**
2. **The same types of human trade processing errors that can occur within the equity trading system also apply to this system, with additional complications owing to the fact that bonds bear interest. This leads to the possibility of 'reference data errors', for example, the interest rate on a particular bond should be 5% but it has been set up in the system as 5.5%. This leads to incorrect data being sent to the main settlement system, which in turn feeds the same incorrect data to the general ledger.**
3. **The same kinds of technical errors that can occur with the equity trading system can also occur with this system.**

Foreign Exchange (FX) and Money Market Trading System
This system processes orders and transactions in foreign exchange and money market

loans and deposits. When the transactions are executed, they are then forwarded – usually electronically and in real time – to the main settlement system.

System Impact on Financial Control:

1. **This system is usually responsible for calculating interest and trade proceeds.**
2. **The same kinds of trade processing human errors that can occur in a bond or equity trading system also apply to this system.**
3. **The same kinds of technical errors that can occur with the equity trading system can also occur with this system.**

Derivatives Trading System
This system processes transactions in relatively complex financial instruments, such as financial futures, traded options, interest rate swaps and currency swaps.

What derivatives have in common is that the calculations involved in fixing the price of a transaction are far from straightforward; this system will include modules that perform highly sophisticated financial analysis, including 'what-if' scenario analysis.

When trades are executed, the trade details are forwarded to the main settlement system – usually electronically and in real time.

The bank probably holds positions in individual derivative contracts as a result of customer order activity. These positions need to be revalued at the end of each business day in order that the bank can measure the market risk it is exposed to as a result of holding the position. As with the trade price calculation, the revaluation calculation is also complex.

System Impact on Financial Control
Most of the money values that are posted to the general ledger for transactions and positions in derivative instruments are calculated by this system. The calculations are complex; their accuracy may also be affected by:

1. **the accuracy of the market data sources available to this system**
2. **the accuracy of the reference data for both the derivative instrument and the underlying instrument that is held in this system**
3. **human error, and**
4. **technical error.**

2.2.2 Operations Systems

Main Settlement System
The functions of the main settlement system usually include:

1. **Receiving real-time trade details from the trade capture systems and enriching those trade details with client-specific/instrument-specific settlement instructions.**
2. **Sending trade confirmations to clients and counterparties, and 'matching' confirmations received from counterparties with its own records of those trades.**
3. **Reporting trade details to regulators, in real time and within the maximum allowed period demanded by the regulators.**
4. **Sending settlement instructions to clearing houses, custodians and correspondent banks.**
5. **Receiving reports from clearing houses, custodians and correspondent banks about which trades have settled and which have not, and updating its records as a result of such reports.**
6. **Position management activity for bonds, equities and currencies. This involves making the following calculations:a. Positions in bonds and equities need to be revalued at the close of business each day as a result of changing market prices; the resulting gain or loss needs to be posted in the general ledger.b. For each day that the bank holds a position in a bond, it will earn one day's interest. This needs to be calculated, accrued, and posted in the general ledger system. Note that the settlement system does not usually perform these functions for positions in derivative instruments – position management for these instruments is usually performed by the derivative clearing system because of its specialised and complex nature.**
7. **Processing of changes to positions as a result of events such as corporate actions or dividend payments.**
8. **Forwarding details of trades, settlements and positions to the reconciliation system.**
9. **Forwarding details of all the activities listed in items 1–8 that affect the general ledger to the corporate general ledger system and the regulatory accounting system.**

System Impact on Financial Control
Because of the very wide range of functions that are performed by this system, its impact on the money values that are posted to the general ledger is very great.

This system usually forwards the results of its activities to the general ledger system after processing the position management activity, at the end of the day.

The accuracy of what is reported may be affected by any or all of the following:

- **Inaccurate reference data concerning client's standing settlement instructions – this would affect which general ledger account the amount receivable by or payable to the client was posted to.**
- **Inaccurate reference data concerning market prices, exchange rates and bond interest payment details – this would affect the accuracy of the position management entries.**

- **Corporate action processing problems.**
- **System limitations – the investment industry is one that continually innovates. One form of innovation is the invention of new types of equities, bonds and derivative contracts. Such innovation may involve new calculation methods and rules. If the settlements system is not enhanced to deal with these innovations, then the accuracy of its calculations may be impaired.**
- **Human errors in order or trade entry in the trade capture systems that have not been corrected – these may affect any general ledger posting.**
- **Problems with receiving data from the trade capture systems – these might cause the data that is being forwarded to the general ledger to be late, duplicated, incomplete or inaccurate.**
- **Problems on receiving data from the external agents such as clearing houses, custodians and correspondent banks – these might cause the data that is being forwarded to the general ledger to be late, duplicated, incomplete or inaccurate.**
- **Problems in the interface between this system and the corporate general ledger which might cause the data that is being forwarded to the general ledger to be late, duplicated, incomplete or inaccurate.**

Reconciliation System
The reconciliation system takes in feeds about transactions, balances and positions from the main settlement systems and compares them to data received from the external agents (including payment banks, custodians, clearing houses and central securities depositories (CSDs)) so that the bank is able to prove that its records about transactions that have settled today, as well as the resulting position from such settlements, agrees with the records of the external agents concerned.

Many firms also use a specialist reconciliation system to check that the records held by the settlements system agree to those held by the various trade capture systems and the general ledger.

System Impact on Financial Control
The purpose of the reconciliation system is to prove that the data in the general ledger is consistent with the data held by the settlements system and by the external parties whom the firm has contracted to settle trades on its behalf. If reconciliations are not performed on a timely basis, then the firm can have no confidence that the figures reported in its general ledger are accurate.

2.2.3 Financial Control Systems

These were described in section 2.1.

2.3 Conclusion

The technological impact of the financial control function is widespread. Not only does the technology department need to develop or purchase (and then maintain and enhance) dedicated systems for the finance department, but the accuracy of the data in these dedicated systems is affected by the performance and capabilities of virtually all the other application systems that the firm uses.

This has the following impacts on the technology department:

Development Impact

- **In order for the general ledger to be updated on an accurate and timely basis, all systems in the configuration must be continually enhanced to deal with innovations in the structure of the products that are traded by the firm.**
- **Interfaces between systems need to be robust, automated and valid – to avoid the problems of missing, duplicated, erroneous and/or late entries in the general ledger.**

Support Impact

- **Because of the complexity of the configuration, and the dispersed nature of activities within it, the resolution of a support issue may be a complex process. If a user complains that an accounting entry is missing, duplicated or erroneous, then the cause of the problem may lie within the general ledger system itself, or any other system upstream of the general ledger.**

3. The Technology Requirements of General Ledger Accounts

7.3.1 Know the purpose of the general ledger

3.1 Definition of the General Ledger

The general ledger, sometimes known as the nominal ledger, is the main accounting record of a business which uses the double-entry bookkeeping convention.

3.1.1 Brief Introduction to the Double-Entry Principle

Double-entry bookkeeping is a major study area in its own right, but this workbook provides a very simple introduction to the topic to enable students to follow the principles behind sections 3 and 4.

The double-entry bookkeeping principle is based on the idea that each transaction is recorded in at least two ledger accounts. Each transaction results in at least one account being debited and at least one account being credited, with the total debits of the transaction being equal to the total credits.

For example, if a new business is established by a shareholder putting in £1,000 in cash, then its general ledger will look like this:

Type of Asset (debit)	Value of Asset	Type of Liability (credit)	Value of Liabilities
Cash	£1,000	Shareholders' funds	£1,000
Total assets	£1,000	Total liabilities	£1,000

If the new business then purchases office equipment worth £500, then its general ledger will now look like this:

Type of Asset (debit)	Value of Asset	Type of Liability (credit)	Value of Liabilities
Cash	£500	Shareholders' funds	£1,000
Office equipment	£500		
Total assets	£1,000	Total liabilities	£1,000

The double-entry principle insists that, because the value of the office equipment has gone up by £500, then the value of something else – cash in this case – must have gone down by the same amount. The total assets and total liabilities of the business are unchanged at £1,000.

The use of the double-entry convention means that the accuracy of the accounts can be checked quickly – when all the accounts that have a debit balance are summed, they

should equal the sum of all the accounts which have a credit balance. Without this facility, there would be no quick means of checking accuracy.

The general ledger usually includes accounts for such items as current assets, fixed assets, liabilities, revenue and expense items, gains and losses. The general ledger is a summary of all of the transactions that occur in the company. It is built up by posting transactions to general ledger accounts as and when the business events occur.

There are seven basic categories in which all accounts are grouped. The following table shows the seven groups, together with some examples of each group in the finance industry:

General Ledger Account Category	Accounting Convention	Finance Sector Examples
Assets	Debit	Market value of securities purchased
		Interest receivable
		Money due from counterparties and clients
		Cash in the bank account
		Premises, furniture, fittings and equipment
Liabilities	Credit	Market value of securities sold
		Interest payable
		Money due to counterparties and clients
		Overdrawn bank accounts
Revenue	Credit	Net interest income, ie, interest received less interest paid
		Fees for client advice
Expenses	Debit	Salaries and other employee benefits
		Eg, rent, property taxes, heat, light, power,
		All other expenses of running the business

Gains	Credit	Gains are profits (or increases in value) of an investment such as a stock or bond
		Gain is calculated by fair market value or the proceeds from the sale of the investment minus the sum of the purchase price and all costs associated with it
		If the investment is not converted into cash or another asset, the gain is then called an unrealised gain
Losses	Debit	The opposite of gains – losses arise when the investment is sold for less than the purchase price, or when the fair market value is less than the purchase price
Shareholders' equity	Credit	The net value of the business to its shareholders. Based on the accounting equation: Assets – Liabilities = Shareholders' equity Credit if assets are greater than liabilities and debt if liabilities are greater than assets.

The balance sheet and the income statement are both derived from the general ledger, which is where posting to the accounts occurs.

Posting is the process of recording amounts as credits (right side) and as debits (left side) on the pages of the general ledger. The listing of the account names and the sum of the account balances is called a 'trial balance'. The purpose of the trial balance is, at a preliminary stage of the financial statement preparation process, to ensure the equality of the total debits and credits.

Because each bookkeeping entry debits one account and credits another in equal amounts, the double-entry bookkeeping system will ensure that the general ledger will always be in balance, thus maintaining the accounting equation:

Assets = Liabilities + Shareholders' Equity

The accounting equation is the mathematical structure of the balance sheet.

3.2 The Individual General Ledger Account

7.3.1 Know the components of a general ledger account

The information that is held in a technology system about an individual general ledger account should include the following:

Reference Data Items

1. **A unique alphanumeric code to identify the account.**
2. **The name of the account.**
3. **A code to represent the type of the account, ie, bank account or expense account.**
4. **The identity of the currency in which postings are made for this account.**

Balance Information Items

1. **The opening balance of the account.**
2. **The date of the opening balance.**
3. **The closing balance of the account.**
4. **The date of the closing balance.**

Transaction Information Items

1. **The date that the transaction was carried out (transaction or business date).**
2. **The date that the transaction is expected to settle (value date).**
3. **The date that the transaction was entered into the general ledger system (entry date).**
4. **The money value of the transaction.**
5. **A description of the transaction.**
6. **A code to represent the type of the transaction (eg, securities purchase, FX sale).**
7. **A 'configuration origin code' – this tells the user of the general ledger which of the many systems in the configuration produced the transaction; the presence of such a code is an invaluable aid to resolving support calls dealing with the types of problem referred to in section 2.2.1 of this chapter.**
8. **A unique transaction reference number – ideally, this reference number will be used by all the systems (trade capture, operations and FCD) that have recorded this transaction.**

3.2.1 A Typical General Ledger Category, its Accounts and its Sub-Accounts

Most finance industry general ledgers are structured along the lines of the following example. We are going to look at the general ledger structure for a particular type of account – equity positions.

Definitions

- **Position – the position that the firm holds in a particular equity is the net result of posting the money values of all the purchases of that equity, less the money values of any sales. When securities are bought for, say, £10 and sold for, say, £11, then the difference of £1 is a profit or gain. If the securities were purchased for £10 and sold for £9, then the difference of £1 is a loss.**
- **Long positions, debit balances and assets – if the quantity of shares purchased exceeds the quantity of shares sold, then the firm has a long position, which means that there is a debit balance in the general ledger, and the balance of the account concerned represents an asset to the business.**
- **Short positions, credit balances and liabilities – if the quantity of shares purchased is less than the quantity of shares sold, then the firm has a short position, which means that there is a credit balance in the general ledger, and the balance of the account concerned represents a liability to the business.**

Example

General Ledger Accounts for Security Positions

ABC Investment Bank plc trades only in equities that are listed on either the London, New York or Deutsche Börse (ie, German) stock exchanges. The securities that are traded on these exchanges may be priced in GBP, USD or EUR.

ABC, therefore, has three accounts in its general ledger, all of which have the account type of security position (SECPOS) accounts:

Account Type	Account Code	Account Description
SECPOS	POS-LSE	Securities listed on the London Stock Exchange
SECPOS	POS-NYSE	Securities listed on the New York Stock Exchange
SECPOS	POS-DBORSE	Securities listed on the Deutsche Börse

However, because ABC trades in three currencies, each one of the three accounts now has three sub-accounts – one for each currency, so the list of accounts now looks like this:

Account Type	Unique Account Code	Account Description	Currency sub-account code

SECPOS	POS-LSE	Securities Listed on the London Stock Exchange	GBP
SECPOS	POS-LSE	Securities Listed on the London Stock Exchange	USD
SECPOS	POS-LSE	Securities Listed on the London Stock Exchange	EUR
SECPOS	POS-NYSE	Securities Listed on the New York Stock Exchange	GBP
SECPOS	POS-NYSE	Securities Listed on the New York Stock Exchange	USD
SECPOS	POS-NYSE	Securities Listed on the New York Stock Exchange	EUR
SECPOS	POS-DBORSE	Securities Listed on the Deutsche Börse	GBP
SECPOS	POS-DBORSE	Securities Listed on the Deutsche Börse	USD
SECPOS	POS-DBORSE	Securities Listed on the Deutsche Börse	EUR

Developing the example further, SONY Corporation shares are traded on all three of these exchanges, and ABC has traded this stock on all three of them. Lloyds Banking Group shares are traded only on the London Stock Exchange, where ABC has traded them.

In order to provide clarity and granularity within the general ledger, for each of the sub-account codes in the table above, the ledger now has sub-sub account codes for SONY and Lloyds Banking Group if appropriate. The security positions part of the ledger now begins to look like the table below – the account descriptions and any redundant rows have been removed to simplify the table:

Account Type	Unique Account Code	Currency Sub-Account Code	Instrument Sub-Sub Account Code	Closing Balance of the Account	Date of Closing Balance
SECPOS	POS-LSE	GBP	SONY	100,012.50Dr	31 January 2022
SECPOS	POS-LSE	GBP	LLOYDS	175,000.00Cr	31 January 2022
SECPOS	POS-NYSE	USD	SONY	200,000.00Cr	31 January 2022

SECPOS	POS-DBORSE	EUR	SONY	150,000.00Dr	31 January 2022

The balances of POS-LSE/GBP/SONY and POS-DBORSE/EUR/SONY are debit balances because ABC has purchased more SONY shares on each of these accounts than it has sold. Conversely, the other two accounts have credit balances because ABC has sold more shares than it has bought.

The actual accounting entries that were passed across the POS-LSE/GBP/SONY in the month of January 2021 that resulted in the closing debit balance of £100,000.00 might be as shown in the sample general ledger report page below:

ABC Investment Bank PLC General Ledger Postings and Balances Report

Account Code:		POS-LSE	Currency	GBP	Instrument Account Code		SONY	
Business Date	Value Date	Entry Date	Transaction Type	Origin Code	Transaction Description	Transaction Reference Number	Debit Amount	Credit Amount
01/01/2007	01/01/2007	01/01/2007	BAL		Opening Balance of Account		0.00	
02/01/2007	05/01/2007	01/01/2007	PURCH	Equity	Purchased 20,000 shares at GBP11 per share	222222	220,000.00	
03/01/2007	07/01/2007	03/01/2007	SALE	Equity	Sold 10,000 shares at GBP11.30 per share	333333		113,000.00
03/01/2007	07/01/2007	03/01/2007	Trade P&L	Equity	Profit on trade 333333	333333	3,000.00	
29/01/2007	01/02/2007	29/01/2007	SALE	Equity	Sold 1,000 shares at 11.25	444444		11,250.00
29/01/2007	01/02/2007	29/01/2007	Trade P&L	Equity	Profit on trade 444444	444444	250.00	
31/01/2007	31/01/2007	31/01/2007	Revaluation	Setts	Revaluation of 9,000 shares - current market price GBP11.125	555555	1,125.00	
31/01/2007	31/01/2007	31/01/2007			Closing Balance of Account		100,125.00	

3.2.2 Selecting the Correct Account to Post an Entry To

7.5.1 Know how account selection parameters are maintained

This is usually a function of the main settlement system, but this will not be the case for all securities firms. The process usually works along the lines of the following example, which is taken from the entry with transaction reference number 333333 in the sample general ledger page just illustrated. Let us look at this transaction in more detail:

On 3 January, ABC Investment Bank sold 10,000 shares in SONY Corporation to Client A at £11.30 per share, for value 7 January. The bank did not charge the client commission on this trade, so the amount payable by Client A is also £113,000, ie, 10,000 shares x £11.30.

As a result of this, the following amounts (all in GBP) need to be posted to the general ledger:

Entry Number	Amount	Debit or Credit	Description	Account Type for Posting
1	113,000.00	Credit	The principal amount – ie, 10,000 shares x £11.30 per share	Security Position – (SECPOS)
2	3,000.00	Debit	The P&L (ie, profit and loss) on the trade	Security Position – (SECPOS)
3	3,000.00	Credit	The P&L on the trade	Security P&L (SECPL)
4	113,000.00	Debit	The consideration – ie, the amount to be paid by client A	Security Client (SECCLT)

For all of these entries, the firm needs to use a sub-account of the currency of the trade – GBP. It also needs to use a sub-sub-account for a more detailed posting analysis. For entry numbers 1 to 3, the sub-sub-account will be a code to represent whatever security is being traded. For entry number 4, the sub-sub-account needs to represent whichever client the firm is trading with.

Most systems build the business rules for a decision of which account to post to by using an explosion table similar to the one illustrated below:

Account Selection Explosion Table								
Transaction Type	Operation	Amount Code	Dr or Cr	Account Type	Market Code	Account Code	Sub-Account	Sub-Sub-Account
Equity	Sell	Principal	Cr	SECPOS	LSE	POS-LSE	@currencyid	@securityid
Equity	Profit	PandL	Dr	SECPOS	LSE	POS-LSE	@currencyid	@securityid
Equity	Profit	PandL	Cr	SECPL	LSE	PL-LSE	@currencyid	@securityid
Equity	Sell	Consideration	Cr	SECCLT	(null)	SEC-CLT	@currencyid	@clientid

This table enables Finance Department users to specify – in each of the first six columns – different combinations of:

- **transaction type – eg, equity, bond, foreign exchange**
- **operation – eg, buy, sell, lend, borrow, profit, loss**
- **amount code – a code to represent each of the relevant money amounts involved in the transaction**
- **account type – eg, security position, security client, security P&L**
- **market code – a code to represent a particular market, such as the LSE, NYSE.**

In the last three columns, the user is able to specify (for each of the combinations entered in the first six columns):

- **which distinct account code to use for each combination**
- **the rule for deciding which sub-account to use: '@currencyid' means use the unique code that represents the currency being debited or credited on each posting event**
- **the rule for deciding which sub-sub-account to use: '@securityid' means use the unique code that represents the security being traded on each posting event, and '@clientid' means use the unique code that represents the client from whom the securities were bought or sold.**

In other words, these table column entries that begin with the '@' sign are 'indirect references' to system entities such as currencies, securities and clients. The firm may trade thousands of securities with hundreds of thousands of clients. The use of indirect references in an explosion table prevents the table becoming millions of rows long to cope with all the mathematical combinations involving clients, securities and currencies.

4. The Stock Record

7.6.1 Know the purpose of the stock record

4.1 Introduction and Purpose

Just as the general ledger allows firms to use the double-entry bookkeeping convention to record cash transactions and balances, the stock record allows firms to use the double-entry bookkeeping convention to record stock quantities and balances (including listed futures and options in this context) in the same way. The usual types of accounts affected by such postings are book, client and depot accounts.

The business principles and software application structures (double-entry bookkeeping, unique accounts and the use of account selection parameter tables and the underlying data used by these tables) that have been used to record money amounts may also be used to record stock quantities.

The stock record shows both the ownership of securities, and the location of the stock. It is often a component of the main settlement system, but may also be a stand-alone application with interfaces to the main settlement system. Some packaged stock record applications employ the terminology of 'long' and 'short' as alternatives to 'debit' and 'credit' respectively, others use the debit/credit terminology. When they use debit and credit terminology, different vendors do not use it consistently, as some applications are based on the premise that:

> **'A purchase of stock is a debit of money and a credit of stock'.**

while the business logic of other applications is based on the premise that:

> **'A purchase of stock is a debit of money and also a debit of stock'.**

To avoid ambiguity, this workbook will use the long/short terminology.

4.2 Example of Stock Record Postings

The following example transaction shows how the stock record balances change as a result of postings to the stock record on trade date, value date and actual settlement date.

On 3 January 2022, ABC Investment Bank's trading book number 1 purchased 20,000 shares in XYZ for Client A at £11.30 per share, for value 7 January 2022.

ABC's settlement agent is Euroclear. The trade does not settle, however, until 10 January 2022. On trade date, the stock record balances are as follows:

ABC Investment Bank plc			
Stock record balances for 3 January 2022			
Instrument: XYZ Ordinary Shares			
Trade-Dated Balances			
Account Type	Account ID	Sign	Quantity

Book	Book 1	Long	20,000.00
Party	Client A	Short	20,000.00
Purchase and Sale Balance			0.00
Value-Dated Balances			
Account Type	Account ID	Sign	Quantity
Balance			0.00

This reflects the fact that Book 1 owns the shares and Client A owes them to the firm, but because value date has not been reached there is no value date balance.

On value date, 7 January 2022, the trade still has not settled, and the stock record balances now look like this:

ABC Investment Bank plc			
Stock record balances for 7 January 2022			
Instrument: XYZ Ordinary Shares			
Trade-Dated Balances			
Account Type	Account ID	Sign	Quantity
Book	Book 1	Long	20,000.00
Party	Client A	Short	20,000.00
Purchase and Sale Balance			0.00
Value-Dated Balances			
Account Type	Account ID	Sign	Quantity
Book	Book 1	Long	20,000.00
Party	Client A	Short	20,000.00
Balance			0.00

This reflects the fact that the trade has now reached value date and the shares are still owed to the firm by Client A. When the trade does settle, on 10 January, the stock record now looks like this:

ABC Investment Bank plc			
Stock record balances for 10 January 2022			
Instrument: XYZ Ordinary Shares			
Trade-Dated Balances			
Account Type	Account ID	Sign	Quantity
Book	Book 1	Long	20,000.00
Depot	Euroclear	Short	20,000.00
Purchase and Sale Balance			0.00
Value-Dated Balances			
Account Type	Account ID	Sign	Quantity
Book	Book 1	Long	20,000.00
Depot	Euroclear	Short	20,000.00
Balance			0.00

The stock record now reflects the fact that Client A no longer owes the firm the shares; instead, they are now held in its account at Euroclear.

The stock record may be used to identify, inter alia, the following:

1. **trade-dated book positions in securities of all types that require to be marked-to-market**
2. **value-dated book positions in bonds that need to have interest accruals calculated for them**
3. **the actual settled position in the depot, and**
4. **borrowing and lending opportunities.**

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **List the five activities that are commonly performed by the Financial Control Department (FCD) of a securities firm.**
   Answer Reference: Section 1

2. **List the usual functions of a corporate general ledger system.**
   Answer Reference: Section 2.1

3. **Why do derivative contracts need to be revalued at the end of each business day?**
   Answer Reference: Section 2.2.1

4. **What is the business reason for performing reconciliations between data held in the main settlement system and the corporate general ledger?**
   Answer Reference: Section 2.2.2

5. **List the seven basic categories into which all general ledger accounts are grouped, together with whether each category is normally expected to be a debit balance or a credit balance.**
   Answer Reference: Section 3.1.1

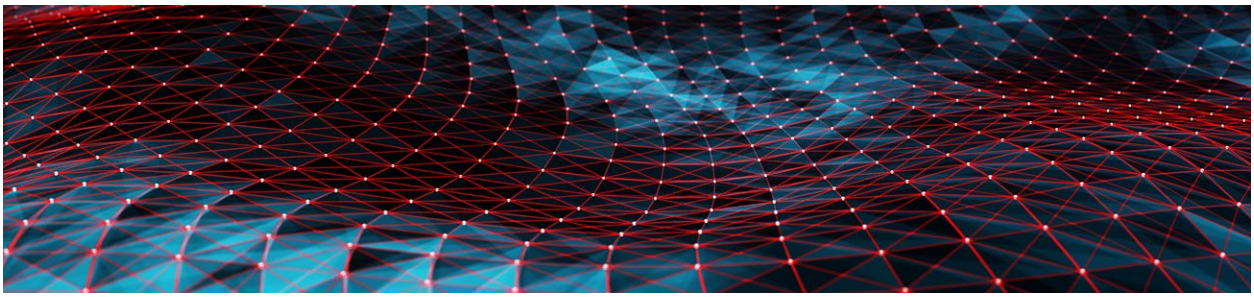
6. **How do we normally express the 'accounting equation'?**
   Answer Reference: Section 3.1.1

7. **List the information that you would expect to see on a general ledger report page, divided into reference data items, balance information items and transaction information items.**
   Answer Reference: Section 3.2

8. **Does holding a short position in a security create a debit balance or a credit balance in the general ledger?**
   Answer Reference: Section 3.2.1

9. **Define an account selection explosion table – what is it that it allows Finance Department users to control?**
   Answer Reference: Section 3.2.2

10. **On which date (trade, value or settlement) is the depot position updated in the stock record?**
    Answer Reference: Section 4.2



Chapter Eight
Technology Management

Section 1	Technology Infrastructure
Section 2	Measuring Performance and Managing Risk
Section 3	The Management and Support of Applications
Section 4	Disaster Recovery (DR), Business Continuity Planning (BCP) and Operational Resilience
Section 5	Change Control
Section 6	Technology Risk

This syllabus area will provide approximately 8 of the 50 examination questions

1.Technology Infrastructure

This section deals with the technology architecture concepts of a typical investment firm.

1.1 Strategy and Organisation Structure

8.1.1 Know the typical roles and responsibilities within the technology department

8.2.1 Know the importance of ensuring a firm's technology strategy matches the corporate strategy

1.1.1 The Importance of a having a Defined Technology Strategy

Before diving in the detail of how a firm needs to manage it Technology, it is important to understand how Technology fits within the overall firm and its strategy.

At the top level, each firm should have a corporate strategy which will set a future vision with a set of interim steps leading towards it. For example a firm could set a vision of increasing its Asset Under Management (AUM) by £40 billion after four years and with annual interim steps of increasing AUM £10 billion each year to met this vision.

Beneath this corporate strategy, each department and function within the firm will set their own strategy to support this vision. For example sales will need to work out to obtain the increased AUM, operations will need to support the increased business volumes, customer support will need to determine how they could support a large increase in customers and so on.

One of these departments will be Technology who will need to develop a strategy containing the following areas:

- **It is important ensure the infrastructure (namely, hardware, applications, networks, data centre, clouds, etc) can support the strategy**
- **Suitable applications will need to be in place to support the corporate strategy. This may mean new applications being rolled out, old applications being decommissioned and existing applications being upgraded.**
- **Technology functions should look at encouraging and supporting innovation within the organisation. This could cover the identification of new and emerging technologies (eg, AI, blockchain, IoT) that could help support the corporate strategy.**
- **As data is so important to Firms, then arrangements will need to be put in place for data Management covering data governance, quality, storage, and accessibility.**

- **A suitable framework to cover cybersecurity and risk management will need to rolled out. This should include threat detection, incident response, recovery plans, policies, industry stadnards and overall governance.**
- **A management structure will also need to be put in place around IT Management (eg, decision-making, accountability, performance and change management) as well ensuring there processes in place for staff development, budget management and vendor oversight.**

1.1.2 Technology Organisational Strategy

Roles and structure will vary between firms depending on the size of the firm concerned, and on factors such as whether the firm operates from a single location or multiple locations, whether it operates globally or in just a single country, and how many individual business units it has. However, the following roles are likely to be found in most organisations, although the reporting lines may vary significantly from the examples in this workbook.

Head of Information Technology (or Information Systems)
This individual is often known as the Chief Information Officer (CIO) or sometimes a Chief Technology Officer (CTO). This is usually a board-level appointment. The CIO manages all the other staff of the division, and sets the company's technology strategy (in conjunction with the rest of the business). All the following positions would usually report to the CIO.

Head of Production Support
This individual reports to the CIO and is usually responsible for the provision of all server and desktop facilities to all users and for the day-to-day running and support of the production (or live) systems.

The following positions normally report to this individual:

- **Database administrators (DBAs) – the role of the DBAs is to:**
    - **develop and enforce database standards, guidelines, operational policies and procedures**
    - **review physical structures**
    - **review performance, maintenance and utilities associated with each structure**
    - **review necessary storage media**
    - **review SQL (Structured Query Language, see section 1.2.4) performance and tuning**
    - **review applications' access to the database structures**
    - **review back-up and recovery strategies**
    - **review, where required, the purge/archive criteria**
    - **monitor database/subsystem performance issues**

    - review migration plans and be responsible for promoting database changes into production.
- Help desk analysts – the tasks involved in this position are discussed in more detail in section 3.2.

Head of Development and Implementation
This individual reports to the CIO and is usually responsible for the commissioning of new applications. These applications may be developed internally, developed for the firm by others, or purchased as packages. The following individuals normally report to this position:

- Business analysts – responsible for discovering and documenting the business processes (current and target) as well as business requirements requirements.
- Application designers/Solution architects – responsible for designing the systems to meet the needs of the business as documented by the business analysts.
- Programmers (or developers) – responsible for writing the application code as specified by the application designers.

Head of Testing
This individual reports to the CIO and is responsible for testing new software releases and implementing change control procedures. Change control procedures are described more fully in section 5.4 of this chapter, and the testing process is described in chapter 9.

The following individuals normally report to this position:

Test analysts – responsible for designing and performing any testing that needs to be performed and reviewing the results.

Head of Change
This individual reports to the CIO although some organisations now have this role reporting to somebody outside the technology group (such as the Chief Operating Officer). Regardless, they are responsible for managing major change programmes and individual projects. They often run matrix teams, pulling in staff from development and testing teams as well as the business lines. The processes that are used to govern these activities are described in more detail in chapter 9, where the roles of the individuals reporting to this position will be examined in detail. These roles include:

- programme managers, and
- project managers.

Head of Business Continuity and Recovery
This individual reports to the CIO and is responsible for managing the company's business recovery plans, which are described in section 4 of this chapter. Although this role is

shown as part of the technology department in this workbook, it should be noted that in many firms this individual's reporting line may be to another board member.

Head of Information Security (or Chief Information Security Office (CISO))
This individual reports to the CIO and is responsible for the overall direction of all security functions associated with applications, voice and data communications and computing services within the firm. The holder must be aware of the implications of the EU's General Data Protection Regulation (GDPR) and previously the Data Protection Act 1998 (DPA) in the UK, or equivalent other countries.

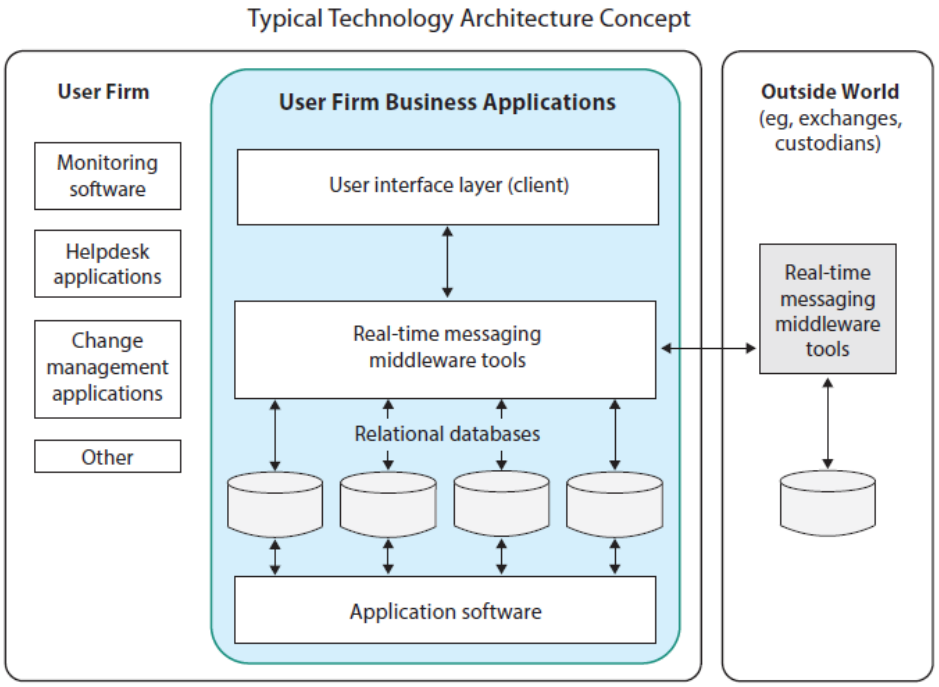
1.2 Technology Infrastructure

8.3.1 Know the typical building blocks of a technology infrastructure

8.4.1 Understand the roles and uses of relational databases, distributed systems and real-time messaging

8.15.1 Understand the challenges of separate systems

The technology infrastructure of a typical financial services firm may be summarised by the following diagram.



The user firm has a number of business applications (eg, settlement, dealing, financial accounting and so on). The majority of them are based on the architecture shown above.

Developing, maintaining and operating a firm's own technology infrastructure is just one of the models employed within the industry, and is typically implemented by large firms who feel they have a competitive advantage in running their own systems. However, there are a variety of other models ranging from a partial outsource to a full outsource, and some firms have no technology infrastructure at all because they outsource development to specialist software vendors and their infrastructure is maintained by specialist hardware providers.

1.2.1 Client

This is the component where users interact with the systems, eg, where users input data or view enquiries. Very commonly, it is a laptop or PC running just an internet browser (often called a 'thin client'), or a 'fat client', which is a PC on which an application other than a browser is installed. However, some systems (eg, Bloomberg) have dedicated terminals other than PCs, while older systems may still use 'green screens'. In addition, some applications have front ends that can be run on mobile phones and tablets.

1.2.2 Application

This component holds the actual programs for processing. It is sometimes called the logic engine or business rules. It will hold the rules for the system, eg, it will validate a trade, create a customer, obtain a customer's details and so on.

1.2.3 Middleware/Real-Time Messaging Layer

This component consists of software products that distribute and obtain real-time data to and from other parties. 'Other parties' could mean internal systems or external systems (such as banks, clearing houses, SWIFT and external emails).

1.2.4 Database

A database consists of an organised collection of data, eg, customer standing data, holding information, prices.

There are various models of databases (eg, the hierarchical model and the network model) – but the most common by far is the relational database. (However, Object Oriented Databases (OODBs) are becoming increasingly popular because they can cater for massive data sets which are required for newer technologies such as big data (see chapter 9, section 6.3)).

A relational database contains a number of tables and relationships between them. A table normally represents a data item (eg, customers, holdings and transactions). The relationships determine how the tables are linked together. For example, a dealing system will hold customers, holdings and trades. Therefore, three tables would be created – one each for customer, holding and trade. The relationships would be as follows: a trade must have a holding and a holding must have a customer. In effect, it will not be possible to a create a trade without a holding or a holding without a customer.

Each table is split into rows (or records). Each row represents a specific actual data item. For example, on the table, an individual row would be created for each actual customer.

Each row contains a number of columns (or fields). Each column represents an individual data item. For example, on the customer table, columns would exist for the customer name, address, post code, telephone number. For the transaction table, columns will exist for trade date, settlement date, asset ID, value, nominal, commission and so on.

The standard method to interface with relational databases is using Structured Query Language (SQL). There are SQL statements to obtain, insert, update and delete rows from tables – as well as creating, deleting and altering tables and columns.

However, there are various software products that can be purchased that allow non-technical users to develop reports over a database (without the need to write complex SQL programs). The most common relational database products are ORACLE, IBM's DB2, Sybase (now owned by SAP), Microsoft's SQL-Server and the open-source product MySQL (which is now owned by ORACLE).

Examples of Using SQL

1. **Creating a customer**
   a. **The user will enter the customer information into the 'Create Customer' screen within the 'Customer' component.**
   b. **The information entered will be passed to the 'Application' component.**
   c. **The 'Application' component will then check that all the data entered is correct and present – eg, a name has been entered, or an address has been entered.**
   d. **If anything is missing, then the 'Application' component will pass an error back to the 'Customer' component which will display a suitable message for the user (eg, 'Customer name must be entered')**
   e. **If everything is valid, then the 'Application' component will pass data to the 'Database' component which will then insert a row into the relevant table(s).**
   f. **The 'Application' component may also pass data to the 'Middleware' component which will send an email to the customer notifying them of their new details.**
2. **Entering and matching a trade**
   a. **The user will enter the trade into the 'Enter Trade' screen within the 'Customer' component.**

b. The information entered will be passed to the 'Application' component – and this component will check the data entered is correct and present, eg, an asset has been entered, valid dates have been entered.
c. If anything is missing, the 'Application' component will pass an error back to the 'Customer' component which will display a message for the user (eg, 'Invalid Asset ID').
d. If everything is valid, then the 'Application' component will pass data to the 'Database' component to create an unmatched trade row on the 'Trade' table. It will also pass data to the 'Middleware' component which will pass details externally to the relevant matching service.
e. Some time later, the matching service will pass details back on whether or not the trade has been matched to the 'Middleware' component. It will then pass details to the 'Application' component which will then pass them on to the 'Database' component which will update the relevant row on the 'Trade' table.

The 'Database' and 'Application' components are normally deployed on servers. A server machine is a high-performance host that is usually dedicated to running one or more server programs and shares its resources.

Many mission-critical applications may be deployed as distributed systems. A distributed system is a configuration which contains a number of hardware elements that are connected by some transmission technology. Such systems consist of a number of executing programs which interact with each other via transmission lines. Many of the computers in a distributed system act as clients to servers.

There are many reasons for implementing a system in a distributed fashion:

1. **To ensure that processing power is as close to the users as possible.**
2. **To ensure a high degree of robustness, for example, via the use of data replication.**
3. **To enable hardware to be easily added as the resource demands of the applications running on the distributed system start increasing.**

There are many problems facing the designer of a distributed system, including predicting the performance of a particular design, keeping all the clocks in the system synchronised, and ensuring that, if a hardware element of the system malfunctions, users are, at best, only affected in a minimal way. Distributed systems have been in existence since the 1970s, but they were mainly closed systems confined to a physical location, such as a building. The rise of the internet has meant that many distributed systems are open to the world. This has given rise to a major problem: ensuring that such systems are secure. The best-known distributed system is the comparatively simple World Wide Web, which consists of a very large number of clients running browsers and a large number of web servers.

Data replication is the process of sharing information so as to ensure consistency between redundant resources, such as software or hardware components, to improve reliability, fault-tolerance, or accessibility. Data replication can be implemented either by storing the same data on multiple storage devices, or by executing the same computing task many times on different devices, in which case it is known as 'computation replication'.

In addition to the business applications themselves, firms will deploy systems such as help desk systems, change management systems and performance monitoring systems to monitor the health of the business applications. These tools are also usually based on relational database technology.

1.2.5 The challenges of separate systems

From reading the above section on the building blocks of a technology infrastructure, it would be easy to obtain to think that technology infrastructures are simple, clean and plug together seamlessly. However, the situation is often far from this. But in reality, most technology infrastructures are a 'patch quilt' of different systems covering:

- **A range of different systems covering a breadth and overlapping range of different business functions (which have to be integrated). Some of the systems could be "End User Applications" such as spreadsheets or local databases.**
- **Some of these systems are supported by in-house staff with others supported by a variety of vendors.**
- **Some of the systems will run on different operating systems, require different databases and will be written in different languages (including outdated languages such as COBOL).**

Therefore this creates several different challenges for the Technology function

- **Supporting all of these systems will require a wide range of skills covering**
  a. the different technologies in place but also
  b. having superior vendor management skills. This is costly and requires a large amount of management attention.
- **It may be necessary to employ offshored and/or outsourcing firms to support older technology**
- **Likewise, there will be a large overhead for operating system, application and database upgrades.**
- **The complexity of the infrastructure will create challenges regarding cyber-security and scalability.**
- **Also as newer technologies (such as Artificial Intelligence) are rolled out then it will be challenging to integrate them robustly, quickly or cheaply.**
- **Finally, if there are any major projects (say BREXIT or MiFID-II) then it could involve a large number of system upgrades are changes.**

1.3 Remote Working and the Coronavirus (COVID-19) Pandemic

While this is not often seen as part of a firm's technology infrastructure, it is definitely worth mentioning due to (a) the massive impact on firms' technology and operational models as well (b) the impact on firms' employees.

In March 2020, the majority of firms had to move almost immediately to a remote or hybrid working model due to the coronavirus (COVID-19) pandemic and associated regional and national lockdowns.

This caused a number of issues for firms and their staff. There was the crucial technology issue around firms needing to ensure their remote-working infrastructure could support remote working for nearly all their staff, as well as managing the other problems this presented such as cyber risks. Firms also had to run complex operating models across multiple sites, cope with social distancing if people had to work from physical offices, manage remote teams, and ensure that the policies and support systems were in place to cope with staff issues such as increased family stress, home schooling and reduced mental well- being.

Following the pandemic, firms are now implementing varying types of hybrid operating models to cope with the array of staff requirements, as well as having to be more operationally flexible in order to cater for similar such occurrences.

2. Measuring Performance and Managing Risk

8.5.1 Understand the technology governance relating to: measuring technology performance; managing change; benefits realisation

This section deals with the techniques and processes that the technology department employs to manage the daily business activities of the investment firm. In managing day-to-day operations, the department seeks at all times to minimise operational risk. Let us first remind ourselves of the seven operational risk events that were identified by the Basel Committee (described in chapter 2) and examine how poor technology practice can increase operational risk, while good practice can mitigate it:

1. **Internal fraud – misappropriation of assets, tax evasion, intentional mismarking of positions and bribery. These activities can be facilitated by practices that allow, inter alia, unauthorised access to applications and underlying data. They may be mitigated by the use of application password control, deployment of systems that support the concept of segregation of duties and full audit checking.**
2. **External fraud – theft of information, hacking damage, third-party theft and forgery. As for (1) above, but in addition, these problems can be mitigated by the deployment of measures such as anti-virus software, anti-spyware, firewalls and remote access controls.**
3. **Employment practices and workplace safety – discrimination, workers, compensation, employee health and safety. There are no specific technology-related issues to this event; it is a company-wide issue.**
4. **Clients, products, and business practice – market manipulation, anti-trust, improper trade, product defects, fiduciary breaches and account churning. 'Product defects' in this context includes defects in the software and hardware that are used to process the firm's data. Good technology practice involves the use of standardised, reliable methodologies to discover and document business requirements, select software vendors and packages, build, test and deploy software and manage projects. It also involves the use of configuration management and change control procedures to ensure that the right software versions are deployed.**
5. **Damage to physical assets – natural disasters, terrorism and vandalism. See (6).**
6. **Business disruption and systems failures – utility disruptions, software failures and hardware failures. These risks may be mitigated by proper Business Recovery Plans, which are examined in section 4. Software failures may also arise as a result of product defects (Basel II Event no.4).**
7. **Execution, delivery, and process management – data entry errors, accounting errors, failed mandatory reporting and negligent loss of client assets. These events, in turn, may be caused by product defects.**

Generally, the governance of the risk management of information technology can be divided into two categories within securities companies:

- **maintaining 'business as usual' activity, and**
- **introducing business change.**

The maintenance of 'business as usual' activity is the responsibility of operations. Operations in this context includes many business areas, including technology, settlements and finance. Therefore, Operations will keep track of a number of metrics and commitments with the business in order to continuously assess risk. In support of this structure, a number of technology owners may contribute to the underlying data that is being assessed and be asked to participate in regular status update calls throughout the business day.

For the introduction of 'business change', projects are often initiated at the request of the business and carried out in parallel to production activities. On a day-to-day basis, those supporting production are not often concerned about the progress of ongoing business change initiatives that are in the pipeline. However, if there is a critical issue with production and a business change is required immediately or during major deployment activities, the two differing governance structures of business as usual and business change work closely together. Typically, business change teams meet with a frequency sufficient to ensure that the delivery is on track, and the frequency increases as the go-live date approaches.

2.1Maintaining 'Business as Usual' Activity

To manage the risk of maintaining adequate day-to-day systems within the technology function, operational procedures need to be put in place to manage, control and escalate risks and issues.

Some areas of risk management within the business as usual activity are as follows:

- **Ensuring that business applications and the configurations that run them are stable, and are able to cope with normal business volumes.**
- **Recording deficiencies in the design or operation of systems that support the firm's activities and maintaining documentation of the workarounds to keep the process in control.**
- **Protecting the organisation from system security issues such as unauthorised access.**
- **Ensuring system development keeps pace with rapidly evolving user requirements.**
- **Ensuring that systems integrate effectively, minimising manual intervention and data integrity issues.**

2.2 Introducing Business Change

By definition, the introduction of business change means that the way that business is done at a future date is going to change. Business change is usually delivered by a project or programme (a collection of related projects); the day that the business change occurs is known as the 'go live' date.

When a business change initiative is planned, it is necessary that there is an adequate governance structure to ensure that those impacted by the change have had an

opportunity to communicate their assessment of the risks and impacts on their areas and customers.

Risks that need to be managed when delivering business change within the technology function include:

- **aligning technology strategy with the business strategy**
- **aligning the solution to the strategic business drivers**
- **managing and monitoring risks of introducing the change to the business**
- **providing visibility of risks and issues to responsible stakeholders**
- **risk of over- (and under-) spend**
- **risk of 'reinventing the wheel' – ie, implementing duplicate systems**
- **delivery risk – ie, delivering late, or not delivering what is required**
- **complexity risk – ie, the end solution becomes so complex that it increases cost and impacts delivery**
- **scope expansion risk – ie, the scope grows and grows (also known as 'scope creep'), and**
- **managing external parties, eg, clients or suppliers.**

The securities industry existed before information technology. It should be noted that the way that operational risk is managed within the information technology function is not different from how it is managed within operations, financial control, legal or compliance functions. Therefore, the CISI's Managing Operational Risk in Financial Institutions qualification is an exam that should be taken by those wishing to understand how risks are identified, measured, assessed, reported and mitigated.

2.3 'Change as Usual'?

Some people now argue that these traditional demarcations of 'business as usual' and 'change' are too simplistic. Because we live and work in such a rapidly changing world, firms ought to be managed to deal with constant change, or 'change as usual'. Proponents of this theory point out that, in this century, financial services firms have had to deal with a series of major changes that have been imposed from outside, one after the other. These have included Basel II, Basel III and the Markets in Financial Instruments Directive (MiFID II), and in the next few years will include new regulatory changes, as well as changes caused by new technologies, products, new services, rising customer expectations and Brexit Given the scope of this seemingly never-ending series of changes, to talk of 'business as usual' is an oversimplification.

2.3.1Benefits Realisation

Proponents of the 'change as usual' concept argue that an important step in the project life cycle which is often ignored is measuring whether or not a change programme or project has actually achieved the benefits that were intended.

This means that, for any new project:

- **the intended benefits of that project must be documented and clearly understood at the outset, and agreed by senior management**
- **they should be expressed in financial terms if possible, ie, the expected return on investment should be measurable or, better still, quantified**
- **the identities of the business units that will enjoy these benefits must be known at the outset, and**
- **as part of the change plan, time and resources must be set aside to measure whether these intended benefits were or were not, in fact, achieved.**

3. The Management and Support of Applications

3.1 Data Security

8.6.1 Understand the importance of cyber security

3.1.1 The Importance of Cyber Security

Cyber security involves the methods and processes used to protect computer systems' hardware, software and data from:

- **damage**
- **theft**
- **unauthorised use, and**
- **disruption.**

Due to the asset management industry's massive reliance on technology (for trading, settlement, maintaining client data, remote access, and outsourcing), this area is important for technology managers and their teams.

Therefore, technology managers are under increasing pressure to ensure they have implemented sufficient and robust cyber security safeguards to ensure sufficient protection.

Cyber security is now recognised as such a critical issue that many firms have individuals or teams and significant budgets dedicated to monitoring and maintaining cyber security. A serious breach of cyber security could cause a firm significant financial loss and arguably worse still for the 'trusted advisers' – huge reputational damage.

3.1.2 Types of Threat

There is a wide range of threats. These are documented below.

Hacking is the process of gaining unauthorised access to computer systems for the purpose of stealing and/or corrupting data.

Hacking is sometimes a highly technical and sophisticated process, but can be very low tech in nature. The journalists employed by the News of the World who hacked mobile phones, mainly guessed the PIN numbers of their victims – they did not need any advanced technology. Neither did Chelsea Manning, the US soldier who was arrested in May 2010 on suspicion of having passed 250,000 diplomatic cables, and 500,000 army reports to the 'whistleblowing' website WikiLeaks. Manning was convicted for a large number of offences under the US Espionage Act and sentenced to 35 years in prison (although in January 2017 President Obama commuted all but four months of her remaining sentence). According to the evidence in her trial, Manning simply burned the stolen files onto a CD using her office computer and walked out with the CD in her pocket.

The main criminal purposes of hacking are to facilitate identity fraud and cyber espionage. Successful phishing expeditions, the installation of malware, the creation of Botnets and the instigation of Distributed Denial of Service (DDoS) attacks – these terms will be explained in this chapter – are, therefore, all forms of hacking.

There are various types of hacking techniques and some of them are detailed below. It is important to note that some of them are very similar.

Identity fraud, which is more commonly known by the less accurate name of identity theft, is the process of stealing personal information, such as name and address details, kinship information, dates of birth, bank account and credit card details, passport information, driving licence information and computer system passwords, so that the criminal is able to pose as the person or organisation whose identity has been stolen.

The direct victim of this type of fraud may be the financial institution itself, and/or its customers. Some of the software applications that are involved in this type of crime will be described later in this section. It is important to realise that many of these tools also have

legitimate uses, and this creates problems in identifying, immobilising and removing them.

The purpose of cyber espionage is to steal valuable and often confidential information about products, services, patents, designs and other intellectual property. The UK Ministry of Defence has publicly stated that defence companies in particular face cyber attacks almost daily, often from nation states, seeking to steal sensitive information about new technology and weapons. Companies in other industries, such as financial institutions, might become targets if they have valuable intellectual property that gives them a competitive advantage.

Malware (short for malicious software) is software which is designed to gain surreptitious access to computer systems in order to disrupt normal operations or gather private information that may be used illegally.

Normal operation of a computer or network may be disrupted by hacking or by a DDoS attack.

Spyware is software that gathers information about a person or organisation without their knowledge, and may send such information to a third party. Most spyware is installed by using deceptive tactics (such as bundling itself with desirable software). When the user navigates to a webpage controlled by the spyware author, the page contains code which attacks the browser and forces the download and installation of spyware.

Spyware's presence is typically hidden from the user and can be very difficult to detect. Spyware can collect almost any type of data, including personal information such as internet surfing habits, user logins and bank or credit account information. It can also interfere with user control of a computer by installing additional software or in changing computer settings, which can result in slow internet connection speeds, unauthorised changes in browser settings or changes to software settings.

Phishing is a very specific type of cybercrime designed to trick users into disclosing personal financial details. Cybercriminals will create a fake website that looks just like a bank's website (or any other website where online financial transactions are conducted). They then try to trick users into visiting this site and typing in confidential data, such as login IDs, passwords or PINs. Typically, cybercriminals send out large numbers of emails containing a hyperlink to the fake site.

Ransomware is another increasingly common threat. It involves a criminal blocking access to a system, threatening to publish personal/private data or threatening to destroy systems unless a ransom is paid.

Scamming is a low-tech alternative to phishing and is usually carried out by phone. The caller simply invents a plausible story to persuade the recipient to disclose confidential

information (such as bank details) that belongs to either the target itself or to customers of the target.

Viruses, Worms and Trojans

A computer virus is a software program that can copy itself and infect multiple files on an individual computer as well as spread from one computer to another. Worms are considered to be a subset of viruses. A worm is a computer program that replicates, but does not infect, other files. Instead, a worm installs itself once on a computer and then looks for a way to spread to other computers.

A Trojan virus, or 'Trojan horse virus', is a computer program that appears to be legitimate but actually results in unauthorised access to the victim's computer files. For a malicious program to accomplish its goals, it must be able to run without being detected, shut down, or deleted. Therefore, it is often disguised as something normal or desirable so that users may willingly install it without realising it. In broad terms, a Trojan horse is any program that invites the user to run it, concealing harmful or malicious code. The code may take effect immediately and can lead to many undesirable effects, such as deleting the user's files or installing further harmful software.

One of the most common ways that spyware is distributed is as a Trojan, bundled with a piece of desirable software that the user downloads from the internet. When the user installs the software, the spyware is installed along with it. Spyware authors may include an end-user license agreement that states the behaviour of the spyware in loose terms which users may not read or understand.

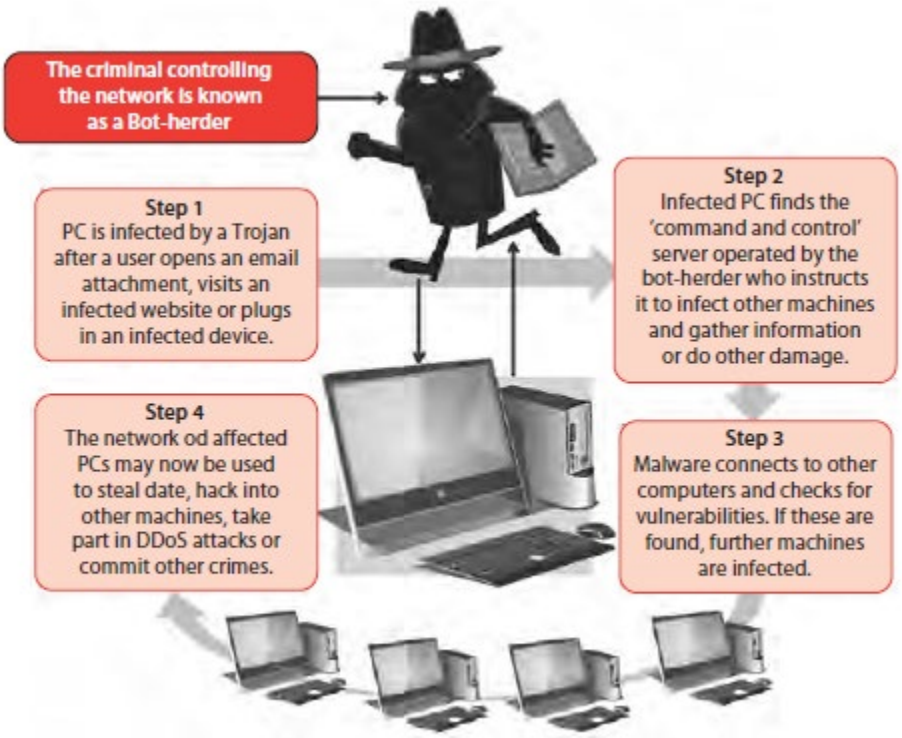
Keylogging and Form Grabbing

Keystroke logging, often referred to as 'keylogging', is the action of recording (or logging) the keys struck on a keyboard, typically in a covert manner so that the person using the keyboard is unaware that their actions are being monitored. It has legitimate uses in studies of human-computer interaction and in software testing, where a set of keystrokes can be recorded in order that the exact keystrokes can be repeated in later tests. However, criminals often install keylogging applications as viruses or Trojans on computers in order to capture personal details.

Form grabbing is software that has the same purpose as illegal keystroke logging – it intercepts data submitted to web browsers, collects it before it passes over the internet and can pass it to criminals.

Botnets

A botnet is a network of computers controlled by cybercriminals using a Trojan or other malicious program. This diagram illustrates how a botnet is established:



Distributed Denial of Service (DDoS) Attacks

A denial-of-service attack (DoS attack) or distributed denial-of-service attack (DDoS attack) is an attempt to make a machine or network resource unavailable to its intended users. It generally consists of efforts to temporarily, or indefinitely, interrupt or suspend services of a host connected to the internet, usually by bombarding that host with a very large number of requests to the extent that the server is unable to fulfil genuine user requests at all or only after unacceptable delays.

The victims of these attacks are usually sites or services hosted on high-profile web servers, such as banks, credit card payment gateways, large e-commerce companies and computer security databases. The motives for instigating DDoS attacks vary. Sometimes, the motive is pure vandalism or sometimes the motive is political. In 2013, there were DDoS attacks against most of the retail banks in the Netherlands, and these have been linked to political protest against alleged tax evasion by these banks. In 2010, there were attacks on Amazon, PayPal and MasterCard made by a group called 'Anonymous'. This group stated that it made these attacks in retaliation when these companies withdrew services from WikiLeaks as a result of the leaking of classified US government files by WikiLeaks. This type of politically motivated hacking has become known as 'hacktivism'.

Revenge by disgruntled employees may also be a motive for some attacks, others are believed to be instigated by unscrupulous competitors, and criminals may use DDoS to prevent the target company informing affected customers that their security has been breached.

The attack itself may be instigated by a network of infected computers involved in a botnet, but it is possible to launch an attack from a single computer – 17 different methods of launching such attacks have been identified.

3.1.3 Prevention and Detection

The following steps are recommended:

1. **Conduct an impact analysis of the systems the firm is using. Establish which of them are most likely to be attacked, and if they are attacked, what the likely consequences would be (eg, financial loss to the firm itself, financial loss to customers or others, reputational damage, regulator sanctions). Concentrate efforts on protecting those parts of the infrastructure where the likelihood of attack is high, and the consequences are most severe.**
2. **Staff training – Ensure that all staff are trained in basic security measures, such as keeping passwords private and regularly changing them, taking care of portable devices, recognising phishing and scamming, and taking care of customer information; and train technical staff in the use of anti-hacking software and hardware, such as vulnerability scanners and encryption software. Be aware of the 'insider threat'. The Bradley Manning case has shown that a disgruntled employee can steal vast quantities of sensitive data from what was supposed to be one of the most secure environments in the world – the US Army.**
3. **Personal devices and portable devices – Increasingly, staff are demanding to be able to connect their own personal devices, such as smartphones and tablets, to corporate networks. When these devices are connected, employ software products that scan and check these devices for malware. Portable hardware is, of course, easy to lose or steal, so make sure that any sensitive data that is downloaded to such machines is encrypted.**
4. **Be open and approachable in any dealings with online customers. Use effective tools such as one- time password hardware to control access to networks by customers, and let them know how they can contact you if they have spotted a potential threat. Test all new releases of e-commerce software for security breaches. If you e-mail customers, always greet them by name. Phishers will not know your customer names unless they have already stolen your client data. If you are offering contactless payment systems, then try to encourage users to install anti-virus applications on their devices and to password-protect their smartphones.**
5. **Install vulnerability scanners to assess computers, networks and applications for weaknesses. A number of types of vulnerability scanners are available which are distinguished from one another by a focus on particular targets, such as ports, applications and databases. While functionality varies between the different types of scanners, they share a common, core purpose of identifying and recording the vulnerabilities identified in each target. These scanning programs should identify all entry points from the internet into the internal network of the company. Any attack to the network needs to start from these points. Identifying these entry**

points, however, is not at all an easy task. Some firms have used the services of 'ethical hackers' who have taken special network security training to perform this task successfully.

6. **Identify where firewalls (systems that control the incoming and outgoing network traffic by analysing the data packets and determining whether they should be allowed through or not, based on a rule set) are needed, configure them correctly and keep them up-to-date. If a firewall is not configured properly, it can act like an open door for any intruder. Hence, it is vitally important to set the rules to allow traffic through the firewall that is important to the business.**
7. **Encryption – identify what data needs to be encrypted and encrypt it. The problem is that a single enterprise might use several dozen different, and possibly incompatible, encryption tools, resulting in thousands of encryption keys – each of which must be securely stored, adequately protected and reliably retrievable. Encryption key management is the administration of tasks involved with protecting, storing, backing up and organising encryption keys. High-profile data losses and regulatory compliance requirements have spurred a dramatic increase in the use of encryption in the enterprise. There are now a number of encryption key management standards and products available to firms.**
8. **Keep anti-virus software up-to-date and periodically benchmark it against competing products. There are a number of websites that provide benchmarking services. In response to the emergence of malware, software vendors such as Norton, McAfee and Kaspersky have developed applications which:**
   a. provide real-time protection by scanning all incoming network data for malware and blocking any threats it detects, and
   b. detect and remove any malware products that have already been installed onto the computer by inspecting the contents of the registry, operating system files, and installed programs, and removing items which match a list of known malware. Many anti-malware applications are able to detect some software keyloggers and quarantine, disable or cleanse them. However, because keylogging programs may be being used legitimately, anti-spyware software sometimes fails to label malicious installations as malware. As a result, anti-keylogger software has been specifically designed to handle this problem. The primary difference between this type of application and conventional anti-virus software is that an anti-keylogger does not make a distinction between a legitimate keystroke-logging program and an illegitimate keystroke-logging program (such as a virus); hence, legitimate keylogging applications, if any are installed, will be immobilised or deleted by these applications.
9. **Ensure physical security – You need to think about the physical security of your organisation. Unless your organisation has full security, any intruder can simply walk into your office premises to gain whatever information they want. Hence, as with technical security, you must also ensure that the physical security mechanisms of your organisation are fully functional and effective.**
10. **Perform attack and penetration tests: These can identify those vulnerable points in the network that can be easily accessed from both external and internal users. After**

identifying these points, you would be able to thwart attacks from external sources and correct the pitfalls that could become the entry points for intruders to hack into your network. The test must be done from both the internal as well as external perspectives to detect all the vulnerable points. Specialist organisations can be employed to perform 'pen tests'. This should include frequent tests to ensure that all staff are aware of the many different forms of cyber attack.

11. **The importance of regular and thorough testing based on the results of the impact analysis cannot be over-stated.**
12. **Defensive responses to DDoS attacks typically involve the use of a combination of attack detection, traffic classification and response tools, aiming to block traffic that they identify as illegitimate and allow traffic that they identify as legitimate. Firewalls can be set up to have simple rules, such as to allow or deny protocols, ports or IP addresses. In the case of a simple attack coming from a small number of unusual IP addresses for instance, one could put up a simple rule to drop all incoming traffic from those attackers. More complex attacks will, however, be hard to block with simple rules such as this.**

Across a securities company there will be dozens, if not hundreds, of applications that need to be supported. To have an initial concept of the importance of managing and supporting these applications, one should appreciate that some of these applications are critical to the operational effectiveness of an organisation.

3.2 Cataloguing the Applications

8.7.1 Understand the concept of management and support of applications

An effectively managed help desk is a prerequisite for minimising operational risk. If the help desk is being established for the first time, then the following information needs to be collated. This type of information is often known as an 'infrastructure catalogue', and includes full details of all:

- **Users the help desk supports – key details include:**
  - **name, department, telephone number, email address and physical location**
  - **normal working hours and working days.**
- **Applications the help desk supports – key details include:**
  - **name of application**
  - **details of its role in the business**
  - **name and full contact details of the organisation that is responsible for supporting it. Note that this may be the firm's technology department, or an external vendor. If it is an external vendor, then full details of any service level agreements (SLAs) need to be available to the help desk**

    - technical details – is it a PC application such as Word or Excel, or is it a web-based application that does not require installation in a user PC, or is it a client-server application employing a database? If it is a client-server application, what database is used, and what specific servers does it run on?
    - any requirements for specific version numbers for database and operating system software
    - hours during the day and days of the week on which there is expected to be activity. If there is a great deal of night-time activity in this application, then the desk will need to hold out-of-hours contact details, and perhaps rotas for support staff who may need to be contacted at home
    - an assessment as to how critical the loss of this application for an extended period would be to the business
    - licence details – such as the number of simultaneous users, scope of use and volume limits
    - details of who supports the application, ie, whether it is a third-party application or an in-house application
- Hardware the help desk supports – key details include:
    - locations of all servers and routers (especially if they are not in the same location as the business areas)
    - whether they are used for development, production, testing or disaster recovery
    - which applications are running on each server.

Once the infrastructure catalogue has been built up, technology management needs to decide:

- which applications are 'critical' to the business
- which applications need to be supported 'around the clock' on normal working days and which need to be supported for shorter periods
- which applications need to be routinely supported at weekends and on public holidays.

3.3 Managing the Help Desk

8.8.1 Understand the function of service (help) desks and follow-the-sun model

3.3.1 Help Desk Functions

As part of its 'business as usual' activity, the department will normally need to set up a help desk to handle requests for assistance from its users. In a large organisation, these

requests will cover a very wide range of topics, which may be divided into the following categories.

- **Planned administrative or preventative maintenance activities, such as:**
  - **provide a new user with a PC and/or appropriate software to run on that PC and/or usernames and passwords to run software applications**
  - **move one or more PCs or servers or other hardware items within the office**
  - **upgrade an item of hardware or software at an agreed date in the future, including the latest antivirus software.**
- **Unplanned emergency activities, such as:**
  - **an item of hardware or an application is not performing correctly and needs to be fixed to enable the user to continue normal daily operations**
  - **an item of hardware or software has failed in the recent past and action needs to be taken to recover from the problems that were created.**

Such requests are often referred to as 'issues'. The role of the help desk is, therefore, to:

1. **receive issues from users**
2. **prioritise them**
3. **pass them to the appropriate individuals for action**
4. **monitor whether the issue has been actioned to the satisfaction of the requestor, and:**
   - **if they have, to close the issues**
   - **if they have not, to escalate them to management**
5. **provide a database of 'Frequently Asked Questions' (FAQs) that can be used by help desk staff in the future to deal with common queries, and**
6. **provide statistical and trend reports to management about the number of issues, and the severity of issues that are recorded:**
   - **by different business units**
   - **for different applications.**

If 'round-the-clock support' is required, then what is the best way to achieve it? The following models are commonly used:

- **'Follow-the-Sun' – this model is widely used by firms that have operations in more than one time zone, and users accessing the same applications and servers from different countries. During normal European working hours, support for all users worldwide is provided from a European location. When Europe closes, support moves to a North American support centre, and when North America closes, support is handled by an Asian support centre.**
- **Extended working hours – this model is widely used when a firm is doing business in a single time zone, but is using applications that are working throughout the day and night. A single help desk works in shifts. One shift coincides with normal**

working hours for the majority of the users, and is more heavily manned than the other shift, which deals only with emergency calls.

- Partial outsourcing – if the number of out-of-hours calls are expected to be very few in number but may be critical, then overnight manning of the help desk could be outsourced to a third-party specialist firm.

3.3.2 Recording and Actioning Issues

In many firms, issues are now recorded directly into a help desk management system by the users affected. Such systems have business rules that allow for the automatic logging of issues by the user concerned, and also:

- provide a pre-defined series of issue types, priority codes, applications and environments for the reporting user to select from
- based on the input into these pre-defined lists, automatically assign the problem to the correct individual or section
- provide facilities for the section dealing with the issue to respond to the requestor by automated email when the issue has been actioned
- provide facilities for the responder to provide details of the time spent dealing with a particular problem, and
- provide facilities for issues of a particular type to follow a particular workflow pattern. For example, an issue that requires a software enhancement needs to be directed to:
    - a business analyst – to decide what the software change needs to be, then
    - a developer – to make the change, then
    - a test analyst – to test the change, then
    - the user who reported the issue – to sign it off.

Because help desk activities are essentially collaborative, many help desk management systems now incorporate social networking capabilities, and, increasingly, such applications are now based in 'the cloud'. These concepts are discussed more fully in chapter 10.

The illustration below shows an example of an issue that has been entered into a help desk management system by a user:

As soon as the user makes the entry in the help desk system, the assignee will receive an email informing them of the new issue. Depending on the nature of the issue, the assignee will take one or more of the following actions:

1. Action it immediately.
2. Diarise it for action at a later date.
3. Respond to the user with requests for clarification.
4. Delegate it to another individual.

5. **Provide an estimate for the effort required to handle the issue.**
6. **Split the issue into two or more issues, or create sub-issues.**
7. **Attach further documents to the issue.**

The assignee records each action taken in the help desk system, and each time they make an entry an email is automatically generated to the requestor informing them of the current state of the issue. Sometimes, there are online screens that permit users to track their outstanding issues.

3.3.3 Service Level Agreements (SLAs) and Key Performance Indicators (KPIs)

8.9.1 Know the purpose of service level agreements (SLAs) and key performance indicators (KPIs) (internal and external)

In its role in managing the help desk, the technology department often enters into SLAs with its users and third parties.

An SLA is that part of a service contract in which a certain level of service is agreed upon. 'Level of service', in this context, refers to both the quality of the service and the time deadlines for performing the service. It may also specify penalties to be paid by either party if the level of service provided fails to reach the minimum standards in the agreement for an extended period of time.

The SLA is a fundamental tool from the perspective of both the supplier and the recipient in provision of a service. The quality of the service level agreement is a critical matter as it defines the relationship between all concerned parties.

The SLA itself must be of sufficient detail and scope in relation to the service being offered and the scale thereof. Typical SLA sections are as follows:

- **introduction (parties, signatures, service description)**
- **scope of work (service hours, support)**
- **performance levels**
- **tracking and reporting (content, frequency)**
- **problem management (change procedures, escalation)**
- **compensation and service credits (in the event that service levels are not being met)**
- **customer duties and responsibilities**
- **warranties and remedies**
- **security**
- **intellectual property rights and confidential information**
- **legal compliance and resolution of disputes, and**
- **termination and signatures.**

'Internal SLAs' are agreements set out between two groups within the same organisation, while 'external SLAs' involve external parties. Some securities companies provide a service to an external customer where they are assessed on their compliance with the SLA, while other securities companies might outsource some of their non-essential business to an external vendor who is able to provide an agreed service.

An SLA sets out the expectations of both parties and the method for escalation, if and when issues arise. The SLA should also identify which metrics need to be provided, how they should be reviewed and the consequences or escalation required when certain limits are met or breached. These metrics or key performance indicators (KPIs) are often categorised into areas of supportability, recoverability, durability, performance, reliability, functionality, scalability, and flexibility.

The metrics, or KPIs, for a given system or suite of systems that support a business line might be presented in a dashboard to give a health evaluation of the technology systems supporting the business. Where an area is below what is expected, it will be given a low mark or highlighted by an alert.

Examples of measured values that might be included in a dashboard include:

- **availability of the application over a length of time (downtime measurement)**
- **transaction speeds**
- **response times**
- **functional errors reported by the system, or**
- **average number of users or transactions.**

Dashboards can be used to initiate discussion around business strategy and ongoing investment required to support the business. Service level management (SLM) is the management of SLAs to ensure that they are up to date and current. The goal of SLM is to maintain and gradually improve the services that are being provided through a continuous cycle of monitoring, reporting and agreeing on new targets during periodic reviews.

3.3.4 Support Call Prioritisation

8.10.1 Understand prioritisation levels and the responsibilities of support teams

Support teams are often tiered in order that an appropriate resource is assigned to work on relevant incidents. From the perspective of the person with the problem, an appropriate resource might be seen as a person with experience or appropriate specialisation to deal with an incident. An incident will get escalated, based on its urgency, severity or impact. Incidents might also get escalated if they are not resolved within an agreed amount of time. Typically, the service level agreement will outline what metrics need to be recorded and how incidents should be assessed and escalated.

The typical responsibilities of teams providing technology services are as follows:

Level 1 – Help Desk
The level 1 resource is responsible for:

- **receiving, recording, prioritising and tracking service calls**
- **ensuring that SLA time targets are met**
- **monitoring and status-tracking of all incidents**
- **escalation and referral to other parts of the organisation**
- **first line support, and**
- **closing incidents with confirmation from the requestor.**

If the solutions documented in the repository do not resolve the incident, it is assigned to level 2.

Level 2 – Analyst
The core aspects of an incident should have been obtained by the help desk. If incidents can be easily answered by looking at the problem report management database, they will be sent by level 2 to level 1 with instructions to contact the customer and resolve. Incidents entered by the help desk which do not have the core aspects filled in will also be sent by the analyst back to the help desk for completion. This allows level 2 resources to focus on the analysis of new problems rather than re-investigating known solutions, or those with incomplete information that might lead to a known solution.

Incidents that cannot be resolved by the level 2 resource are then escalated to level 3. When problems previously escalated to the third level return to the analysts, the solution needs to be edited to ensure that it is clear for the purposes of the user and stripped of any internal comments amongst the support lines.

Level 3 – Service Specialists
Service specialists should normally be hidden from the user, letting the analysts handle interaction with the users. Knowing the identity of the level 3 service specialist of the day should not be necessary for the second-level support, as second-level resources should have an internal mechanism to escalate to the right person via impersonal email accounts or service boxes. When a specific problem with a service has been identified, the service specialists (level 3) should inform level 2 (analysts) of problem repercussions and the likely timescale for returning to a normal production environment.

Any major anticipated system changes should be announced by the service specialists to the users and the second level analysts on a timescale according to the relevant rules, together with the documentation, tools and assistance to handle any additional questions.

The time for service incidents being satisfied should be recorded and any incidents that took an unacceptable amount of time to be resolved might need to be recorded in a specific report to be reviewed by level 4 management.

Level 4 – Management
Through a series of review meetings, the operational aspects of the services being provided can be determined in terms of service level, statistics, issues from problematic cases and overall performance and resourcing. All outstanding escalated problems should be reviewed for status and to ensure that the problem is being given the correct amount of attention. Where one business area has had a greater number of recorded problems per week than deemed acceptable, then a review of support requirements within the business needs to be arranged.

4. Disaster Recovery (DR), Business Continuity Planning (BCP) and Operational Resilience

8.11.1 Understand the technology implications of disaster recovery (DR) and business continuity planning (BCP): planning; risk assessment; priorities for processing and operations; recovery strategies; data collection; written plan; testing criteria and procedures

8.12.1 Understand the technology implications of operational resilience

4.1 Definitions

Business continuity plans (BCPs) are concerned with ensuring that the firm is able to recover from an emergency such as utility disruptions, software failures and hardware failures – some of the key operational risk events defined in Basel II.

Disaster recovery (DR) is the process of regaining access to the data, hardware and software necessary to resume critical business operations after a natural or human-induced disaster. A disaster recovery plan (DRP) should also include plans for coping with the unexpected or sudden loss of key personnel. DRP is part of the larger process of BCP.

A 'disaster' could be any one or more of the following kinds of events, ranked by increasing severity:

1. **One or more of the applications that the firm uses to process its business is lost, either as a result of a major software or hardware failure. The failure is in one of the firm's own systems, and it is the only firm affected.**
2. **An external application on which the firm is dependent (such as one provided by an exchange or clearing house system or an information provider's system) is lost, either as a result of a software or hardware failure. Other user firms with which the firm trades are also dependent on this application.**
3. **The firm is the victim of an event such as fire, flood, or criminal or terrorist-related activity, and has lost access to one of its key buildings. Other neighbouring businesses may also be affected. In locations such as the City of London or downtown Manhattan, where there is a large concentration of investment firms, there is the likelihood that many of the firm's trading parties and critical suppliers may also be affected.**
4. **The firm is subject to a natural disaster. Hurricanes/typhoons and earthquakes are a major concern in Asia.**

Operational resilience – while most firms have had effective BCP and DR plans in place, this is an area that the regulators are very concerned about. Consequently, the Bank of England, the Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA) published (in March 2020) shared policy summaries and coordinated consultation papers on new requirements to strengthen operational resilience in the financial services sector.

The policy made is crystal clear that firms are expected to proactively take ownership of their operational resilience and treat it as a priority activity.

The proposals specifically stated that firms are expected to:

1. **identify their important business services that, if disrupted, could cause harm to consumers or market integrity, threaten the viability of firms or cause instability in the financial system**
2. **set impact tolerances for each important business service, which would quantify the maximum level of disruption they would tolerate**
3. **identify and document the people, processes, technology, facilities and information that support their important business services, and**
4. **take actions to be able to remain within their impact tolerances through a range of severe, but plausible, disruption scenarios.**

Consequently, with firms almost 100% reliant on technology, these new regulatory operational resilience demands have increased the role and implications for technology functions to ensure that firms have effective and efficient BCP and DR plans.

4.2 The Disaster Recovery Planning Process

A disaster recovery plan is a comprehensive statement of consistent actions to be taken before, during and after a disaster. The plan should be documented and tested to ensure the continuity of operations and the availability of critical resources in the event of a disaster.

The primary objective of disaster recovery planning is to protect the organisation in the event that all (or part) of its operations and/or computer services are rendered unusable. Preparedness is the key.

The planning process should minimise the disruption of operations and ensure some level of organisational stability and an orderly recovery after a disaster.

Other objectives of disaster recovery planning include:

- **providing a sense of security**
- **minimising the risk of delays**
- **guaranteeing the reliability of standby systems**
- **providing a standard for testing the plan**
- **ensuring there is a clear communicative plan in the event of an issue, and**
- **minimising decision-making during a disaster.**

The methodology is described below.

4.2.1 Obtain Top Management Commitment

Top management must support and be involved in the development of the disaster recovery planning process. Management should be responsible for coordinating the disaster recovery plan and ensuring its effectiveness within the organisation. Some organisations now nominate a senior member of management (such as the CIO) to be responsible for DR and BCP planning.

Adequate time and resources must be committed to the development and frequent testing of an effective plan. Resources could include both financial considerations and the effort of all personnel involved.

4.2.2 Establish a Planning Committee

A planning committee should be appointed to oversee the development, testing and implementation of the plan. The planning committee should include representatives from all functional areas of the organisation. Key committee members should include the

operations manager and the data processing manager. The committee should also define the scope of the plan and the frequency of the tests.

4.2.3 Perform a Risk Assessment

The planning committee should prepare a risk analysis and business impact analysis that includes a range of possible disasters, including natural, technical and human threats.

Each functional area of the organisation should be analysed to determine the potential consequence and impact associated with several disaster scenarios. The risk assessment process should also evaluate the safety of critical documents and vital records.

Traditionally, fire has posed the greatest threat to an organisation. Intentional human destruction, however, should also be considered. The plan should provide for the worst-case situation: destruction of the main building.

It is important to assess the impact and consequences resulting from loss of information and services. The planning committee should also analyse the costs related to minimising the potential exposures.

In December 2006, the FSA published its 'Business Continuity Management Practice Guide' (BCMP Guide) which is available from its website (www.fca.org.uk). Among its recommendations for leading practice in this area are the following:

1. Planning considers wide area destruction involving significant loss of staff.
2. Local authority and emergency services plans are taken into account by the firm.
3. Procedures that are agreed with the firm's insurers are included in the plans.

4.2.4 Establish Priorities for Processing and Operations

The critical needs of each department within the organisation should be carefully evaluated in such areas as:

- functional operations
- key personnel
- information
- processing systems
- service
- documentation
- vital records, and
- policies and procedures.

Processing and operations should be analysed to determine the maximum amount of time that the department and organisation can operate without each critical system.

Critical needs are defined as the necessary procedures and equipment required to continue operations should a department, computer centre, main facility or a combination of these be destroyed or become inaccessible.

A method of determining the critical needs of a department is to document all the functions performed by each department. Once the primary functions have been identified, the operations and processes should be ranked in order of priority: essential, important and non-essential.

4.2.5 Determine Recovery Strategies

The most practical alternatives for processing in case of a disaster should be researched and evaluated. It is important to consider all aspects of the organisation, such as:

- **facilities**
- **hardware**
- **software**
- **communications**
- **data files**
- **customer services**
- **user operations**
- **end-user systems, and**
- **other processing operations.**

Alternatives, dependent upon the evaluation of the criticality of each application, may include:

- **Hot sites – an approach to maintaining system availability whereby all transactions are routinely written to the production server and the standby server at different locations simultaneously. The standby server is therefore ready to take over the processing load instantaneously, should there be any failure in the production system.**
- **Warm sites – implementing a range of automated procedures to maintain same data on the two servers in the different locations. Typically, this involves some form of automatic synchronisation between the databases, such as is provided by 'log shipping'. Log shipping essentially consists of automating and integrating the process of backing up, copying and restoring the database from the primary server to the secondary server. This maintains the secondary server's database as an identical copy of the primary server's database apart from a small time latency of between 5 and 15 minutes.**
- **Cold sites – a cold standby server is a spare server at a standby location that is configured similarly to the primary server and is running the same version of the operating system, database and application software, with all the same service packs applied. If the primary server suffers a failure then the SQL database is**

restored to the secondary server from the primary's back-up files. The back-up files may not be totally up-to-date, for example, they may have been made the previous evening, so there may be a large amount of data that needs to be re-entered. This means that there may be a delay of a few hours before service is restored.

Written agreements for the specific recovery alternatives selected should be prepared, including the following special considerations:

- **contract duration**
- **termination conditions**
- **testing**
- **costs**
- **special security procedures**
- **notification of systems changes**
- **hours of operation**
- **specific hardware and other equipment required for processing**
- **personnel requirements**
- **circumstances constituting an emergency**
- **process to negotiate extension of service (including clear roles and responsibilities)**
- **guarantee of compatibility**
- **availability**
- **non-mainframe resource requirements**
- **priorities, and**
- **other contractual issues.**

4.2.6 Perform Data Collection

Recommended data-gathering materials and documentation include:

- **back-up position listing**
- **critical telephone numbers**
- **communications inventory**
- **distribution register**
- **documentation inventory (covering recovery procedures as well as normal business as usual (BAU) procedures)**
- **equipment inventory**
- **forms inventory**
- **insurance policy inventory**
- **main computer hardware inventory**
- **master call list**
- **master vendor list**
- **microcomputer hardware and software inventory**
- **notification checklist**
- **office supply inventory**

- **off-site storage location inventory**
- **software and data files back-up/retention schedules**
- **telephone inventory**
- **temporary location specifications, and**
- **other materials and documentation.**

It is extremely helpful to develop pre-formatted forms to facilitate the data-gathering process.

4.2.7 Organise and Document a Written Plan

An outline of the plan's contents should be prepared to guide the development of the detailed procedures. Top management should review and approve the proposed plan. The outline can ultimately be used for the table of contents after the final revision. Other benefits of this approach are that it:

- **helps to organise the detailed procedures**
- **identifies all major steps before the writing begins**
- **identifies redundant procedures that only need to be written once, and**
- **provides a 'road map' for developing the procedures.**

A standard format should be developed to facilitate the writing of detailed procedures and the documentation of other information to be included in the plan. This will help ensure that the disaster plan follows a consistent format and allows for ongoing maintenance of the plan. Standardisation is especially important if more than one person is involved in writing the procedures.

The plan should be thoroughly developed, including all detailed procedures to be used before, during and after a disaster. It may not be practical to develop detailed procedures until back-up alternatives have been defined.

The procedures should include methods for maintaining and updating the plan to reflect any significant internal, external or systems changes. The procedures should allow for a regular review of the plan by key personnel within the organisation.

The disaster recovery plan should be structured using a team approach. Specific responsibilities should be assigned to the appropriate team for each functional area of the company.

The structure of the contingency organisation may not be the same as the existing organisation chart. The contingency organisation is usually structured, with teams responsible for major functional areas such as:

- **administrative functions**

- **facilities**
- **logistics**
- **user support**
- **computer back-up**
- **restoration, and**
- **other important areas.**

The management team is especially important because it coordinates the recovery process. The team should assess the disaster, activate the recovery plan, and contact team managers and third-party suppliers. The management team also oversees, documents and monitors the recovery process. Management team members should be the final decision-makers in setting priorities, policies and procedures.

Each team has specific responsibilities that must be completed to ensure successful execution of the plan. The teams should have an assigned manager and an alternative in case the team manager is not available. Other team members should also have specific assignments where possible.

4.2.8 Develop Testing Criteria and Procedures

It is essential that the plan be thoroughly tested and evaluated on a regular basis (at least annually). Scenarios to be tested and testing procedures should be documented. The tests will provide the organisation with the assurance that all necessary steps are included in the plan. Other reasons for testing include:

- **determining the feasibility and compatibility of back-up facilities and procedures**
- **ensuring the plan is realistic**
- **identifying areas in the plan that need modification**
- **providing training to the team managers and team members**
- **demonstrating the ability of the organisation to recover, and**
- **providing motivation for maintaining and updating the disaster recovery plan.**

4.2.9 Test the Plan

After testing procedures have been completed, an initial test of the plan should be performed by conducting a structured walk-through test. The test will provide additional information regarding any further steps that may need to be included, changes in procedures that are not effective, and other appropriate adjustments. The plan should be updated to correct any problems identified during the test. Initially, testing of the plan should be done in sections and after normal business hours to minimise disruption to the overall operations of the organisation.

Types of tests include:

- **checklist tests**
- **simulation tests**
- **parallel tests**
- **full interruption tests, and**
- **cross-industry tests involving suppliers and customers.**

Key recommendations about testing in the FCA's BCMP Guide include:

1. **Critical suppliers are involved in tests at least annually.**
2. **The firm should be prepared to supply evidence of its testing to its own customers, suppliers and regulators.**

To facilitate these recommendations, most exchanges and clearing houses offer their customers facilities to test whether their back-up facilities are able to communicate successfully with the providers' own systems.

4.2.10 Approve the Plan

Once the disaster recovery plan has been written and tested, the plan should be approved by senior management. It is senior management's ultimate responsibility that the organisation has a documented and tested plan. Management is responsible for:

- **establishing policies, procedures and responsibilities for comprehensive contingency planning, and**
- **reviewing and approving the contingency plan annually, documenting such reviews in writing.**

If the organisation receives information processing from a service bureau, management must also:

- **evaluate the adequacy of contingency plans for its service bureau**
- **ensure that its contingency plan is compatible with its service bureau's plan, and**
- **approve the budget for the DR test.**

4.2.11 Update the Plan

Whenever new applications are deployed, old applications retired, new business units opened or existing units closed, the plan will require updating. Depending on the nature of the change, it may be necessary to repeat some or all of the steps described in this chapter.

4.3 Conclusion

Disaster recovery planning involves more than just off-site storage or back-up processing. Organisations should also develop written, comprehensive disaster recovery plans that address all the critical operations and functions of the business. The plan should include documented and tested procedures which, if followed, will ensure the ongoing availability of critical resources and the continuity of operations. The plan must be updated whenever any change is implemented within the organisation.
The probability of a disaster occurring in an organisation is highly uncertain. A disaster recovery plan, however, is similar to liability insurance: it provides a certain level of comfort in knowing that, if a major catastrophe occurs, it will not result in financial disaster. Insurance alone is not adequate because it may not compensate for the incalculable loss of business during the interruption, or the business that never returns.

5. Change Control

8.13.1 Understand the importance of change control procedures

5.1Definition

One of the responsibilities of the department is to release new software and new hardware into the configuration. Changes may be required as a result of process improvement or bug fixes. New releases sometimes cause as many problems as they are designed to solve, and change control procedures are an essential method of minimising this type of risk.

Change control procedures are processes designed to prevent software or hardware from being amended without control, auditability and review of the impact by all interested parties. There are two aspects to change management: the use of version control systems to control access to items that need to be changed; and the development of procedures that ensure that only authorised changes are made to software or hardware items.

5.2 Symptoms of Poor Change Control

Symptoms of poor change control practices include:

- **The latest version of the source code cannot be found.**
- **A difficult defect that was fixed at great expense suddenly reappears.**
- **A developed and tested feature is mysteriously missing.**
- **A fully tested program suddenly does not work.**
- **The wrong version of the code was deployed.**
- **The wrong version of the code was tested.**
- **There is no traceability between the software requirements, documentation and code.**
- **Programmers are working on the wrong version of the code.**
- **The wrong versions of the configuration items are being used as the baseline.**
- **No one knows which modules comprise the software system delivered to the customer.**

5.3 Version Control Systems (VCSs)

Version control systems (VCSs) are software applications that manage multiple revisions of the same unit of information. In particular, they:

1. **prevent more than one developer working on a change to a program or other software object at the same time (without the other developer knowing)**
2. **ensure that when a program or other object is selected for modification, there is an audit trail of who is modifying it, and**
3. **ensure that the modifications are being made to the right version of the program.**

In the event that the wrong version of an object is released, these applications provide the ability to 'roll back' to a prior version.

Because version control and change management are essentially collaborative activities, many version control systems now incorporate social networking capabilities and, increasingly, such applications are now based in the cloud. These concepts are discussed more fully in chapter 10.

5.4 Software Change Control Procedures

Implementing version control software on its own is not enough to guarantee effective change control. Firms also need to develop appropriate 'change control procedures' – business practices that are designed to:

- **allow changes to accepted work products to be proposed and evaluated, schedule and quality impact assessed, and the changes approved or rejected for release into production systems in a controlled manner**
- **provide a mechanism for management to accept and sign off changes that improve the product overall while rejecting those that degrade it**
- **notify all parties materially affected by a proposed revision of the need to accept the new version**
- **notify interested parties on the periphery of development regarding change proposals, their assessed impact, and whether the changes were approved or rejected, and**
- **facilitate efficient and controlled deployment of changes to environments where they are required.**

Many firms hold periodic (often weekly in the case of large organisations with complex configurations) change control meetings to ensure that these aims are achieved. The participants will include representatives of all the business areas affected. Change control meetings may be guided by a change management policy. For example:

1. **Many firms do not allow any major changes to critical systems in the last four weeks of their financial year, in order that the production of their annual accounts is not destabilised because of problems with new software.**
2. **Many firms do not allow any major changes applied to critical systems in the last week of any accounting month. This is to avoid destabilising the preparation of the bank's monthly accounts.**

6. Technology Risk

8.14.1 Understand the nature and management of technology risk

6.1What is Technology Risk?

As it is possible to gather from the other parts of this workbook, the technology configuration used by investment firms consists of various layers of complexity:

- **Firstly, it consists of multiple in-house or third-party systems integrated together to support various business functions (such as trading, settlement and post-trade compliance).**

- **Layered on top of this is the need to integrate externally with industry platforms (such as SWIFT or Euroclear), clients (for order entry and reporting) and data providers (for prices and other market data).**
- **Additionally, several firms outsource various business functions like the data centre, fund accounting, transfer agency and client reporting.**
- **Finally, many firms employ spreadsheets and other manual processes that use the data from the core technology configuration. These are developed to bridge the gap in functionality when firms' main systems cannot perform all of the functions required.**

This complexity creates a business risk because (a) the configuration is costly and complex to run and maintain on a day-to-day basis and (b) the complexity means making changes to the configuration is challenging.

This risk is always increasing because there is a constant need for the technology configuration to cater for new products, more accurate and timely data, new and more complex regulation, changing customer needs as well as the need to keep costs down.

6.2 How can Technology Risk be Managed?

It is essential that this business-critical risk is managed and mitigated.

This can be done by implementing solid and robust governance in the following areas:

- **management of applications (see section 3)**
- **implementing solid processes for DR and BCP (see section 4)**
- **employing solid and rigorously reinforced change control process (see section 5)**
- **implementing an organisation-wide business change process (see chapter 9).**

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **List all the things that a technology department can do to mitigate the risks of internal and external fraud.**
   Answer Reference: Section 2

2. **What are four of the risks that need to be managed when introducing business change?**
   Answer Reference: Section 2.2

3. **What is cybersecurity and why is it important to firms?**
   Answer Reference: Section 3.1.1

4. **What is a Botnet?**
   Answer Reference: Section 3.1.2

5. **List the possible actions that the receiver of an issue might do when an issue is routed to them through a help desk management system.**
   Answer Reference: Section 3.3.2

6. **What are the usual responsibilities of a team providing level 3 help desk support?**
   Answer Reference: Section 3.3.4

7. **What is the definition of disaster recovery and how does it differ from business continuity planning?**
   Answer Reference: Section 4.1

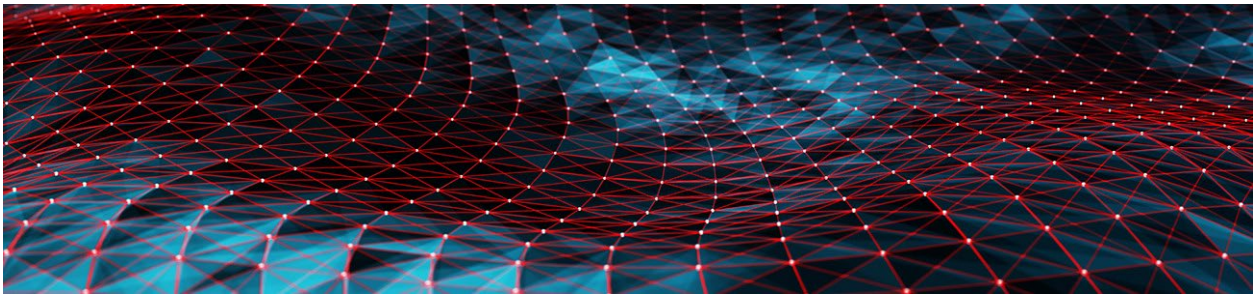
8. **List the symptoms of poor change control practice.**
   Answer Reference: Section 5.2

9. **What is the purpose of version control software?**
   Answer Reference: Section 5.3

10. **What is the purpose of software change control procedures?**
    Answer Reference: Section 5.4

11. **Why would a firm have a policy of not accepting major changes to software during the last few weeks of its financial year?**
    Answer Reference: Section 5.4

12. **What factors contribute to the amount of technology risk that firms experience?**
    Answer Reference: Section 6



Chapter Nine
Managing Business Change

Section 1 Introduction

Section 2 Software Development Life Cycles (SDLCs)

Section 3 Software Development Methodologies

Section 4 Project Management Methodologies

Section 5 Software Testing and Quality Assurance

Section 6 Disruptive Innovation

This syllabus area will provide approximately 6 of the 50 examination questions

1. Introduction

9.1.1 Understand the purpose and benefits of project planning and control

9.2.1 Understand the importance of project governance

This chapter deals with the processes and procedures that need to be put in place in an investment firm in order to minimise the risks of introducing business change.

Effective technology project governance is about ensuring that complex technology projects deliver the value expected of them, rather than being an expensive and embarrassing failure. An appropriate governance framework helps save money by ensuring that all expenditure is appropriate for the risks being tackled.

Project governance is important because, in the global information economy, technology-supported business project management and execution becomes fundamental to an organisation's survival. While successful ICT project delivery should improve competitive positioning, a failed project can place an organisation at a strategic disadvantage to its competitors, and is a source of operational risk.

Project governance is vital because:

- **It ensures that all external and internal roles and responsibilities are documented; in other words, ownership of projects and sub-roles is allocated.**
- **It provides a decision framework, eg, the programme board can only make certain decisions but other, less material, decisions can be delegated to sponsors, suppliers, project managers and so on. Therefore, if decisions need to be made, then clear guidance is provided on who can make these decisions.**
- **It provides a framework for reporting and tracking, eg, regular weekly reports, monthly programme board meetings and cost reports.**
- **It provides a framework to control and manage changes to a project (such as scope, cost and timeline) and to understand the impact this could have on the project in question as well as on other projects in progress across the firm.**
- **It provides a structure to manage resources (covering money, people and technology, for example) so that the organisation can focus on the most important and/or urgent change projects.**
- **Modern theory of project governance states that, for each programme or project, a senior executive should be appointed as the senior responsible owner (SRO). In some project management methodologies, the SRO may be known as the project sponsor. The SRO is the individual responsible for ensuring that a project or programme of change meets its objectives and delivers the projected benefits. They should be the owner of the overall business change that is being supported by the project. The SRO should ensure that the change maintains its business focus**

and has clear authority and that the context, including risks, is actively managed. This individual must be senior and must take personal responsibility for the successful delivery of the project. They should be recognised as the owner throughout the organisation.

An individual's responsibilities as an SRO should be explicitly included in their personal objectives and the individual should remain in place throughout the project or programme, or alter only when a distinct phase of benefit delivery has been completed.

The SRO should be prepared to take decisions, and should be proactive in providing leadership and direction throughout the life of the project or programme. They should be responsible for ensuring that the organisation can fully exploit the outcome of the change such that the benefits are delivered as a result of that outcome.

The SRO works with programme managers and project managers to develop and implement procedure and practices for project planning and control, and, where applicable, for software development. Some of the common approaches to these issues are discussed below.

2. Software Development Life Cycles (SDLCs)

9.3.1Understand the key stages of a software development life cycle (SDLC) including: project planning; feasibility study; systems analysis; requirements definition; systems design; code generation; development; integration and testing; acceptance, installation, deployment; maintenance

2.1Introduction

The software development life cycle (SDLC) is a standardised process of developing information systems or applications through the completion of defined steps or phases. Synonyms include Systems Development Life Cycle, Systems Implementation Life Cycle and Software Implementation Life Cycle.

The SDLC recognises the following factors:

1. **The further the project is from completion, the higher the risk and uncertainty. Risk and doubt decrease as the project moves closer to fulfilling the project vision.**

2. **Cost and resource requirements are lower at the beginning of a project, but grow as the project progresses. Once the project moves into the final closing process, cost and resource requirements again taper off dramatically. It is important for a project manager to be able to assess how much resource is actively working on their project (in terms of time or cost) so that this risk can be monitored.**
3. **Changes are easier and more likely at the early phases of the project life cycle than at the completion. Changes at the beginning of the project generally cost less and have lower risk than changes at the end of the project. Therefore, stakeholders need to be happy with project deliverables from the early phases, otherwise there is a risk that in the final phases of the project life cycle additional costs may need to be incurred.**

2.2 Standardised SDLC Approaches

There are a number of standardised versions of the SDLC, but many organisations have adapted their own versions. In the standardised UK version, known as the Systems Life Cycle (SLC), the following names are used for each stage:

1. **Terms of Reference – the management decides what capabilities and objectives it wishes the new system to incorporate.**
2. **Feasibility Study – this asks whether the management's concept of its desired new system is actually an achievable, realistic goal – in terms of money, time and end result. Often, it may be decided simply to update an existing system, rather than to replace one completely.**
3. **Fact-Finding and Recording – how is the current system used? Often questionnaires are used here, but also just monitoring (watching) the staff to see how they work is better, as people will often be reluctant to be entirely honest, through embarrassment, if merely asked about the parts of the existing system they have trouble with and find difficult.**
4. **Analysis – free from any cost or unrealistic constraints, this stage lets minds run wild as 'wonder systems' can be thought-up, though all must incorporate everything asked for by the management in the terms of reference stage.**
5. **Design – designers will produce one or more 'models' of what they see a system eventually looking like, with ideas from the analysis section either used or discarded. A document will be produced with a description of the system, but nothing is specific: eg, they might say 'touchscreen' or 'GUI operating system', but not mention any specific brands.**
6. **System Specification – having generically decided on which software packages to use and which hardware to incorporate, the plan now has to be very specific, choosing exact models, brands and suppliers for each software application and hardware device.**

7. **Implementation and Review – set up and install the new system (including writing any bespoke code required), train staff to use it, then monitor how it operates for initial problems, and then regularly maintain thereafter. During this stage, any old system that was in use will usually be discarded once the new one has proved it is reliable and usable.**
8. **Use – obviously, the system needs to be actually used by somebody, otherwise the above process would be completely useless.**
9. **Close – the last step in a system's life cycle is its end, which is most often forgotten when you design the system. The system can be closed, it can be migrated to another (more modern platform), or its data can be migrated into a replacing system.**

2.3 Adapting the SDLC for an Individual Organisation's Requirements

Section 2.2 describes the standard UK SDLC. However, many organisations have developed their own customised SDLCs to meet their own particular requirements. Some of these SDLCs, for example, put a great deal of emphasis on the early stages of the project, while some of them put emphasis on the later stages.

To some extent, the emphasis varies according to which software development methodologies the organisation uses. These are dealt with in section 3 of this chapter.

3. Software Development Methodologies

9.4.1 Understand the different software development methodologies including: waterfall methodologies; iterative/incremental methodologies; other methodologies

A software development process is a structure imposed on the development of a software product. There are several models for such processes, each describing approaches to a variety of tasks or activities that take place during the process, but the various models can be divided into three categories:

- **traditional or waterfall models**
- **iterative/incremental models, and**
- **other models.**

The key point to remember is that one approach or model is not necessarily better than another approach at the general level, but each approach has its own advantages and disadvantages and are, therefore, suited to different circumstances.

3.1 Waterfall Models

These ways of developing software divide the process into a number of sequential or linear phases, the first of which is requirements-gathering. They are based on the theory that no design or development should start until the requirements:

1. **have been gathered from the users**
2. **are fully understood by the designers**
3. **have been fully documented by the design team, and**
4. **these documents have been signed off by the users.**

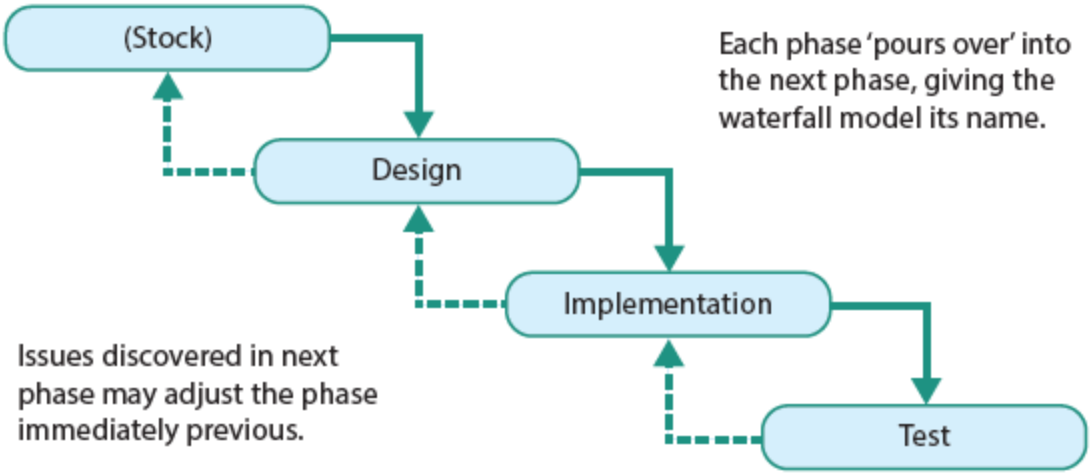
They, therefore, place great emphasis on the requirements-gathering process.

3.1.1 The Basic Waterfall Model

The waterfall model was the first methodology and is also known as the 'classic life cycle model' or 'linear sequence model'.

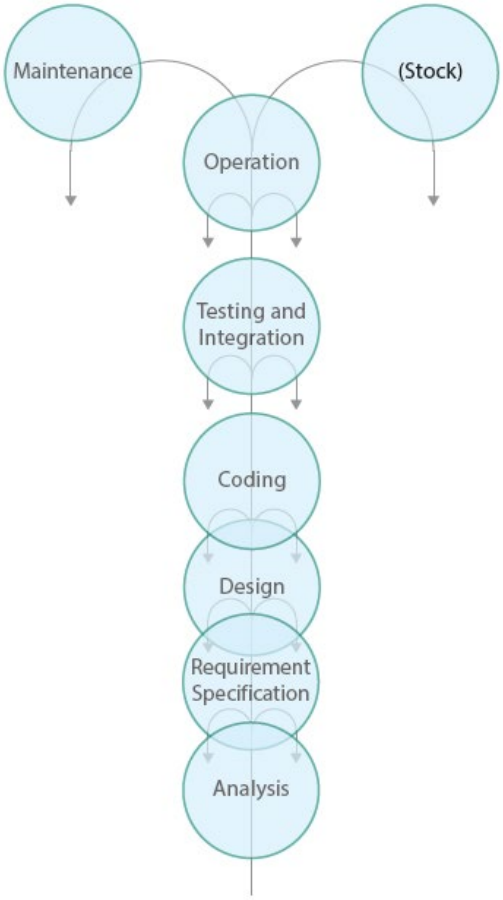
In the waterfall methodology, there are sequences of phases. Where there is a problem with the previous phase of delivery, the solution is returned to the previous phase and rework occurs before the waterfall continues. This is sometimes known as the 'implied waterfall model' or 'waterfall model with backflow'.

The model maintains that one should move to a phase only when its preceding phase is completed and perfected. The 'output' of each phase becomes the 'input' of the next phase. It assumes that software development is like constructing a building – starting with the foundations and then the walls, then the roof and so on. Phases of development in the waterfall model are discrete, and there is no jumping back and forth or overlap between them.



3.1.2 The Fountain Model

The fountain model recognises that there are opportunities for some phases of the life cycle to occur at the same time or to overlap. Overlap occurs between adjacent phases, and change control processes need to be effective to ensure that work is not undertaken on incorrect assumptions.



3.1.3 Drawbacks of Waterfall Methodologies

1. **The most prominent criticism revolves around the fact that, very often, customers or users do not really know what they want up front; rather, what they want emerges out of repeated two-way interactions over the course of the project. For this reason, the waterfall model, with its emphasis on upfront-requirements capture and design, is seen as somewhat unrealistic and linear, and therefore unsuitable for the complexities of the real world.**
2. **Given the uncertain nature of customer needs, estimating time and costs with any degree of accuracy (as the model suggests) is often extremely difficult. In general, therefore, the model is recommended for use only in projects which are relatively stable and where customer needs can be clearly identified at an early stage.**
3. **The model's implicit assumption is that designs can be feasibly translated into real products; this sometimes runs into problems when developers actually begin implementation. Often, designs that look feasible on paper turn out to be expensive or difficult in practice, requiring a redesign and hence destroying the clear distinctions between phases of the waterfall model.**

4. **Some critics also point out that the model implies a clear division of labour between, say, 'designers', 'programmers' and 'testers'; in reality, such a division of labour, in many organisations, is neither realistic nor efficient.**

Because of these criticisms, some organisations prefer to use iterative/incremental software methodologies.

3.2 Iterative/Incremental Models

Several different iterative/incremental models have been developed to overcome the drawbacks of the waterfall model.

'Incremental development' is a scheduling and staging strategy in which the various parts of the system are developed at different times or rates, and integrated as they are completed. 'Iterative development' is a rework scheduling strategy in which time is set aside to revise and improve parts of the system. A typical difference is that the output from an increment is released to users, whereas the output from an iteration is examined for further modification before release.

Common iterative/incremental models include the following:

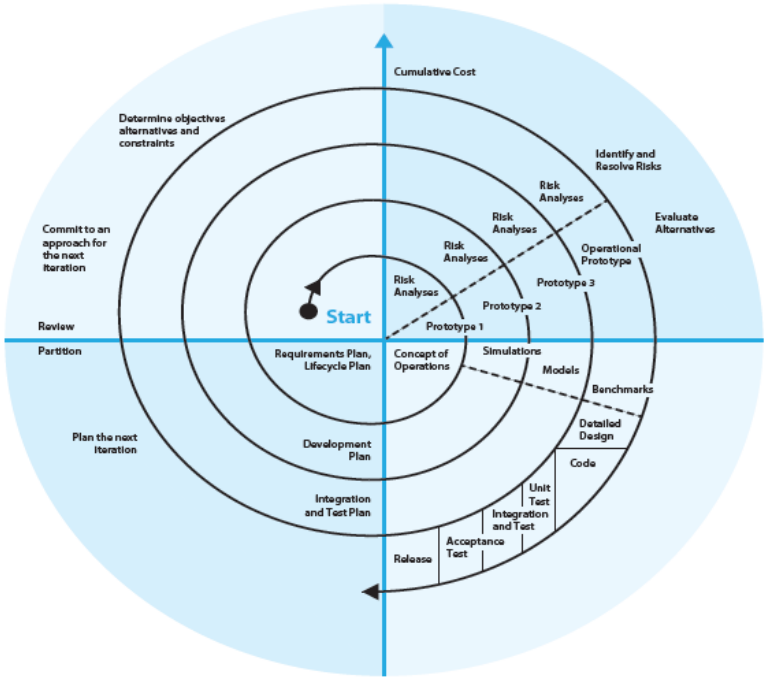
3.2.1 Prototyping

Prototyping' is the process of quickly putting together a working model (a prototype) in order to test various aspects of a design, illustrate ideas or features and gather early user feedback. Prototyping is often treated as an integral part of the system design process, where it is believed to reduce project risk and cost. Often one or more prototypes are made in a process of iterative and incremental development, where each prototype is influenced by the performance of previous designs; in this way, problems or deficiencies in design can be corrected.

When the prototype is sufficiently refined and meets the functionality, robustness, manufacturability and other design goals, the product is ready for production. The technology used to build the prototypes is not necessarily the same technology that is used to build the production system.

3.2.2 The Spiral Model

This model of development combines the features of the prototyping model and the waterfall model. The spiral model is intended for large, expensive and complicated projects. Graphically, the spiral model is represented by the following diagram:



The processes in the spiral model are as follows:

1. **The new system requirements are defined in as much detail as possible. This usually involves interviewing a number of users representing all the external or internal users and other aspects of the existing system.**
2. **A preliminary design is created for the new system.**
3. **A first prototype of the new system is constructed from the preliminary design. This is usually a scaled-down system, and represents an approximation of the characteristics of the final product.**
4. **A second prototype is evolved by a fourfold procedure:**
   - **evaluating the first prototype in terms of its strengths, weaknesses, and risks**
   - **defining the requirements of the second prototype**
   - **planning and designing the second prototype**
   - **constructing and testing the second prototype.**
5. **At the customer's option, the entire project can be aborted if the risk is deemed too great. Risk factors might involve development cost overruns, operating cost miscalculation, or any other factor that could, in the customer's judgment, result in a less-than-satisfactory final product.**
6. **The existing prototype is evaluated in the same manner as was the previous prototype, and if necessary, another prototype is developed from it according to the fourfold procedure outlined above.**
7. **The preceding steps are reiterated until the customer is satisfied that the refined prototype represents the final product desired.**

8. **The final system is constructed, based on the refined prototype.**
9. **The final system is thoroughly evaluated and tested. Routine maintenance is carried out on a continuing basis to prevent large-scale failures and minimise downtime.**

3.2.3 The Agile Model

The Agile Model is a family of methods (such as Scrum, Lean and Kanban), but they all have the same objective of minimising risk by developing a series of small packages of software in short amounts of time. Software developed during one unit of time is referred to as an iteration, which may last from one to four weeks. Each iteration is an entire software project, including planning, requirements analysis, design, coding, testing, and documentation. An iteration may not add enough functionality to warrant releasing the product to market, but the goal is to have an available release (without bugs) that is capable of being deployed at the end of each iteration. At the end of each iteration, the team re-evaluates project priorities.

The agile model emphasises face-to-face communication over written documents. The method produces very little written documentation relative to other methods. This has resulted in criticism of agile methods as being undisciplined. Further criticisms include:

1. **There is a lack of formal documentation of both the requirements and the project direction and controls.**
2. **The ultimate solution may 'drift' from the optimal solution. This also means that it is hard to plan a budget and project end date. This may be caused by the effect of a dominant personality on the team, or by the fact that the users have poorly formed ideas of their needs or struggle to make decisions.**
3. **Face-to-face communication can be difficult to implement on large projects, or on projects where the team members are geographically dispersed.**

For these reasons, agile software development is not usually recommended for:

- **large-scale projects involving more than 20 developers**
- **projects with mainly inexperienced developers**
- **projects where the development teams are geographically dispersed**
- **life-critical or mission-critical systems, or**
- **projects that have a time-critical deadline.**

Finally, there are several specific roles within all the Agile Methodologies, and it is worth noting them here for completeness:

- **Product (or system) owner – this is the most senior role in the group and is responsible for representing the stakeholders (or users) of the product as well as providing a steer on what needs to be done.**

- **Scrum master (or team lead) – this role is like a project manager by ensuring all activity is planned, tracked and coordinated.**
- **Team members – these are people who do most of the actual work. They are skill sets such as business analysts, developers, testers, and subject matter experts.**
- **Stakeholders – these are the users of the product (or system) that is being enhanced. They include internal users, customers, suppliers, and regulators.**

3.3 Other Commonly Used Models

3.3.1 Joint Application Development (JAD)

Joint application development (JAD) is a methodology that involves the client or end-user in the design and development of an application, through a succession of collaborative workshops called 'JAD sessions'.

3.3.2 Rapid Application Development (RAD)

Rapid application development (RAD) is a methodology that works on the basis that a prototype can quickly be constructed that looks and acts like the desired product in order to test its usefulness. During the requirements determination phase, the prototype is developed, sometimes using different tools for the proposed final product.

3.3.3 Build and Fix/Fix on Fail

Build and Fix/Fix on Fail is the method of modifying the code until the customer is happy. There is a substantial risk that consumed effort is undertaken without adequate planning and that users request 'fixes' which are actually enhancements, which can result in projects appearing to run indefinitely.

3.3.4 End-User Development (EUD)

End-User Development (EUD) (or End-User Computing (EUC)) is a set of activities or techniques that allows individuals, who are non-professional developers, to create or modify a software object. A typical example of EUD is macro-programming in applications such as Microsoft Excel™. End-user development is not limited to programming. Other examples of end-user development include the creation and modification of web pages and the use of applications such as Crystal Reports™ that allow users to create online and printed reports based on SQL queries.

End users may be able to employ their specialised business knowledge directly and quickly – they know the requirements and can implement them without having to explain them to developers.

However, there are often cases where the application's existence is either unknown to the technology department at all, or its place in the configuration is insufficiently understood. As a result, the application:

- **may not be included in the business continuity plan**
- **may not be fully tested**
- **may be forgotten about completely if a decision is made to outsource an aspect of processing**
- **may not be included in change control procedures, as a result of which a change may be made to another software product on which this application relies that destabilises this application**
- **may not be fully documented, or**
- **may become unsupportable if the staff member who developed it leaves the firm.**

3.3.5 Synchronise and Stabilise

Synchronise and stabilise (or sync and stabilise) is an SDLC in which teams work in parallel on individual application modules. There is a requirement for all teams to synchronise their code with the other teams regularly and debug or stabilise it regularly throughout the development process.

4. Project Management Methodologies

9.5.1 Know the following different methodologies used in technology delivery: PRINCE2; PMI; ISO

4.1 Introduction

Before we examine project management in more detail, let us first of all try to define a 'project'. Some commonly used definitions include the following:

1. **A temporary and one-time endeavour undertaken to create a unique product or service, which brings about beneficial change or added value.**

2. **A set of inter-related and controlled activities with start and finish dates, undertaken to achieve a unique objective conforming to specific requirements, including the restraints of time, cost and resources.**

The properties of being a temporary and one-time undertaking contrast with normal operations, which are permanent repetitive functional work carried out to create the same product or service over and over again. Because the objective is to bring about change, it is necessary to define the reasons for and extent of the change (the requirements); the resources that are available to make the change and the costs of those resources; and the date on which the change is required (the time constraint).

Project management, in turn, can be described as the discipline of organising and managing resources (eg, people) in such a way that the project is completed within defined scope, quality, time and cost constraints.

There are a number of generally accepted methodologies used by industry and governments to manage projects of all types – these methodologies are just as applicable to, say, the mounting of an important exhibition at an art gallery as they are to building and/or implementing new software in the financial sector. All of these methodologies are designed to reduce project risk, ie, the risks that the project may be delivered late, and/or over budget, and/or that it does not deliver the benefits that were expected of it.

The most commonly used methodologies are described below.

4.2 PRINCE2

PRINCE stands for Projects in Controlled Environments and is a management methodology covering the organisation, management and control of projects. PRINCE was first developed in 1989 by the Central Computer and Telecommunications Agency (CCTA), now part of the Office of Government Commerce (OGC), as a UK government standard for technology project management.

Since its introduction, PRINCE has become widely used in both the public and private sectors throughout the world. Although PRINCE was originally developed for the needs of technology projects, it has also been used on many non-technology projects. The latest version, PRINCE2, is a more generic, best practice approach for the management of all types of projects.

The method describes how a project is divided into manageable phases or stages, enabling efficient control of resources and regular progress-monitoring throughout. The various roles and responsibilities for managing a project are fully described and are

adaptable to suit the size and complexity of the project and skills of the organisation. The project's business case outlines the justification, commitment and rationale for the deliverables, while the project plan is product-based, which means that there is a focus on delivering results.

The PRINCE2 methodology provides a common language and structure for all interested parties involved in a project, and embodies proven and established best practice in project management. Good PRINCE2 practice encourages:

- **a controlled and organised start, middle and end**
- **regular reviews of progress against plan and of the business case**
- **built-in decision points**
- **management control of deviations from plan**
- **the involvement of management and stakeholders at the right time and place of the project life cycle, and**
- **good communication channels between stakeholders.**

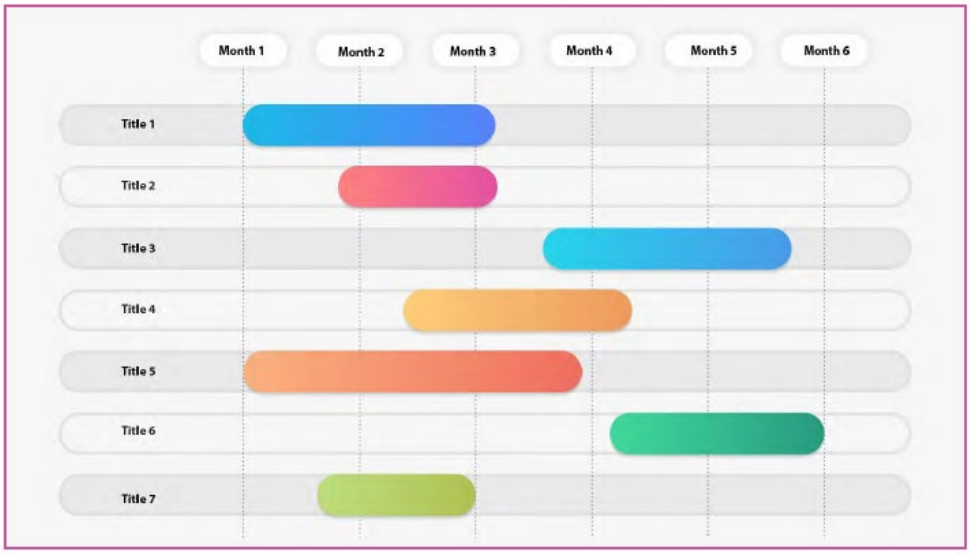
4.2.1 PRINCE2 Process Stages

PRINCE2 divides projects into the following phases:

- **Starting up a project (SU) – in this process, the project team is appointed and a project brief (describing, in outline, what the project is attempting to achieve and the business justification for doing it) is prepared. In addition, the overall approach to be taken is decided and the next stage of the project is planned. As part of this phase, the project board, project sponsor and project manager are appointed. The project board is usually chaired by the project sponsor. This is normally the senior executive who instigated the change and is responsible to the business for the success of the project. Other members of the project board will include executives from the various sections of the firm that will either benefit from the project or have a role in delivering it. The project manager is also a member of the project board. The project manager is the individual responsible for delivering the project. Once this work is done, the project board is asked to authorise the next stage, that of initiating the project.**
- **Planning (PL) – PRINCE2 advocates product-based planning, which means that the first task when planning is to identify and analyse products. Once the activities required to create these products are identified, it is possible to estimate the effort required for each and then schedule activities into a plan.**
- **Initiating a project (IP) – this process builds on the work of the start-up (SU) activity and the project brief is augmented to form a 'business case' – the non-technical reason for the project. The logic of the business case is that, whenever resources, such as money or effort, are consumed, they should be in support of the business. An example could be that a software upgrade might improve system performance,**

but the 'business case' is that better performance would improve customer satisfaction.

- Directing a project (DP) – these sub-processes dictate how the project board should control the overall project. It also specifies the way in which the board can give ad hoc direction to a project and the way in which a project should be closed down.
- Controlling a stage (CS) – PRINCE2 suggests that projects should be broken down into stages and these sub-processes dictate how each individual stage should be controlled. Most fundamentally, this includes the way in which work packages (subsets of a project that can be assigned to a specific party for execution) are authorised. It also specifies the way in which progress should be monitored and how the highlights of the progress should be reported to the project board.
- Managing product delivery (MP) – this process specifies the way in which a work package should be accepted, executed and delivered.
- Managing stage boundaries (SB) – this process dictates what should be done towards the end of a stage. The fundamental principle of this stage is to ensure that, at the end of each stage, the project stays focused on delivering business benefit. Most obviously, the next stage should be planned and the overall project plan, risk log and business case amended as necessary. The process also covers what should be done for a stage that has gone outside its tolerance levels. Finally, the process dictates how the end of the stage should be reported.
- Closing a project (CP) – this process covers the things that should be done at the end of a project.



The project should be formally de-commissioned (and resources freed up for allocation to other activities), follow-on actions should be identified and the project itself should be formally evaluated.

4.2.2 PRINCE2 Qualifications

There are two PRINCE2 qualifications:

- **the foundation examination certifies that the principles and terminology have been understood, and**
- **the practitioner examination certifies that the holder exhibits competence to apply PRINCE2 while running and managing a project.**

4.3 The Project Management Institute (PMI)

The Project Management Institute (PMI) was formed in 1969 in the US to serve the interests of the project management industry. The PMI is now a global body with (as of 2023) over 700,000 members in 214 countries. The premise of the PMI is that the tools and techniques of project management are common, even among the widespread application of projects from the software industry to the construction industry.

4.3.1 The PMBOK Guide

In 1996, the PMI published the first edition of what is now known as A Guide to the Project Management Body of Knowledge (PMBOK Guide), containing the standards and guidelines of practice that are widely used throughout the profession. PMBOK is divided into two major parts: 'project initiation' and 'exam essentials'. The project initiation part focuses on developing and executing a project plan and creating, protecting and fulfilling a project scope. The latest version (edition 7) released in August 2021 moved more towards a system of principles, rather than its earlier process-based approach.

The Guide is process-based, meaning that it describes work as being accomplished by processes. Processes overlap and interact throughout a project or its various phases. Processes are described in terms of:

- **inputs (eg, documents, plans and designs)**
- **tools and techniques (mechanisms applied to inputs), and**
- **outputs (eg, documents and products).**

The Guide recognises 44 processes that fall into five basic process groups and ten knowledge areas that are typical of almost all projects. The five process groups are:

1. **initiating**
2. **planning**
3. **executing**

4. controlling and monitoring, and
5. closing.

The ten knowledge areas are:

1. project integration management
2. project scope management
3. project schedule management
4. project cost management
5. project quality management
6. project resource management
7. project communications management
8. project risk management
9. project procurement management, and
10. project stakeholder management.

4.3.2 PMI Qualifications

Membership of the Institute is based upon examination. The Institute offers accredited education programmes, based on PMBOK, in partnership with academic institutions in North America, Europe and Asia, together with a large number of learning tools and publications that are available both to members and non-members.

PMI professional credentials are available which demonstrate that appropriate education or professional experience has been fulfilled, a rigorous examination has been passed and the individual is committed to maintaining their active credentials and agrees to abide by a professional code of conduct.

4.4 ISO Standards

The International Organization for Standardization (ISO) was established in 1947 to develop common international standards in many areas. Its members come from over 120 national standards bodies which, through associated accreditation and certification bodies, act as audit organisations in recognising which companies have gained applicable ISO standards. ISO's purpose is to facilitate international trade by providing a single set of standards that people everywhere can recognise and respect. Within the UK, there are also some mature British standards that have been developed in parallel, and often adopted by the ISO.

The ISO has provided the following standards that are concerned with project management.

4.4.1ISO 9000

ISO 9000 includes the following standards:

- **ISO 9000:2000, Quality management systems – fundamentals and vocabulary – the basics of what quality management systems are; it contains the ISO 9000 series of standards.**
- **ISO 9001, Quality management systems – requirements – provides the requirements that an organisation needs to fulfil in order to achieve customer satisfaction through consistent products and services.**

There are many different standards which are referenced in the ISO 9000 family. A lot of them do not even carry 'ISO 900x' numbers. For example, parts of the 10,000 range are also considered part of the 9000 family.

ISO 9001 certification has been adopted by thousands of organisations in over one hundred countries and is an internationally recognised quality management tool. It should be noted that, when an organisation claims to be ISO 9000-compliant, it actually means that it conforms to ISO 9001:2000.

In order to achieve ISO 9001 certification, the applying organisation is assessed based on an extensive sample of its sites, functions, products, services, and processes and a list of how problems have been made known and resolved by management. An ISO certificate must be renewed at regular intervals, following a review by an independent standards auditor, as recommended by the certification body, usually every three years.

Both internal and external audits must occur in a continual process of review and assessment to verify that the system is working as defined and to identify where it can be improved and corrected. The auditing process is typically addressed by performing compliance auditing:

- **Tell me what you do (describe the business process).**
- **Show me where it says that (reference the procedure manuals).**
- **Prove the results (exhibit evidence in documented records).**

As the organisation's ISO maturity improves, the audit should tend to focus on risk, status and importance with increasing judgments on what is effective or not. ISO 19011 is the standard that should be applied to the auditing of ISO certifications.

One criticism of ISO 9000 is that, although it makes processes more consistent, it also may make it more difficult to improve and readapt processes. In Japan, amid complaints of ISO 9000 undermining world-class thinking, Toyota abandoned the standard in 2000, moving back to its in-house Toyota production system.

- **ISO 9004, Quality management systems – guidelines for performance improvements – covers continual improvement.**

5. Software Testing and Quality Assurance

9.6.1 Understand the need for testing and its importance to quality assurance including: testing strategies; test stages; techniques; cycles; test reporting

5.1Introduction

Software testing is the process used to measure the quality of developed computer software. Software testing is a value judgment or risk management exercise. It is not possible to produce a complex application that is completely free of defects – this would equate to delivering 'perfection', which is something that human beings rarely achieve. The number of defects in a complex application can be large; some of them will be critical and some less so. In addition, an individual product may be implemented within a large number of configurations. For example, many applications used in the investment industry run on both SQLServer™ and Unix databases, and errors may be found in one configuration variable but not others.

The purpose of testing is, therefore, to gain a level of confidence in the software so that the organisation is confident that the software has an 'acceptable defect rate': and where defects do exist, they are understood by all relevant parties, documented and there are adequate workarounds available to the users.

What constitutes an acceptable defect rate depends on the nature of the software or the project. The level of defects that are acceptable in, say, an arcade game, would be completely unacceptable in an application that was used in an operating theatre or in a flight control centre serving a busy airport.

It is therefore necessary to grade any problems that may be found during testing. The table overleaf is an example of a problem-grading matrix. Each problem is allocated a severity grade, and the firm that developed the system has a set of rules for deciding how many problems of each grade it will tolerate when it decides whether or not to release the developed software. These rules are normally incorporated into its change control policies (see chapter 8, section 5).

Grade	Meaning	Policy
A	An extremely serious problem. An important part of the system does not work as it should, and there are no workarounds available to the users.	This release cannot go into production if there are any Grade A defects outstanding.
B	An important part of the system is not working in the way that was intended, but there are workarounds available so that data can be processed in another way.	This release can go into production if there are a very limited number of Grade B defects outstanding and there is an agreed time frame for their resolution after live date.
C	A minor part of the system is not working in the way that was intended, but there are workarounds available so that data can be processed in another way.	This release can go into production if there are a number of Grade C defects outstanding and there is an agreed time frame for their resolution after live date.
D	Cosmetic error – eg, a spelling mistake in the headings of an input/enquiry screen or printed report.	This release can go into production despite the presence of Grade D defects.

5.1.1 Software Testing Axioms

As software testing is based on a value judgment or risk assessment, it is always worth remembering these eight 'axioms':

1. **It is impossible to test a program completely.**
2. **Software testing is a risk-based exercise.**
3. **Testing cannot show that bugs do not exist.**
4. **The more bugs you find, the more bugs there are.**
5. **Not all the bugs you find will be fixed or even need to be fixed.**
6. **Product specifications are never final.**
7. **If you find a problem that occurs once and you cannot repeat it, then you cannot fix it.**
8. **Test environments are not always an exact match of production environments (eg, the server specification may be smaller or some external interfaces may not be fully automated).**

5.2 Test Stages

During the SDLC, applications are usually subject to the following series of tests, normally in this order:

1. **Unit testing – tests the minimal software component, or module. Each unit (basic component) of the software is tested in isolation to verify that the detailed design for the unit has been correctly implemented.**
2. **Integration or system integration testing – exposes defects in the interfaces and interaction between integrated components (modules). Progressively larger groups of tested software components corresponding to elements of the architectural design are integrated and tested until the software works as a system.**
3. **Functional testing – tests at any level (class, module, interface, or system) for proper functionality as defined in the specification.**
4. **System testing – tests a completely integrated system to verify that it meets its requirements.**
5. **Volume testing or load testing – tests a software application for a certain data volume. This may be expressed in a number of ways, such as the size of the database, the number of transactions to be processed for a given time period, the length of time that the user has to wait for the results of an enquiry, or the length of time that an overnight process should take to complete. One form of volume testing that is becoming more common is breakpoint testing, ie, adding more and more load onto the system to find out when it actually becomes unusable or breaks.**
6. **System integration testing – verifies that a system is integrated to any external or third-party systems defined in the system requirements.**
7. **User acceptance testing – conducted by the end user, customer or client to validate whether or not to accept the product. Acceptance testing may be performed as part of the hand-off process between any two phases of development.**
   - **Alpha testing is simulated or actual operational testing by potential users/customers or an independent test team at the developers' site. Alpha testing is often employed for off-the-shelf software as a form of internal acceptance testing before the software goes to beta testing.**
   - **Beta testing comes after alpha testing. Versions of the software, known as beta versions, are released to a limited audience outside the company. The software is released to groups of people, so that further testing can ensure the product has few faults.**
8. **Penetration testing – testing the security elements of a system by simulating an attack from a malicious source (such as hackers).**

It should be noted that, although both alpha and beta are referred to as 'testing', they are in fact 'user immersion'. The rigours that are applied are often unsystematic, and many of

the basic tenets of the testing process are not used. The alpha and beta period provides insight into environmental and utilisation conditions that can impact the software.

5.2.1 Regression Testing

After modifying software, either for a change in functionality or to fix defects, a regression test re-runs previously successful tests on the modified software to ensure that the modifications have not unintentionally caused a regression of previous functionality. Regression testing can be performed at any or all of the above test levels.

5.3 Test Techniques

Software may be tested by using any or all of the following techniques:

- **Code walkthrough – a manual testing technique where program logic is traced manually using a small set of test cases to analyse the programmer's logic and assumptions.**
- **White box testing – in white box testing the tester has access to the source code and can write tests specific to the area of change.**
- **Black box, concrete box or functional testing – in black box testing the tester only accesses the software through the same interfaces that the customer or user would use, or through automation of similar interfaces, to confirm the functional specification of the program.**
- **Grey box testing – a technique that uses a combination of black box and white box testing. Grey box testing is not black box testing, because the tester does know some of the internal workings of the software under test. In grey box testing, the tester applies a limited number of test cases to the internal workings of the software under test. In the remaining part of the grey box testing, one takes a black box approach in applying inputs to the software under test and observing the outputs.**
- **Smoke, sanity or skim testing – this is a cursory examination of all of the basic components of a software system without reference to the internal workings to ensure that they hang together. Typically, smoke testing is used to verify a software build. The term originates from the electronics industry where the circuits are laid out and power is applied; if anything starts smoking, there is a problem.**
- **Agile testing – agile software development (described in section 3.2.3 of this chapter) adheres to a test-driven software development model where the unit tests are written first and fail initially until the code is written. The test harness is continuously updated as new failure conditions are discovered and they are integrated with any regression tests that have been developed. The stages of an agile development cycle are as follows:**

    - write the test
    - write the code
    - run the automated tests
    - re-factor
    - repeat.
- Handshake or rattle test – this test aims to prove that it is possible to send and receive communications between two or more systems. Such a test does not prove that the two or more systems can understand one another, just that messages do not get lost en route.

5.4 The Test Cycle

The test cycle usually consists of the following steps:

1. Requirements analysis – testing should begin in the requirements phase of the software development life cycle. During the design phase, testers work with developers to determine what aspects of a design are testable and under what parameters those tests work.
2. Test planning – the planning stage comprises the development of the test strategy, test bed and test plan(s). These, in turn, comprise the following:
   - The test strategy outlines which of the stages (section 5.2) will be used, which techniques (section 5.3) will be used, and what critical needs must be met to allow testing to be deemed successful (eg, all modules need to be tested with no critical defects outstanding).
   - The test bed is the definition of the hardware, operating system and database configuration that will be used to perform the testing.
   - The test plan allocates resources to the testing, and specifies how issues will be reported, actioned and retested prior to release.
3. Test development – in this phase, the test scenarios, test cases and test scripts are written.
   - A test case is a set of conditions or variables under which testers will determine if a requirement is partially or fully satisfied.
   - They will then prepare a test script for each test case. A test script details the inputs that will be made to the application and the expected results of each input.
   - A test scenario is a collection of test cases that are connected with each other.

5.5 Test Automation

Traditionally, testing of financial sector applications has been performed by test team members manually entering transactions, running background processes such as the sending of settlement instructions, mark-to-market and interest accrual, and then reviewing the results of this activity by the inspection of reports, enquiries and interface files created by the application. For a large application, this is a highly labour-intensive process that can create bottlenecks. In particular, the resource-hungry nature of this way of working makes it extremely difficult to carry out volume tests and regression tests, because of the very large amount of data entry and inspection that is required by these types of tests.

There are now a large number of software tools on the market that can automate some of these activities. Usually, these tools provide record and playback features that allow users to record user actions and replay them back any number of times, comparing actual results to those expected.

In addition to the tools that provide the 'record and playback' facilities, there are a number of automation tools available that allow the code to conduct unit tests to determine whether various sections of the code are acting as expected in various circumstances. Test cases describe tests that need to be run on the program to verify that the program runs as expected. These tools are particularly useful for running regression tests because this involves running a similar set of tests for every release.

Automated test tools can be expensive to purchase and set up, and can automate only a well-thought-through test script. It is an addition to, not a replacement for, manual testing.

5.6 Test Reporting and Control

In order to execute a test plan, there has to be an agreed methodology for reporting issues, actioning them, retesting them, and either releasing them to the production environment when they pass or re-working the fix if they fail the retest. In addition, the stakeholders will require regular reports of the numbers and severity of issues outstanding. The type of help desk management system that was described in section 3.2 of chapter 8 is usually used for these purposes.

6.Disruptive Innovation

9.7.1Know the impact of disruptive innovations and FinTech initiatives: cloud computing; big data; cryptocurrencies; blockchain/distributed ledger technology; artificial intelligence; machine learning; open finance

6.1 What is a Disruptive Innovation?

A disruptive innovation is an enhanced or innovative technology that improves a product or service in ways that the market does not expect, typically by lowering prices, designing for a different more efficient set of consumers or delivering it in a different way. As a result, it creates demand for new types of services and reduces demand for existing services – it, therefore, disrupts the existing market. Historical examples include the development of low-cost motor vehicles by Henry Ford at the beginning of the 20th century, the invention of the personal computer in the 1970s and 80s, and the availability of high-speed internet connections in this century.

The term 'disruptive innovation' was coined by Clayton Christensen in 1997, a Harvard academic, and Christensen defines disruptive innovations as generally being:

> **'Technologically straightforward, consisting of off-the-shelf components put together in a product architecture that was often simpler than prior approaches. They offered less of what customers in established markets wanted and so could rarely be initially employed there. They offered a different package of attributes valued only in emerging markets remote from, and unimportant to, the mainstream'.**

For example, early automobiles were not a threat to the horse and carriage, because they were too expensive. However, when Henry Ford invented the low-cost automobile the existing road transport industry was disrupted to the point of virtual obliteration. Early PCs were not capable of replacing mainframes, so mainframe manufacturers never regarded them as a threat. Twenty years later, however, vast numbers of applications that in the past would have run on mainframes now run on servers that use PC architecture which are sold for a fraction of the cost of a mainframe computer.

6.2 Cloud Computing

6.2.1 Definition

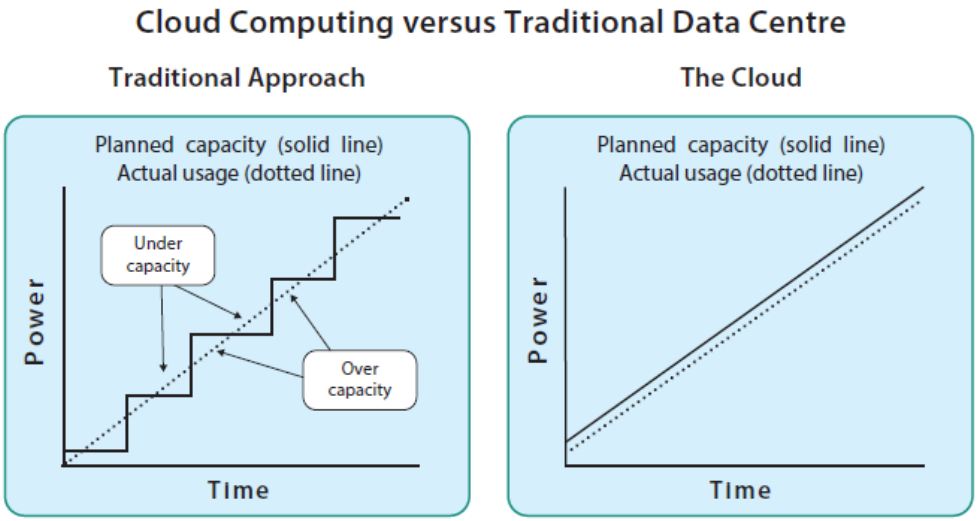
Cloud computing is the provision of technology resources (eg, hardware, software, networks and applications) on demand via a network. It has been compared to the supply of electricity and gas, or the provision of telephone, television and postal services. All of these services are presented to the users in a relatively simple way that is easy to understand without the users needing to know how they are provided, what location they are provided from, or what the physical configurations of the systems that deliver the services are.

There are several different cloud models, but the following three are the most popular:

- **Infrastructure as a service (IaaS) – the provider will offer basic infrastructure, such as network, servers, storage, and processing power.**
- **Platform as a service (PaaS) – the provider will offer the infrastructure (as IaaS above), but will also offer the operating system, manage security and perform backups.**
- **Software as a service (SaaS) – the provider will offer the infrastructure (per IaaS) and the operating system (per PaaS), but they will also offer all the application software.**

Anybody who has used services such as Hotmail, Gmail, Google Docs, Facebook, YouTube or Twitter, or has an online blog or a personal website, is using cloud computing. The major providers of cloud computing services include Microsoft, Google, and Amazon Web Services. These three companies individually own computing resources which are far larger than any one financial institution.

The benefits of delivering applications using the vast resources of the cloud are shown in the following diagram:



The traditional approach to delivering an application is to build a data centre to house it. Capacity planning can never be precise and, if new servers, networks or software licences need to be purchased because of increased demand, there will always be a lead time to commission them. This means that, at any one time, the data centre will either be running with excess capacity (which creates additional expense) or inadequate capacity (which results in dissatisfied users). Using the cloud model, the actual capacity that cloud vendors are able to deliver through their enormous data centres is much more closely aligned with actual usage. In effect, an organisation is moving from a fixed/step cost model to a variable one.

6.2.2 Cloud Computing in the Banking and Securities Industry

While it is easy to see how the services provided by the example companies to the personal sector have transformed the way people communicate with each other and share photographs, music and videos, and have disrupted the retail markets for music, books and processing of photographs, the question is: to what extent is 'the cloud' capable of disrupting the markets for financial services software, hardware and networks?

The Cap Gemini 2023 World Cloud report revealed that 91% of banks and insurers are using the cloud, and that the main motivation for doing so is to reduce costs (move from a fixed/step cost model to a variable cost model). The same survey revealed that 44% of firms in all industries are entrusting critical applications to cloud providers. One UK fund management firm, which has £6 billion under management, deploys all its computing requirements from cloud providers.

The firm claims the benefits of this approach to be as follows:

- **Reduced technology costs – they have no significant networks or servers and no internal technology department.**

- **In particular, they claim to have no project management overheads. They claim that all their software requirements can be sourced from the cloud at a fraction of the cost of internal projects, and that the controls on projects and change programmes that were discussed in earlier chapters are unnecessary, because of the low costs of cloud computing.**
- **Simpler business recovery plans, as there are no servers or networks to replicate or relocate in the event of not having access to their offices. It is the responsibility of the cloud to define resilience in the cloud.**
- **A greater ability to match data resource availability with actual demand.**
- **The whole company is more customer-facing as a result of the previous benefits.**

In 2018, Capital One partnered with Amazon Web Services to migrate most of its infrastructure for its mobile banking application to the cloud.

According to Gartner, the global spending on cloud services is forecast to grow 20.7% to total $591.8 billion in 2023, up from $490.3 billion in 2022.

6.2.3 Concerns about Cloud Computing

Most of the concerns about the cloud are concerned with data security and related issues, including:

- **uncertainty as to whether and how the supplier is complying with the client's data security policies;**
- **uncertainty about suppliers' skills, training and auditing policies**
- **data proximity – the customer will never know whether its data is held in the same databases as that of its competitors, or what dangers this presents**
- **since customers have no – or very little – knowledge of which country the data is actually stored in then, they may be unable to answer regulators' questions**
- **uncertainty on how data is segregated between different organisations; a firm would like its data completely segregated from the cloud's other customers and/or users**
- **the complete reliance on a third-party vendor for a firm's technology; therefore, if the supplier has issues or 'down time' then it will impact the firm adversely**
- **there is little room for negotiation on the contracts; therefore, unless the firm can give the cloud provider a substantial amount of business, then it has to agree with the terms of the cloud provider**
- **once a firm has moved to the cloud, then it will be challenging, complex and costly to move back 'in house' because (a) the firm will either have sold or given away its original hardware and infrastructure and (b) the firm will have lost all the relevant 'inhouse' skills**
- **firms may have spent a large amount of time, stress, resource and money on developing in-house systems. Therefore, it could be challenging to develop a**

suitable business case to effectively discard this investment and relocate everything to the cloud.

6.2.4 Conclusion

Cloud computing has already shown itself to be a disruptive innovation in many retail markets, such as books, music and image processing. It now has also become a disruptive innovation in the banking and securities industries, although the issues mentioned previously will need resolving.

The cloud delivers access to computing anytime and from anywhere. Cost saving is also a main driver for cloud adoption.

6.3 Big Data

6.3.1 Background

According to the Pepper and Rogers Research Group, every day in the US some 7 billion shares of stock or other securities are traded on various financial exchanges, and fully two-thirds of these trades are executed by computers using algorithms to trade with other computers, without human participation.

Roughly 33,000 discrete trades take place every second on the New York Stock Exchange and, of course, they must (and do) take place in a particular order, one trade at a time, each trade separated from the next by just a few microseconds.

Financial transactions generate an enormous quantity of data to be stored, processed and re-processed. But all human activity is now generating such data at an accelerating rate, from investing and retail spending, to web browsing, social media, and mobile phones, to such an extent that IBM estimates that 90% of all data in use today has been accumulated within just the last two years. This data comes from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records and mobile phone GPS signals to name a few.

A Gartner research report published in 2001 (which is still appropriate despite being over 20 years old) suggested that problems are created not just by the volume of data being generated, but by the increasing velocity at which it is being created (33,000 ordered trades per second, for instance), as well as by its proliferating variety (think of 'unstructured' data such as text documents, videos and pictures, for instance).

However, the growth of very large cloud-based data centres has provided opportunities to store and analyse very large, very complex data sets in ways that only a few years ago would not have been possible. Basically, developers can use statistics from these very large data sets to solve problems in new ways. A trade repository (see chapter 3) is one example of such a data set. Neither the European nor the US regulators have yet published any information about how they are going to interrogate such data sets, and what routine uses they will make of them.

6.3.2 A Definition of Big Data

With reference to section 6.3.1 above, big data is an important subject which will become increasingly more prominent in investment management. However, it is challenging to define the term. A number of people have created definitions but these are either too narrow or have been written to match a particular point of view or product.

However, it is possible to piece these variations together to create the following definition:

1. **a large amount of data; this is normally in the region of a minimum of a billion data items**
2. **the data is in a different number of formats, such as video, verbal media, images and spreadsheets, and could include different databases (in different formats)**
3. **the data is constantly changing; new data items are being added, existing data items are being removed or existing data items are being amended**
4. **normal or traditional techniques for analysing the data are not adequate.**

6.3.3 Some examples of uses of Big Data

Google and Machine Translation
Machine translation has been around in one form or another for decades, but has always lagged far behind translations produced by human experts. Much of the software written to perform machine translation involved defining different languages' grammars and dictionaries, a difficult process whose results were unsatisfactory.

Google's approach was to replace all that with a purely statistical approach. Looking at masses of data in parallel – for instance, over 100 years' worth of both the English and French verbatim reports of speeches in the Canadian Parliament – produced far better translations than the old algorithm-driven method. The bigger the corpus, or body of parallel texts, the better the results.

Tesco plc and Performance Efficiency
The supermarket chain collected 70 million refrigerator-related data points coming off its units and fed them into a dedicated data warehouse. Those data points were analysed to

keep better tabs on performance, gauge when the machines might need to be serviced and do more proactive maintenance to cut down on energy costs.

Macy's inc. and Real-Time Pricing
The retailer adjusts pricing in near real time for 73 million items, based on demand and inventory, using technology from SAS.

6.3.4 Issues with Big Data

There are a number of issues and challenges with implementing big data which firms will need to address before progressing:

- **Firstly, big data is dependent on the quality of data for its analysis and without good data any analysis will be poor. Data could be received in different formats (which are challenging to link together) produced at different time points and based on different assumptions.**
- **Secondly, processing a large amount of data will require a large amount of disk space, powerful computing processing power and some very efficient software. This could be costly and complex to maintain.**
- **Finally, even if the data is of good quality and the necessary computing power is there, then there are challenges in analysing the data. It may not be possible to find any appropriate patterns or the analysis finds irrelevant and/or misleading patterns. This could, at best, just waste time or, at worst, mislead the firm into making incorrect decisions.**

6.4 Cryptocurrencies (and how they differ from Crypto Tokens)

6.4.1 What are cryptocurrencies (and how they differ from crypto tokens)?

A cryptocurrency is a virtual medium of exchange that uses technology and cryptography to process currency transactions and to control the creation of new currency units. No physical coins or notes are created. All balances and transactions are stored in a database.

Cryptocurrencies are also decentralised, which means there are no central banks, organisations or governments to control them. This means that all transactions are processed directly between the sender and receiver on a peer-to-peer basis.

There are several cryptocurrencies in place, such as LiteCoin, PeerCoin, NameCoin and, the most commonly known, Bitcoin. Bitcoin made headline news in 2014 when its value jumped from $22 to $266 within a two-month period. Bitcoin was created in 2009 by an

individual called Satoshi Nakamoto whose identity, despite several news reports, is still unknown. Satoshi left the Bitcoin project in 2010.

Another term that is increasingly being used is crypto tokens. This term is often incorrectly used to describe cryptocurrencies, but it does have a specific meaning. Crypto Tokens are assets that are stored on another cryptocurrency's blockchain. These digital assets can represent a wide range of areas covering traditional physical assets (such as art, real estate or other rare items) as well as digital assets (such as photos or images). Crypto Tokens can be traded like a cryptocurrency.

6.4.2 How does Bitcoin Work? (the most commonly known cryptocurrency)?

Bitcoin is a complex subject involving some in-depth technology (particularly in the area of cryptology), which means a detailed description is outside the scope of this book. Therefore, the description below provides a summary.

Who Controls Bitcoin?
Nobody owns the Bitcoin network or the various software applications that underpin it. Bitcoin is actually controlled by all of its users across the globe. This means that any changes to Bitcoin (such as new features) need to gain the consensus among the majority of users.

How does Bitcoin Work?
From an individual user point of view, access to Bitcoin is gained via an application on a mobile phone, tablet or PC. This application provides a Bitcoin wallet that allows the user to receive and send Bitcoins.

Behind the scenes, Bitcoin is underpinned by a public ledger called the 'blockchain'. This ledger contains every single transaction that has ever been processed. For a transaction to be approved, it needs to be approved by all members of the network. The legitimacy of each transaction is ensured by using digital signatures that match the sending address.

How to Buy Bitcoins?
Bitcoins need to be purchased from a Bitcoin exchange. In effect, an investor would join an exchange and buy the Bitcoins (using a traditional currency such as US dollars) online. Bitcoins can be sold as well as bought, and the process is the same as buying but in reverse.

There are number of advantages to Bitcoin, such as:

- **no government or central bank interference (although per section 6.4.3 of this chapter, new regulation is gradually being implemented)**
- **first mover advantage**

- **there is a limited total insurance of 21 million (c. £330 billion – at the time of writing in February 2023) of which 19 million (c. £330 billion) are currently available with the remaining left to be mined, and**
- **low transaction costs.**

There are a number of issues to note:

- **Transactions currently take a long time to clear – in some cases, up to 40 minutes. Until this is reduced to seconds (like credit cards), Bitcoin will struggle to gain popularity.**
- **The take-up at major stores and shops is very low because people still prefer to use 'traditional' cash or credit cards.**
- **As there is no central control body (like for SWIFT), there is no clear or transparent method for suggesting, coordinating and approving changes.**
- **The price of Bitcoin is very volatile, which generally discourages investors.**
- **The unfamiliarity of the concept and the complexity of Bitcoin frightens individuals and organisations.**
- **Finally, as there is no central controlling body (unlike SWIFT, for example), Bitcoin does not have a legal status for regulation and oversight – which makes many individuals and firms nervous.**

Bitcoin is still trying to shake off its earlier reputation as a payment mechanism for transferring the proceeds of criminal activity. The amount of cryptocurrency spent on so-called dark net markets, where stolen credit card information and a wide array of illegal drugs can be purchased with Bitcoin, rose 60% to reach a new high of $601 million in the last three months of 2019, according to data released by Chainalysis, a firm that tracks every Bitcoin transaction and serves as an adviser to an array of government authorities.

Therefore, while several firms have expressed an interest in or opinion on Bitcoin, most of them are taking a 'wait and see' approach until it becomes clearer whether the use of Bitcoin will become mainstream.

6.4.3 The Changing Regulatory Landscape of Cryptocurrencies

Governments, policy makers and regulators are now becoming increasingly aware of the dangers of crypto and are now starting to implement regulations to control them more tightly – namely:

- **European Union – Markets in Crypto-Assets (MiCA) - This regulation was applicable as of December 30, 2024, after being adopted in April 2023. MiCA establishes a harmonised legal framework across the EU for crypto assets, including authorization, supervision, stablecoin issuance, and service providers ('CASPs').**
- **United States – The US is trying to move towards a clearer regulatory environment. This will be done by implementing two sets of regulation Firstly, the**

GENIUS Act (passed July 2025) states that stablecoins must be backed one-for-one by US dollars or other low-risk assets. It also introduces dual federal and state oversight and enhances transparency. Secondly, the FIT21 Act (Financial Innovation and Technology for the 21st Century Act), passed by the US House in May 2024, tries to clarify regulatory responsibilities—assigning the Commodities Future Trading Commission oversight of decentralized commodities and the SEC oversight of securities, while exempting certain stablecoins from both except for anti-fraud enforcement.

- **United Kingdom – The UK is creating a crypto regulatory framework under FSMA (Financial Services and Markets Act) 2000, updated via the Cryptoassets Order 2025, which includes crypto activities such as trading, custody, staking, and stablecoin issuance into FSMA's regulatory perimeter.**

6.5 Artificial Intelligence (AI)

6.5.1 What is AI?

Artificial intelligence (AI) is the branch of computer science that focuses on programming computers so they behave like humans. The term AI was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology (MIT).

Despite a large amount of work, effort and money, the development of truly intelligent machines has not been realised. In fact, we are probably still several decades away from creating real AI. However, research on AI has produced a number of technologies that are currently in use, such as:

- **Speech recognition – computers 'listen' to the user's speech, analyse it and then act based on a set of predefined rules, eg, the Apple iPhone 'Siri' application and large call centres using speech recognition to route calls to the relevant operator.**
- **Advanced search techniques – computers are developed to retrieve information from a predefined data store and return the results to the user, eg, Google's PageRank system.**
- **Vision systems analysis – computers are developed to understand and make sense of their surrounding environment(s) and then act based on a set of preprogrammed rules, eg, spy planes working autonomously to search for predefined structures (such as missiles), and the police using photo-fit software to compare photos they have taken to those held on a central computer.**
- **Handwriting recognition – computers are developed to recognise handwriting in order to activate certain events, eg, signature authentication.**
- **Advanced game playing – computers have been developed that consistently beat Grand Masters at chess.**

- **Robotics – robots have been developed to undertake a wide range of activities, ranging from car manufacture to astrogeological analysis.**
- **Expert systems – software is developed that uses databases of expert rules and knowledge to offer or make decisions, eg, medical diagnosis.**

6.5.2 AI in Asset Management

AI technologies are in use within asset management and the wider financial services sector.

For example, firms are using AI technology to develop complex and efficient algorithms for high-frequency trading (HFT). These algorithms will monitor trading information, such as market values and transaction volumes, to quickly determine which buys and sells should be processed.

Additionally, firms are using AI technology to try to detect fraudulent and criminal activity. AI applications will analyse client trades, client movements, the countries/markets that clients operate in, and their counterparties, to determine whether they show any suspicious patterns. If so, these can be investigated in more detail.

Finally, firms are using AI to personalise the service they provide to their customers. AI applications will assess individual clients against similar clients to determine which products they could be sold, how reports and websites should be formatted and to be proactive regarding questions and queries these clients could raise.

6.5.3 The Future of AI

AI is here to stay – it is a big area, which receives a lot of media attention and funding.

The use of AI in asset management (and financial services in general) will continue to grow. This is because firms need ways to cope with the demands of their customers, they need to offer more tailored products, they need to comply with complex regulation, and there is an overarching need to keep costs under control.

6.6 Blockchain/Distributed Ledger Technology (DLT)

6.6.1What is Blockchain or Distributed Ledger Technology?

A distributed ledger is a database that is shared and synchronised across multiple sites, firms or geographies. The participant at each node of the network can access the

databases across the network as well as having their own identical copy of it. Any changes made across the ledger is copied to all members within a few seconds.

Blockchain is a type of distributed ledger. It is a distributed and shared database that maintains a continually growing list of records called 'blocks'. Each block contains a timestamp and a link to its previous block. The contents of each block cannot be altered retrospectively.

Its main and most well-known use is providing the ledger that underpins the Bitcoin cryptocurrency. As detailed in section 6.6.2, blockchain contains the details of every single transaction that has ever been processed which means a user's computer is able to verify the validity of each transaction. However, blockchain does have a number of other uses, such as tracking and issuing reward points, tracking and issuing digital keys and storing rights data for authenticating copyright registration.

6.6.2Implications for Asset Management (AM) Firms

The implications for asset management (AM) firms are unclear at the moment.

If Bitcoin becomes popular and mainstream, the dependence on blockchain is likely to increase, and require firms to develop their understanding of how it works in order to build interfaces to trade Bitcoins over automated links.

Likewise, if blockchain is used for other services (for example, share or bond trading) then firms will also need to develop their knowledge, skills and understanding to build interfaces to allow automation and automated trading.

6.7 Machine Learning

6.7.1 What is Machine Learning?

Machine learning is a discipline of AI that allows technology systems to automatically learn and improve from experience (a) without being explicitly programmed programmed and (b) with minimal human interaction.

The process involves the technology system obtaining historic data (or observations to use the technical name). This data can be structured (such as database records) or unstructured (such as images and voice recordings). This data is then processed using algorithms (such as decision trees, naïve Bayes, K-means clustering and random forests) to look for patterns to allow improve future decision making.

There is a sub-set of machine learning called deep learning which is becoming increasing common. It uses far more complex and layered algorithms (called neural networks) to try to mimic how a human brain would operate. This means deep learning can cope with more complex situations but does require a massive amount of data and processing power to operate (or learn).

6.7.2 Implications for Asset Managers

A large number of firms are already using machine learning techniques and their uses will no doubt continue to increase. However, the following uses are common:

- **Algorithmic trading – machine learning can be used to assess previous trading patterns to ensure that future trading is more profitable.**
- **Portfolio management – machine learning can be used to devise rules to manage portfolios better against clients' long-term aims, market risks and trading patterns.**
- **Selling of financial products – machine learning techniques can be used to model customer needs so better recommendations can be made.**
- **Marketing and customer service – machine learning techniques can be used to model customer activity and behaviours so better customer servicing capabilities can be developed.**
- **Fraud management – machine learning rules can be developed to predict and, therefore, prevent fraudulent activities.**

6.8 Open Finance

6.8.1 What is Open Finance

'Open finance' is the term employed to describe the extension of open banking data-sharing principles to enable organisations to access customer data across a range of financial sectors (including savings and investments).

6.8.2Implications for Asset Managers

The FCA has suggested that open finance has the potential to transform the way the financial services sector operates. This is because it will make it easier for consumers to:

- **shop around for and compare products**
- **make informed decisions on the suitability of products and, if necessary, and**
- **switch to an alternative provider with minimal friction.**

This will, in turn, ensure that all firms will only offer products and services that are appropriate to the market and will also ensure that they constantly try to improve their products and services. It will also enable firms to collect data from other financial institutions and build and present a total picture of a client's wealth, including all their investments, and savings held in various accounts, portfolios, pensions, and ISAs. This data, gathered from disparate sources, can then be presented to the client in the form of a dashboard, enabling them to monitor all their finances in one place.

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **List the nine stages of the standard UK software development life cycle.**
   Answer Reference: Section 2.2

2. **What are the four pre-conditions that must have been fulfilled before commencing design and/or development using the waterfall model?**
   Answer Reference: Section 3.1

3. **What are the four main criticisms of the waterfall model of software development?**
   Answer Reference: Section 3.1.3

4. **How does the 'agile' method of software development attempt to reduce development risk?**
   Answer Reference: Section 3.2.3

5. **List the advantages and disadvantages of end-user development.**
   Answer Reference: Section 3.3.4

6. **List the six 'good practice' guidelines of PRINCE2.**
   Answer Reference: Section 4.2

7. **What is the role of a project sponsor?**
   Answer Reference: Section 4.2.1

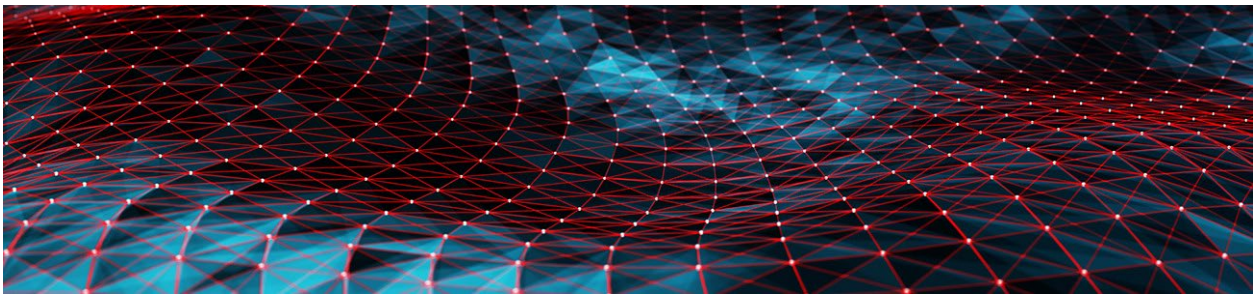
8. **When completing a defect report as a result of software testing, what is the purpose of a 'severity grade'?**
   Answer Reference: Section 5.1

9. **List the eight 'software testing axioms'.**
   Answer Reference: Section 5.1.1

10. **How does cloud computing apply to the banking and securities industry?**
    Answer Reference: Section 6.2.2

11. **What is a cryptocurrency?**
    Answer Reference: Section 6.4.1

12. **In what ways are firms using artificial intelligence (AI) within their day-to-day activities?**
    Answer Reference: Section 6.5.2



Chapter Ten
Technology Services Procurement

Section 1 Introduction

Section 2 Making the Buy or Build Decision

Section 3 Outsourcing

Section 4 Insourcing

Section 5 Offshoring, Near-Shoring and Best-Shoring

Section 6 The Vendor Relationship

This syllabus area will provide approximately 4 of the 50 examination questions

1. Introduction

This chapter deals with the issues relating to the introduction of new technologies (section 2), outsourcing, insourcing and the offshoring of key activities of the securities industry firm (sections 3 to 5), as well as the vendor selection process for technology packages, projects and services (section 6).

2. Making the Buy or Build Decision

10.1.1 Understand the buy vs build decision; and the implications and varieties of open-source software

When a new solution is required to resolve a business problem, there is often a decision to be made as to whether to build it internally or buy a packaged product (by using an external specialist). In some conditions, it is more cost-effective to buy; in others, it makes more sense to build the solution in-house.

The overall cost of the solution, whether it is built or bought, should include the cost of delivering the solution to production and the ongoing expenses of the solutions once they become part of business as usual operations. For example, a vendor might build a solution for a very low cost, but the ongoing support and maintenance fees might be high. Equally, an internal team might be able to deliver a solution relatively cheaply, but the entire team might need to be retrained to support the solution in production.

2.1Possible Reasons to Build

- **Costs – the cost of an internal development may (or may not) be lower than either the purchase of a software package or the fees paid to external developers.**
- **Expertise – depending on the nature of the product or system being introduced, there may be more expertise within the firm than there is outside the firm.**
- **Competitive advantage and intellectual property rights – if the firm requires an application that will give it some competitive advantage, it might not wish to share the intellectual property with a software vendor that could then sell the application to competitors.**
- **Resource availability – and its effect on the elapsed time to bring the system or product into production.**
- **There is no suitable package, or any suitable package has a large amount of expensive functionality that is not required**

2.2 Possible Reasons to Buy

- **Business strategy – if the new system or product is not a core application, the firm's internal resources may be better spent on core business software.**
- **Costs – may be lower if there are packaged products available that meet the business needs.**
- **Time – if a packaged application exists, it is likely that it could be implemented more quickly.**
- **Generic solution – many parts of the firm's application architecture consist of elements that are needed by all firms in the same sector. For example, all London Stock Exchange and SWIFT member firms need communications with the LSE and SWIFT respectively, and all firms, in all sectors, need to perform bank and depot reconciliations. These commodity functions do not usually confer any competitive advantage on a particular firm and, as a result, software vendors that specialise in building the necessary applications have evolved. These vendors usually have more skilled resources available in their areas of expertise than an individual securities firm, and are usually able to deliver packaged products for quick delivery.**

In addition, user firms hope to become part of an unofficial 'club' of users of that solution, who are jointly funding its onward development and maintenance. Smaller firms can benefit from the investment made by larger firms in developing the system, and on large-scale projects such as regulatory change, where every firm needs their system to be changed in the same way and at the same time, and it will almost always be cheaper to deliver a solution if all clients contribute towards the development cost.

The build or buy decision is one that needs to be answered very early in a change project as it is fundamental to the approach of how change is to be delivered. The decision may be self-evident at the outset, in which case the reasons for the decision will be included in the project brief at the beginning of the project. In other cases, the build versus buy decision will need research, in which case the project planning phase will include a task to evaluate the alternatives. Until such time as the project steering committee has considered the alternatives, it may not be possible to plan the project any further.

2.3 Open-Source Software (OSS)

Firms and suppliers are now increasingly starting to use open source software (OSS) for a range of software applications. This means it is important that firms both understand what OSS is and what its advantages and disadvantages are. This is because it will contribute to the 'buy-or-build' decision mentioned above. Suppliers could use OSS in their applications (ie, buy) or firms could use OSS in their own developed software (ie, build).

OSS is software that is distributed with its source code with a supporting licence which allows organisations to use the code in their own software. They can also enhance the code by adding or enhancing features, although these enhancements must be re-distributed for others to use.

The benefits are that firms or suppliers can enhance the software themselves, it is supported by a dedicated community who can help with any issues, the software is often functionally rich and it is often free (or at least inexpensive).

The drawbacks are that firms or suppliers will need to 'learn' the source themselves so they can enhance it. Also, due to a large number of OSS versions, it can have integration difficulties with other technologies. Finally, there is no guarantee or warranty around fit-for-use; therefore, firms/suppliers have no recourse in the event of issues.

3. Outsourcing

10.2.1 Know the advantages and disadvantages of outsourcing

3.1 The Concept of Outsourcing

'Outsourcing' entered the business lexicon in the 1980s and refers to:

> **'the delegation of non-core operations from internal production to an external entity specialising in the management of that operation'.**

For example, ABC Investment Company plc is an investment manager. As such, its core operation could be defined as selecting the correct financial instruments and markets in which to invest (in order to meet the specified investment goals of its customers) and executing transactions as a result of such selections. In order to be able to manage just its core operation, it needs to employ customer account managers, fund managers, investment analysts, economists and dealers.

However, once the investment decisions have been taken, it then needs to employ operations personnel to settle the transactions, accounting staff to account for them, technology staff to select and manage the systems that play a part in making the investment decisions and process the trades, and human resources (HR) staff and building management staff to manage the people and property.

It is argued that all of these activities are 'non-core' operations, and that some or all of them would best be delegated to an outside supplier whose own core competence lies in the management of one or more of these activities. Almost any non-core activity may be outsourced; some possible examples are shown in the table that follows.

Business Area	Department	Activity	Notes
Trade Capture	Investment Research	All investment research; or:	
		Economic research for a particular market; eg, US; or for a particular sector, eg, pharmaceuticals	
	Trade Execution	All trade execution; or:	
		Trade execution for a particular market; eg, US; or for a particular sector, eg, pharmaceuticals; or for certain types of financial instruments; eg, FX, derivatives	
Operations	Settlements	All settlement activity, or some of:	Note that when settlement activity is outsourced, the supplier – not the customer – usually takes on the risks of non-payment of debts by the customer's own customer
		Settlement activity for a particular geographical market; eg, US, Japan	
		Settlement activity for particular financial instruments; eg, derivatives, FX, equities	
	Information Technology – 'Production Outsourcing'	All technology activities; or some of:	
		Supply and maintenance of desktop PCs and associated software	
		Provision of business continuity (disaster recovery) back-up site	
		Supply and maintenance of data servers	

		Maintenance and support of specific (existing) business applications	The customer may choose to outsource the management of all its applications, or just outsource the management of some of them, while developing and supporting the others in-house
	Information Technology – 'Innovation Outsourcing'	Development of (specific) new business applications	The customer may choose to outsource the development of all its new applications, or just a single one of them while continuing to develop the others in-house
Administration	HR	All HR activities; or some of:	
		Permanent staff recruitment	
		Temporary staff recruitment	
		Payroll administration	
		Pension and benefit administration	
	Premises	All premises-related activities; or some of:	
		Building maintenance	
		Reception services	
		Catering	

Notice that the outsourced technology activities may be divided into two distinct categories. Production outsourcing is concerned with the maintenance and support of software products that have already been developed, while innovation outsourcing is concerned with the development of new applications.

3.2 The Advantages and Disadvantages of Outsourcing

Outsourcing involves the transference or sharing of the management control and/or decision-making of a business function to an outside supplier. This involves a high degree of two-way information exchange, coordination and trust between the outsourcer and its client.

Entering into an outsourcing agreement for a significantly large non-core business area is, therefore, not a decision to be taken lightly; the investment company needs to take considerable care in the following:

- **Selecting a supplier that has the right level of competence in the activity to be outsourced (see section 6).**
- **Selecting a supplier that has a good culture fit. It is important to bear in mind that outsourcing contracts will last several years and it is important that the two organisations are compatible.**
- **Planning and managing the migration project (see chapter 9, section 4).**
- **Drawing up and finalising the legal and commercial arrangements.**
- **Drawing up a service level agreement (SLA) that states quite clearly the scope of the activity to be outsourced, the responsibilities of both the customer and the vendor, the escalation procedures to be adopted when the service level falls below the requirements of the SLA, and any financial penalties that the vendor must pay to the customer if the service level falls below the SLA level for an extended period of time.**

3.2.1 Benefits of Outsourcing

A correctly managed outsourcing agreement and migration project should provide the customer with the following benefits.

Specialisation: Enabling a Higher Quality of Service
ABC Investment Company plc is not a specialist technology company. It would normally delegate the management of some, or all, of its technology functions to a company that is a specialist technology company; this company should be able to improve the quality of the service offered because of the following factors:

- **It is in a better position to recruit highly skilled staff because it can offer them a career path in their chosen specialisation.**
- **It has a larger pool of skilled specialist staff to cover for absences and to share problems.**
- **It has other customers similar to ABC Investment Company and may be able to leverage the experience gained by working with those customers to ABC's benefit.**

- **It may be in a better position than the customer to replace outdated technologies and working methods.**

Specialisation: Enabling Cost Reduction
The specialist technology company should be able to reduce ABC's costs because of the following:

- **It has greater bargaining power when negotiating with its own suppliers.**
- **It has a larger pool of specialist labour, which means that it can provide cover for absences without the expense of recruiting temporary staff.**
- **It may be able to carry out some or all of the outsourced functions 'offshore' in countries with lower labour unit costs and/or favourable tax regimes and/or weak currencies.**
- **It may be able to undertake 'joint developments' for more than one customer in the same industry so that the capital cost of a large software development project is shared by more than one customer.**

Business Focus: Management is Now Free to Concentrate on its 'Core Operations'
ABC Investment Company's core competence is in fund management. Because it has outsourced some or all of its non-core operations, its management is now free to manage its core business – it is no longer distracted by these activities, so it is able to concentrate on the following:

- **improving customer relationships**
- **improving the quality of their core business activity, and**
- **extending the range of services offered to its customers – innovation.**

Summary of the Advantages
As a result of successful outsourcing, the company should be in a position to deliver new and improved products to customers more quickly and with a lower level of investment.

3.2.2 Possible Disadvantages of Outsourcing

No business decision of any kind just offers benefits. Companies that are considering outsourcing some, or all, of their non-core functions should be aware of the following problems and disadvantages that can, and do, occur in some outsourcing arrangements.

Information Security
When an activity is outsourced, sensitive information about customers, staff, investment decisions and positions, the firm's own financial position and its own intellectual property are passed to third parties. The exact nature of the sensitive information that is passed on depends on the type of activity that is being outsourced. Such information can be misused and, in an extreme example, could be used fraudulently.

As a result of a small number of high-profile fraud cases involving US corporations, NASSCOM (the National Association of Software and Services Companies) in India has attempted to address these fraud concerns by creating the National Skills Registry. This database contains personal and work-related information, enabling employers to verify a staff member's credentials and allowing police to track the background of workers.

Is the Decision to Outsource Reversible?
When an activity is outsourced, the employees that used to carry out the activity either leave the company (often to become employees of the service provider) or are redeployed within the company. If the company wanted to terminate the outsourcing arrangement at some time in the future, then hiring an entire replacement team might be difficult. If the company is unhappy with the service it receives, it may be easier to change outsourcers than to bring the operation back in-house.

Work, Labour and the Economy
Outsourcing – more specifically offshoring in this context – is controversial. Politicians and consumer groups are quick to criticise firms that outsource jobs abroad or that incorporated overseas in tax havens to avoid paying their fair share of taxes. In the UK, offshoring decisions that involve the creation of large numbers of jobs in offshore centres and/or the loss of large numbers of jobs in the domestic economy sometimes generate negative press. Some UK companies – including some major retail banks – have made promises to customers that all their call centres will remain in the UK.

The Quality of the Service Fails to Live Up to Customers' Expectations
There are a number of reasons why the service that is delivered might fail to live up to the expectations of the management, staff and/or customers of the company that has outsourced its operations. Many of these issues are preventable, and the techniques and procedures to prevent them are discussed in other learning objectives in this workbook. They include the following:

Problem Description	Section
Poor selection of vendor – the vendor does not have the expertise to carry out the functions.	This chapter, section 6
Inadequate service level agreement – the SLA either does not cover the real requirements of the service or it defines unrealistically high or low levels of service.	This chapter, section 6
Communication – the SLA has not been properly explained to staff or customers, therefore, their expectations are not the same as those of the service provider. They are unsure of what to do when something goes wrong.	This chapter, section 6

Poor project management – managing the transition from in- to outsourcing is a complex project. It needs to be managed using an accepted project management methodology such as PRINCE, PMI or one of the other standards described here.	**Chapter 9, section 4**
Inadequately documented systems and working practices.	**This section**
Existing systems and working practices are unsuitable for outsourcing.	**This section**
Inadequately documented development requirements.	**This section**

Inadequately Documented Systems and Working Practices
When an operation is outsourced, the systems that are used to support it may or may not change, but the working practices always do. There will need to be different procedures for escalating and resolving problems. It is important that the staff of both companies are provided with comprehensive documentation and training in how to use the systems concerned, how to work with normal and exceptional workflows, and how to escalate and resolve problems.

Existing Systems and Working Practices are Unsuitable for Outsourcing
In an extreme example, it could prove to be the case that a customer's existing systems and working practices are so company-specific and so antiquated that they are basically unsuitable for outsourcing in their current form. In such a case, the outsourcing programme should allow for the replacement of some systems and workflows before the operation is outsourced. Both parties should recognise this problem before taking the decision to outsource. In fact, some outsourcers may refuse to take on any systems or working practices that are bespoke.

Inadequately Documented Development Requirements
This is a particular problem for those commissioning software developments that are to be outsourced to an offshore location for the first time. The commissioning company may have had no experience in this method of working before, and the fact that the users can no longer raise or resolve queries by meeting the developers informally and at short notice may come as a culture shock.

For a large outsourced development to be successful, there needs to be very clear and precise documentation of requirements, and very clear procedures for raising queries and raising change requests.

These standards should, of course, be in place for internal developments, as well as outsourced developments, but they become far more critical when development is outsourced, especially if it is outsourced to an offshore location in a remote time zone.

4. Insourcing

10.3.1 Know the advantages and disadvantages of insourcing

4.1 Definition of Insourcing

In this context, insourcing (internal outsourcing) occurs when a company sets up an operation to carry out work that would otherwise have been contracted out. Insourcing often involves the centralisation of activities that have previously been dispersed across a number of business units and geographical territories.

Example

A firm currently has securities settlement operations in every one of its European offices (Amsterdam, London, Frankfurt, Madrid, and Paris), each reporting to the local office manager, who is also responsible for sales and trading in those centres.

Using the insourcing model, the securities firm would set up a single settlements division reporting to its own manager. The settlements division would centralise, where possible, all activities in one location. This location could be in one of the cities where there is a sales and trading office, or it could be in an offshore location.

The settlements division would treat all the sales offices as customers in exactly the same way that an outsourced operation would have done. It would charge them a fee for its services and would expect to recover its costs by this fee.

In other words, the settlement operation has been outsourced, but the provider of the outsourced service is part of the same company as the customer.

4.2 Advantages of Insourcing over Outsourcing

- **Centralisation of the activity provides the opportunities to create:**

    - economies of scale, and
    - a centre of excellence for the activity being insourced
- Retention of 'institutional memory'.
- Goals and vision shared with the customer business units.
- Continued employee loyalty/improved career paths.

4.3 Disadvantages of Insourcing over Outsourcing

Unless insourcing is accompanied by offshoring, there are fewer opportunities for cost-saving due to high employment costs in major financial centres.

Outsourcing offers more opportunities for radical change to systems and working practices. With the insourcing model, there is a danger that the firm carries on doing things in the same way that it has always done them.

Senior management may continue to regard the insourced operation as a cost centre; it may have difficulty obtaining budget approval for radical developments.

5. Offshoring, Near-Shoring and Best-Shoring

10.4.1 Know the advantages and disadvantages of offshoring, near-shoring, best-shoring

5.1Definition of Terms

5.1.1 Offshoring

Offshoring is defined as the movement of a business process done at a company in one country to the same or another company in another, different country. It is almost always the case that work is moved due to a lower cost of operations in the new location.

The reasons why costs are lower usually include:

- lower salary rates in the offshore location
- lower infrastructure costs in the offshore location

- **lower tax rates in the offshore location**
- **economies of scale because offshore providers will already have robust infrastructures which will cope relatively easily with increased volumes**
- **the offshore location may have a weak currency compared to the onshore location, and**
- **the possible availability of government grants and other incentives to set up business in the offshore location.**

Offshoring is usually – but not always – associated with outsourcing; it is, of course, possible to outsource without offshoring, and to offshore without outsourcing. Some large banks and other companies have formed wholly-owned subsidiary companies in India and the Philippines to carry out business processes for their parent company – these companies are, therefore, both insourcing and offshoring.

When we hear the term 'offshoring', we usually think of a business process being moved from, say, the UK or the US to India or the Philippines, several thousand miles and time zones away. This is classic offshoring, but there are forms of offshoring that have a different model.

5.1.2 Near-Shoring

Near-shoring implies the relocation of business processes to (typically) lower-cost foreign locations, but in close geographical proximity. Some common examples include:

- **shifting US-based business processes to Canada or Latin America**
- **shifting London-based operations either to a lower-cost European country, such as Hungary, or to a lower-cost part of the UK, such as Northern Ireland, or**
- **shifting German-based operations to countries such as the Czech Republic, Poland or Hungary. These countries have a competitive advantage over their counterparts, the 'classic' outsourcing countries such as India and the Philippines, because German is more widely spoken in these near-shore locations.**

Near-shoring is usually more expensive than classic offshoring, so it is usually chosen as an alternative to classic offshoring when any of the following factors becomes important:

1. **There is a shortage of resources in the classic offshoring centres that are able to communicate in the customer's native language.**
2. **The work involves frequent visits to, or by, the customer – in such a situation, the costs of air fares might erode the classic offshore centre's usual cost advantages.**
3. **The work being undertaken has such a strong customer focus or regulations-driven reporting element, and is tied so intrinsically to the business, that it is harder to draw a solid line between it and the rest of the operation.**

However, the near-shore centres do not, in general, attract a high proportion of 'innovation outsourcing' work. This is because new application development usually needs a very large number of man-hours, and the 'classic' offshore locations have a significant competitive advantage over the near-shore locations in terms of personnel and premises costs.

5.1.3 Best-Shoring

The idea behind best-shoring is that some services need to be delivered in a location close to the customer, while other services do not. The 'best-shoring' strategy involves tailoring specific customer care needs to locations that are best suited for these functions. It allows the customer to save on the cost of domestically sourcing the work, while at the same time removing the inflexibility of using only one offshore location.

Many of the world's leading consultancy companies, such as Perot Systems and Accenture, as well as many of the large Indian outsourcing companies, have invested in facilities in near-shore locations, such as the Czech Republic, Hungary and Northern Ireland, so that they can offer their clients the advantages of best-shoring.

5.2 Advantages and Disadvantages

The following table summarises the advantages and disadvantages of each offshoring methodology, and also lists the typical services that are usually provided through each: While near-shoring, off-shoring and best-shoring are the most common outsourcing models, there is also a new model – friend-shoring – that is becoming increasingly popular. Friend-shoring involves outsourcing activities to countries that are friendly with the firm's home country.

Offshoring Methodology	Advantages	Disadvantages	Typical Work Undertaken
Classic Offshoring	Usually the lowest-cost option Very large numbers of skilled resources are available in the major centres in India and the Philippines	Major time zone differences Travel costs Possible language and cultural barriers – especially if the customer's working language is not English Lack of control	Call centre functions Simple transaction processing Software maintenance

	Usually the most appropriate location for 'innovation outsourcing', ie, the creation of new business applications. This is because these tasks involve a very large number of man-hours, and hence the low-cost environments of the major development centres in Asia have a considerable advantage over their near-shore competitors		**Large-scale software development/ business process re-engineering** **Research and development Investment analysis**
Near-Shoring	**Lower time zone differences Lower travel costs** **Fewer language and cultural barriers – especially if the customer's working language is not English**	**Higher cost than classic offshoring** **The near-shore centre may not have access to the very large numbers of skilled resources available to classic offshoring centres**	**Call centre functions** **More complex transaction processing – perhaps involving a strong customer focus or regulations-driven reporting element** **Any work that involves frequent visits to or from the customer**

Best-Shoring	**Attempts to provide the benefits of both classic offshoring and near-shoring** **Highly flexible**	**More expensive than classic offshoring** **Fragmentation – the customer may be dealing with service providers in many locations. As a result, this method is suitable only if a large number of functions are to be offshored. Both the customer and the service provider need a management structure capable of handling this fragmentation**	**All of the above**
Friendly-shoring	**Depending on the location mentioned, then there could be cost and flexibility benefits, but the key advantage is that a firm is working with countries who are friendly with their home country and so less likely to be penalised economically, socially or politically.**	**The same issues, per above apply, with time zone differences, travel costs, language barriers, lack of control and possibly higher costs.**	**All of the above.**

6. The Vendor Relationship

10.5.1 Understand the vendor relationship including: the vendor selection process; vendor assessment; task order/work order/contract negotiation and finalisation; effective vendor management and oversight; exit planning

6.1 The Vendor Selection Process

Securities industry technology departments are often involved in selecting vendors for technology products and services. The technology department is usually solely responsible for selecting suppliers of PC and server hardware, networks and configuration management software. The department usually works alongside the user departments in selecting vendors of the following:

- **packaged application software, such as order management systems, settlement systems and general ledger systems**
- **outsourced innovation services, such as bespoke software development, and**
- **some outsourced production services, such as a settlement/transaction processing service that has a high technology content.**

This section deals with the principles of vendor assessment for these types of products and services where the technology department will be working alongside the users.

6.2 The Seven Stages of Vendor Assessment



6.2.1 Form the Project Team

Assumptions

1. **If you are selecting a vendor for a packaged software product, then the company has already made the 'build-versus-buy' decision (refer to chapter 9, section 6) and has decided to buy.**
2. **If you are selecting a vendor for a bespoke development, then the company has already made the 'build-versus-buy' decision (refer to chapter 9, section 6) and has decided to build, and also to outsource the build.**
3. **If you are selecting a vendor for an outsourced production service, then the company has already made the decision to outsource the service.**

Project Team Membership
The team needs to consist of representatives from the relevant user departments and the technology department who have relevant expertise in the application being purchased and who have the time to devote to the vendor selection process. Because this process may be quite time-consuming, project team members may need to relinquish some, or all, of their other routine duties. For this reason, the team is often managed by, or its members may include, third-party consultants.

6.2.2 Specify Requirements

The user department's requirements for the system or service need to be gathered. User requirements in this context need to include all of the following:

- **Functional requirements of the application or service – 'What does it do?'**
- **Volume/performance/availability requirements – 'How fast does it do it?'**
- **Technical constraints – such as permitted or prohibited operating systems, databases and data security requirements.**
- **Support requirements – 'How do we get help and when can we get it?'**
- **Budgetary constraints – 'How much will it cost?'**
- **Delivery date constraints – 'When can we get it?'**

These requirements need to be presented in a form that can be used as a request for proposal (RFP) that will be sent to a list of potential suppliers. An RFP is a statement of intent to purchase, followed by a list of questions covering all of the issues that can be sent to potential vendors for them to reply to in writing. Vendors will need to know the timeline and how the company will make its decision in order to match their capabilities to its needs in the best way. The RFP usually also contains an overview of the current systems infrastructure and a description of the applications that are to be replaced.

Some of the questions asked will be about the cost of the system or service. It is important to phrase these questions in such a way that will trigger detailed information about:

- **one-off capital expenditure for the right to use the package or service for a predetermined period**
- **one-off capital expenditure for consultancy concerned with essential system enhancements and implementation project activity**
- **annual maintenance and support**
- **whether the amounts quoted include value-added tax (VAT) or other local taxes, or whether these amounts are excluded from the quotation, and**
- **whether the amounts quoted include reimbursement of the vendor's travel and subsistence, or whether these amounts are excluded from the quotation.**

6.2.3 Determine Evaluation Criteria

In order to make a reasoned selection, the most important (eg, must-do) requirements must be articulated and the criteria must be prioritised and weighted to allow the suitability of the solutions to be ranked. The financial viability of the vendors and their access to skilled project resources must also be evaluated.

6.2.4 Identify Potential Vendors

Potential vendors may be identified in a number of ways, including:

- **internet search engines**
- **more specialised online directories – for example, when looking for a vendor who has consulting expertise or package products concerned with SWIFT connectivity, then the SWIFT Partner Solutions Directory (at www.swift.com) lists several hundred vendors under various searchable geographical and functional categories**
- **advertisements and editorial items in trade magazines such as STP Magazine, the Securities & Investment Review and Futures & Options World**
- **attendance at exhibitions and conferences, or**
- **by word of mouth – what vendors have counterparties and competitors used? Have any in-house project team members worked at other companies that have recently had to do the same type of evaluation? If looking for a service connected with a particular stock exchange or clearing house, does the exchange concerned have a list of suitable vendors?**

6.2.5 Send Requirements to Potential Vendors

The RFP can then be sent to the vendors identified in the previous stage. If a very large number of potential vendors have been identified, then it might be worth considering sending an abbreviated version of the RFP at this stage, and using the results of that exercise to form a shortlist of vendors to whom the full RFP can be sent. The abbreviated form of an RFP is usually referred to as a request for information (RFI).

As well as asking the questions described in section 6.2.2, the vendors should also be asked to provide at least three suitable customer references that can be followed up. A suitable reference site is an organisation that is using the same packaged product or outsourced service in the same industry and geographic region as the one being addressed. If selecting a vendor for a bespoke development, then a suitable reference site is a company in the same geographical region for whom the vendor has recently worked on a similar project.

The vendor should also be asked to supply a copy of its latest audited accounts, and a draft contract for the service or product to be provided.

6.2.6 Evaluate Vendors (and Packages when Appropriate)

The criteria to be used have already been identified. Vendors should be evaluated against those criteria using all of the following as evidence of the vendors' ability to deliver and commitment to the commissioning company and its project.

Quality of the Answers to the RFP Questions

- **Have all the functional, volume/performance and technical questions been answered in an appropriate amount of depth, or were the answers woolly and vague? Did the vendor seek clarification about any of the questions? Are the answers satisfactory?**
- **Has the vendor confirmed that it is able to deliver on a timely basis?**
- **Do we now have a clear idea of the level of investment that is needed to purchase this service or package? Is the vendor's quote within budget?**

Product Demonstrations
When selecting a packaged application, it is essential to have at least one demonstration of the package – preferably more than one – and to ensure that the right project team members and other key personnel are able to attend. It is a good idea to ask the vendor to demonstrate using sample transactions or scenarios that apply to the commissioning organisation. Some firms share redacted data from their own systems, asking the supplier to demonstrate their processing using data that will be familiar to those team members attending the demo. This also helps to identify 'how' each system handles the data and presents the results of that processing.

When selecting a vendor for an outsourced bespoke development, then that vendor should be asked to demonstrate something else that it has developed for another company in a similar business area.

When selecting a vendor for an outsourced service, and part of that service involves supplying the commissioning company with, say, transaction entry software, then make sure that this software is demonstrated.

Evaluate the Vendor's Key People
By this time, the commissioning company will have had several meetings with the vendor's key personnel. The following questions should be asked:

- **Do they act in a professional manner? Are they punctual in attending meetings and do they return calls promptly?**
- **Do they have sufficient domain expertise in the areas that they are working in? Has the commissioning company met functional and technical experts, or just members of the sales force?**

Evaluate the Vendor's Financial Status
A qualified accountant should be asked to evaluate the vendor's audited accounts and raise any concerns. If there are any, they should be raised with the vendor directly and tactfully.

Review the Contract
The contract should be reviewed to see if the terms of the supply of the service are acceptable. Note that, depending upon what type of product or service is being purchased, the contract may not be a single document, but many documents (see section 6.2.7).

Perform a 'Proof-of-Concept' (PoC)
Depending on the service being delivered, it may be a good idea to perform a proof-of-concept (PoC) to check the service meets the required needs. For example, if a firm is purchasing some software to perform client reporting, then it may be advantageous to produce some sample reports with the live date to ensure everything operates as hoped.

The advantage of a POC is that it will provide greater confidence that business needs are being met and if there are gaps or shortfalls in the service, then either they can be addressed prior to the contract being signed or the vendor could be discarded from the selection process.

The disadvantage is that PoCs do require a large amount of time from the firm, the prospective vendor and possibly other vendors if they are impacted. This means the PoC needs to be tightly managed with a clear pre-defined scope and a set of success criteria to ensure all efforts are clearly focused. In turn, this could also mean that the vendor selection process timeline could be extended with additional resources needed to be allocated. Furthermore, vendors (both the prospective and others impacted) may charge the fee if the amount of work is considerable.

Take up References from Other Users
It is essential to take up references from the reference sites requested in the RFP. This is especially true when commissioning bespoke developments or outsourced services,

where there is a limit to what can be learned from product demonstrations, but it is still necessary to take up references when purchasing a packaged product.

The commissioning company should be very wary of any vendor who cannot supply at least three references that seem relevant, unless purchasing from a start-up company where it may be the first user of the service or product. If the latter is the case, then the principals of the company should be able to supply personal references from previous employers or business associates.

When taking up references, follow these guidelines:

- **Visit the reference site – do not just take up references by phone or email. Try to talk to a variety of people at the reference site, not just those nominated by the technology provider.**
- **Ask questions about the following:**
- **Functionality – does the product, bespoke development or service that they use do what the vendor said it would do? Does it do what they expected it to do? In what way has it improved the process in their company?**
- **System/service performance – does it handle the volumes that they expected it to?**
- **Vendor performance – did the vendor deliver on time and within budget? Are help desk calls usually resolved satisfactorily and promptly?**

6.2.7 Negotiate and Place Orders

By now, the preferred supplier will be identified. It is now time to negotiate contracts.

Price
The vendor may be prepared to reduce the price that was quoted in the response to the RFP. For concessions on price, it will usually ask for something in return. Typically, the vendor will ask the customer to cooperate in publicity about the latest sale; it will usually ask that the customer agree to its issuing a press release mentioning your company's name; additionally, it may ask for cooperation in producing a case study to be published in the trade press.

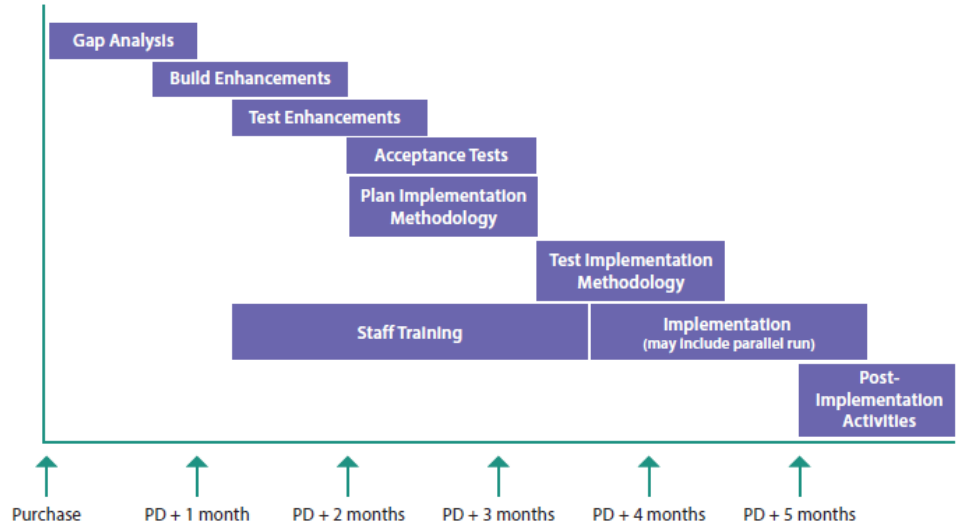
Contractual Terms
The contract may not be a single document, but many documents. The following table illustrates the common types of documents that it will be necessary to agree on for various types of purchase.

Document Type	Document Type/Type of Purchase (where this document is used)	Brief Description of Document

Software Licence	**Software Package**	**The document grants the customer the right to use the software package for a given period of time, in return for the payment of a licence fee** **Typically, this document may have restrictions about the use of the package. For example:** • **The user may only use this product in a given location** • **The licence may expire after a given number of years** • **The licence may restrict the number of transactions to be processed in a given day, week or month**
Software Maintenance Contract	**Software Package**	**The document obliges the vendor to provide support for the package, in return for payment of a maintenance fee** **Typically, this document may have limitations about the provision of support. For example:** • **Support may be restricted to telephone support and not include site visits which are charged separately** • **Support may either be available 24/7, or it may be restricted to normal business hours/days in the country from where it is provided** • **Support may be restricted to just problem-solving, or it might entitle the user to new releases/ upgrades of the package**
Development Contract	**Outsourced Development Projects/ Software Package**	**This document commits the vendor to develop software specified by the customer, in return for payment of development fees** **Development fees may be charged on a 'time and materials' basis, eg, $1,000 per day, or may be on a fixed price basis, eg, $250,000 for the complete development** **When development fees are charged on a fixed price basis, the scope of the development needs to be agreed at the start, and the contract will cater for variations. Variations are then dealt with by work orders or task orders**

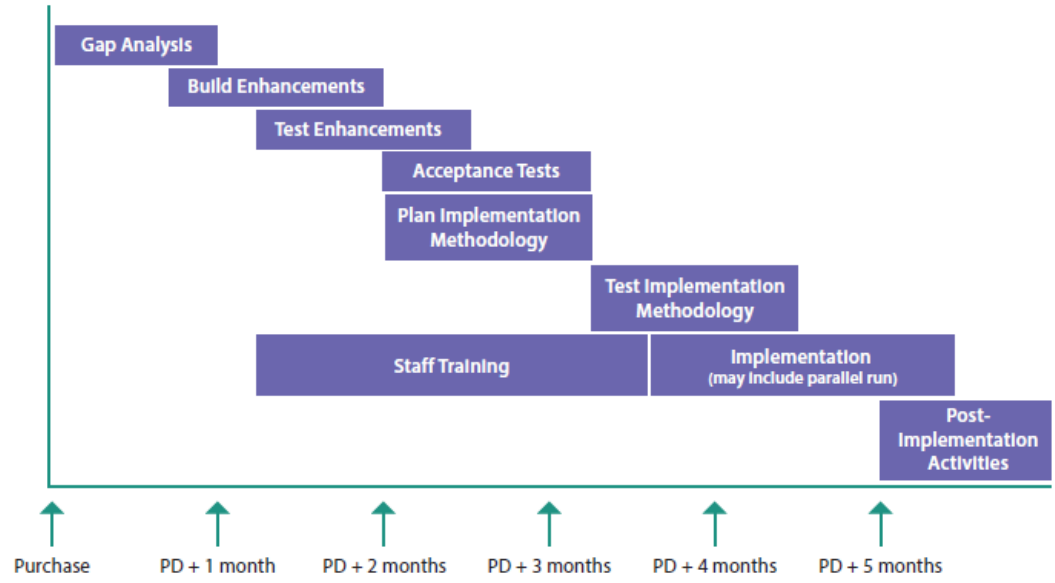
Service Contract	Outsourced Business Process	This document describes the work that is to be outsourced to the vendor in return for payment of a services fee by the customer
		Typically, this document may have restrictions about the use of the service. For example: • The user may only use this service in a given location • The service usually refers to trading volumes; there may be a minimum charge for the first, say, 1,000 transactions per day/week/month, and extra transactions will be charged on a sliding scale
Service Level Agreement	Outsourced Business Process	An SLA is that part of a service contract in which a certain level of service is agreed upon. The level of service, in this context, refers to both the quality of the service and the time deadlines for performing the service. It may also specify penalties to be paid by either party if the level of service provided fails to reach the minimum standards in the agreement for an extended period of time
Work Order	Outsourced Development Projects/ Outsourced Business Process/Software Package	In the case of a package, a work order may be used instead of a development contract
		In the case of an outsourced development project, work orders are used mainly to vary the scope of the previously agreed development
		In the case of an outsourced business process, it is used to request the vendor to carry out work that is outside the scope of the original service contract
		It obliges the vendor to carry out the specified work in return for the agreed fee
Task Order	Outsourced Development Projects/ Outsourced Business Process/Software Package	An alternative to a work order

Change Request	Outsourced Development Projects/ Outsourced Business Process/Software Package	An alternative to a work order



6.3 Effective Vendor Management and Oversight

If the firm has selected a vendor for a core application or service, then it will have to work alongside the selected vendor's staff for an extended period, possibly for many years. Assume that the firm has just selected a vendor and a package to replace its core settlement system. The likely activities that the vendor and the customer will need to undertake jointly can be shown by the following (simplified) project plan, which assumes that the new system can go live five months after purchase date. In practice, this period may be shorter or longer depending on the complexity of the project and the availability of the firm's staff to work on it.



During the period between the purchase date and go-live date, both the customer and the vendor may need to commit significant numbers of people to the project. Often, vendor staff may be working full-time at the customer's premises.

Post-implementation activities include, inter alia the following:

- **Hand-holding customer staff through the initial 'live' period.**
- **General help desk support.**
- **Delivery of new releases of the vendor's system.**
- **Specific client-related enhancements.**
- **Post-implementation review.**
- **Implementing an ongoing oversight function. (The Financial Conduct Authority (FCA)) now expects firms to have solid oversight governance in place to manage any outsourced arrangements.)**

These activities usually demand fewer resources, and there may be no need for a full-time vendor presence on-site.

Even if both parties have used best efforts in the vendor selection process, and employed best practice project governance, things can still go wrong with the vendor-client relationship. Some of the causes of poor relations were examined in section 3.2.2 of this chapter.

Another frequent cause of disputes is the effect of regulatory changes. Take MiFID II as an example. The new regulations created the need for major changes to many applications, and in many cases the client firms may have expected the vendor to fund those changes as

part of the maintenance agreement, while the vendor stated that changes of this magnitude were never anticipated when the level of charges was originally negotiated.

6.3.1 Practical Steps Customers Can Take to Proactively Manage Vendors

Maintain strong communication links with all vendors. This can be achieved through regular progress meetings, user groups, vendor presentations, newsletters and open discussion.

Endeavour to keep acquainted with new enhancements to software and services, to ensure that they are on the right version and communicate any changes required in order to ensure that the system or service meets their ongoing requirements.

Implement regular systems/service 'health checks' to make sure they are getting the most from the software or service and that they are using and maintaining it correctly.

Monitor service level agreements – many organisations will have agreements in place to ensure that levels of service are appropriate to effectively support their business. These should be reviewed regularly with the supplier, to ensure that they are appropriate and that they are being met.

6.3.2 Practical Steps Customers Can Take to Proactively Manage Vendors

Traditionally, it has been seen as an art. However, as configurations become larger and more complex, many firms now use a more formalised approach. There are now vendor management software packages on the market that support this process. They usually automate the administration of contracts and centralise all associated information into one central repository that is globally accessible via a web browser. These products enable organisations to monitor their spending, terminate contracts at the correct time, monitor and track their costs against benefits gained, and ensure that more informed decisions are made based on quantifiable facts and figures.

6.4 Exit Planning

At some point, a firm may decide to leave an outsource provider. The contract signed with the provider should include details on the circumstances in which this can occur:

- **Firstly, the exit could be controlled. This would happen when the contract is terminated by one or both parties; or the contract is not renewed at the renewal point and, therefore, the exit clauses within the contract are evoked and followed.**

- **The second way is an emergency exit – where the outsourcer cannot continue to operate for some reason (such as they are bankrupt or the regulator has removed their permissions to operate this business). Many contracts also provide provision for certain events which can result in an expedited exit.**

Therefore, when firms implement outsourcing arrangements, they need to take into account the potential challenges surrounding leaving a provider and, in particular, a distressed outsource provider. In short, there is the requirement to have considered this and documented a contingency plan. (In fact, the FCA's 'Dear CEO' letter on outsourcing in December 2012 stated clearly that firms needed to address this immediately.)

It is possible to include a legal schedule in the outsourcing contract to cover a controlled exit. It would clearly document what the process would be if one or both parties wanted to leave the arrangement. It would also include details of the approach, costs, roles and responsibilities. This schedule would feed into any project that firms would run to move the arrangement from the 'leaving' outsourcer to the new owner.

The emergency exit is more challenging as it is likely to happen at short notice, and so would need addressing instantly. Therefore, firms need to think about:

a. **what types of emergencies could happen, and**
b. **what plans they could realistically put into place to mitigate against them, eg, plans could include implementing manual processes, moving to a new provider or suspending business.**

6.5 Managing Vendor/Third-Party Risk

10.6.1 Understand the technology implications and risks for outsourced and vendor arrangements

All firms have a web or network of third-party providers to support their operating model. These providers can cover external organisations (such as software providers), market infrastructure (such as trading platforms and outsourcing arrangements) and intragroup arrangements (such as using a central in-house data centre or finance function). Any issues or failures with these third-party providers will cause material issues for the firm.

While some of the vendors will be regulated themselves (such as UK fund administrators being overseen by the UK's FCA), which will provide some sort of comfort, it is essential that processes are in place to oversee the performance and stability of any supplier, so that any issues or risks can be highlighted, mitigated and managed quickly.

Firms should have an ongoing risk assessment in place to monitor the following two variables:

- **What is the impact to the firm if the supplier either fails completely or does not perform what they are being contracting to do. This will involve reviewing the functions that the supplier supports and determining the impact if the suppliers fails. For example, if catering fails, it is not a massive impact to the business; but if a data centre fails then it could mean that the firm may not be able to operate.**
- **What is the likelihood of either the supplier completely failing or not performing their contracted obligations. This can a little more involved because it would involve reviewing the performance against pre-agreed key performance indicators and service level agreements, review of any major issues (eg, information security breaches) during the monitoring period, financial state of play (eg, debtors, creditors, cash at the bank and profitability), staff turnover, experience and any single points of failure and assessing the vendors business continuity plans (including evidence of test results). It may be necessary for the firm to ensure that they have the right to perform internal audits.**

The suppliers with a 'high' impact and 'high' likelihood should therefore be constantly monitored and fallback plans should be put in place (and tested) in case of material issues.

Traditionally, the above oversight is only performed on external organisations, but there is now much more regulatory focus on firms performing similar oversight on intragroup arrangements. However, implementing such arrangements can be challenging because an intragroup provider cannot often be 'sacked' in the same way an external provider can, and often the intragroup provider can be the parent of the firm in question.

There is also much more regulatory pressure on firms to oversee providers' (both external and intragroup) sub-contractors (or fourth parties). Therefore, it is not uncommon for firms to implement oversight and risk management arrangements for the providers' sub-contractors.

End of Chapter Questions

Think of an answer for each question and refer to the appropriate section for confirmation.

1. **List the reasons why a firm might decide to build an application in-house and the reasons why it might decide to buy a package.**
   Answer Reference: Section 1

2. **List the possible benefits and disadvantages of outsourcing.**
   Answer Reference: Section 3.2

3. **List the reasons why the quality of an outsourced product or service might fail to live up to a customer's expectations.**
   Answer Reference: Section 3.2.2

4. **Define insourcing in your own words.**
   Answer Reference: Section 4.1

5. **List the reasons why the cost of an offshore service is likely to be lower than that of an onshore service.**
   Answer Reference: Section 5.1.1

6. **What are the common reasons for preferring to deliver a product or service by near-shoring instead of classic offshoring?**
   Answer Reference: Section 5.1.2

7. **What is the definition of best-shoring?**
   Answer Reference: Section 5.1.3

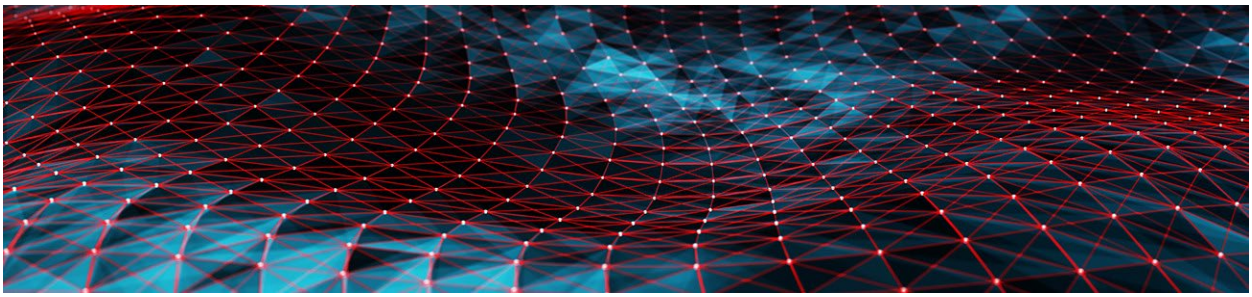
8. **List the seven stages of the vendor selection process.**
   Answer Reference: Section 6.2

9. **What document is sent to potential vendors inviting them to reply to written questions about their products or services?**
   Answer Reference: Section 6.2.2

10. **When sending a list of requirements to potential vendors, what other things should you ask them to provide in addition to the answers to your specific questions?**
    Answer Reference: Section 6.2.2

11. **What obligations does a software maintenance contract place on: the software vendor; the customer and what are the typical limitations to such an agreement?**
    Answer Reference: Section 6.2.7

12. **What two scenarios should a firm's exit plan cover?**
    Answer Reference: Section 6.4



Glossary

Accrual
A method of accounting in which each item is entered as it is earned or incurred, regardless of when actual payments are received or made.

Accrued Interest
The interest that has accumulated on a holding since the last interest payment date or start date, up to, but not including, the current date.

ACK/NACK Protocol
This protocol is used by SWIFT to confirm that messages sent by its members have passed network validation and are, therefore, good messages (ACK), or have failed validation (NACK).

Affirmation
The process where a buy-side firm sends a communication to a sell-side firm indicating their agreement to the details of a confirmation received from the sell-side firm.

Agile Model
A methodology to manage the designing and building of software applications.

Algorithmic Trading
The placing of a buy or sell order of a defined quantity into a quantitative model that automatically generates the timing of orders and the size of orders based on goals specified by the parameters and constraints of the algorithm.

Allocation
The process where a buy-side firm sends a communication to a sell-side firm advising the sell-side firm of the details of the investors who are parties to a trade.

Artificial Intelligence (AI)
The branch of computer science that focuses on programming computers to behave like humans.

Assets
Everything a corporation owns or that is due to it: cash, investments, money due, materials and inventories, which are called current assets; buildings and machinery, which are known as fixed assets; and patents and goodwill, known as intangible assets.

Autex
Autex Trade Route is one of the world's largest global FIX-based order-routing networks. Owned by Refinitiv.

Automation
Working practices and systems that enable transactions to move seamlessly through the processing cycle, without manual intervention or redundant handling. Automation was previously called Straight-Though Processing (STP).

Average Price
The average price per unit of a position. If the position is long (ie, positive), then further purchases modify the average price, and sales create P&L but do not modify the average price. If the position is short (ie, negative) then further sales modify the average price, and purchases create P&L but do not modify the average price.

Basel Committee
A committee of central bankers which publishes a set of minimal capital requirements for banks known as the Basel Accord.

Basis Point (BP)
A basis point is a unit that is equal to 1/100th of 1%, and is used to denote the change in a financial instrument. The basis point is commonly used for calculating changes in interest rates, equity indices and the yield of a fixed-income security. The relationship between percentage changes and basis points can be summarised as follows: 1% change = 100 basis points, and 0.01%
= 1 basis point. So, a bond whose yield increases from 5% to 5.5% is said to increase by 50 basis points; or interest rates that have risen 1% are said to have increased by 100 basis points.

Beneficial Owner
A legal term where specific property rights ('use and title') in equity belong to a person even though legal title of the property belongs to another person, the Nominal or Legal Owner.

Best Execution
The process that an investment firm goes through, when executing orders, to obtain the best possible result for its clients taking into account the prices available in various markets, as well as a number of other defined execution factors.

Best-Shoring
The 'Best-Shoring' strategy involves tailoring specific customer care needs to locations that are best suited for these functions. It allows the customer to save on the cost of domestically sourcing the work, while at the same time removing the inflexibility of using only one offshore location.

Big Data
A collection of data that is so vast and/or complex that traditional data processing approaches are not adequate. For a data set to be termed as 'big data', it needs to (a) contain a large amount of data; this is normally in the region of a minimum of a billion data items (b) have data in a number of formats such as different databases (in different formats), video, verbal media, images, spreadsheets and so on, and (c) be constantly changing with new data items being added and existing data items being removed or amended.

Bitcoin
A cryptocurrency that is not underpinned by any country's central bank or government. It can be traded for goods or services with vendors who accept them as payment.

Blockchain
Blockchain is a distributed and shared database that maintains a continually growing list of records called 'blocks'. Each 'block' contains a timestamp and a link to its previous block. The contents of each block cannot be altered retrospectively. Its main and most well-known use is providing the ledger that underpins the Bitcoin cryptocurrency.

Bond
A debt instrument issued for a period of more than one year with the purpose of raising capital by borrowing. Governments, states, cities, corporations and many other types of institutions issue bonds. Generally, a bond is a promise to repay the principal on a specified future date (maturity) and to pay interest (the coupon rate) at pre-defined intervals throughout the life of the bond.

Botnet
A botnet is a network of computers controlled by cybercriminals using a Trojan or other malicious program.

Broker Crossing Network
A network provided by an investment bank which allows the bank's client orders to match and cross transactions without going through an investment exchange.

Buy-Side Firms
Fund management institutions that take investment decisions on behalf of investors.

Call Option
A call option gives the buyer (or holder) the right (but NOT the obligation) to purchase the underlying instrument at a specified price on or before a given date.

Calastone
Calastone is a large global funds network, connecting many of the world's leading financial organisations.

Cash Instrument
See Underlying Instrument.

Central Counterparty (CCP)
A central counterparty is a financial institution that acts as an intermediary between market participants. This reduces the amount of counterparty risk to which market participants are exposed. See Clearing House.

Central Securities Depository (CSD)
A central securities depository (CSD) is an entity holding securities, either in certificated or uncertificated (dematerialised) form, to enable settlement by book entry transfer. In some cases, these organisations also carry out centralised comparison and transaction processing such as clearing and custody-type services relating to securities. The physical securities may be immobilised by the depository, or securities may be dematerialised (so that they exist only as electronic records). An International Central Securities Depository (ICSD) is a central securities depository that settles trades in international securities and in various domestic securities, usually through direct or indirect (through local agents) links to local CSDs. Clearstream Banking S.A. (Luxembourg) and Euroclear Bank are considered ICSDs.

Change Control Procedures
A process developed to prevent an item of software or hardware from being amended without auditability and review of the impact by all interested parties.

Clearing House
A financial institution that operates clearing, central counterparty or settlement services.

Client Money
Money belonging to clients which an investment business is holding. It could either be free money or settlement money and, in either case, it must be kept in a bank account separate from the firm's own money.

Cloud Computing
The provision of technology resources (hardware, software, networks and services) on demand via a network. Cloud computing provides software, data access and storage services that do not require end-user knowledge of the physical location and configuration of the system that delivers the services. There are a variety of models, but platform as a service (PaaS), infrastructure as a service (IaaS) and software as a service (SaaS) are three of the most common.

Collateral
A security, cash or guarantee (usually an asset) pledged for the repayment of a loan.

Commodity Futures Trading Commission (CFTC)
The CFTC was created in 1974 as an independent agency with the mandate to regulate commodity futures and option markets in the United States. The agency's mandate has been renewed and expanded several times since then, most recently by the Dodd-Frank Wall Street Reform and Consumer Protection Act.

Computer Virus
A malicious software program that can copy itself and infect multiple files on an individual computer, as well as spread from one computer to another.

Confirmation
The process where one party to a trade sends the other party a communication that confirms that the order has been executed, and provides details of the resulting trade.

Consideration
For a securities trade, the amount paid by the buyer and received by the seller. Consideration is the sum of the principal amount, accrued interest, commissions, fees and charges.

Contract for Difference (CFD)
An agreement between two parties to exchange the difference between the opening value and the closing value of a particular financial instrument. These are generally short-term contracts. The firm's exposure to default by its client is controlled by margin requirements and collateral deposits.

Coupon Date
The interest payment date of a bond.

Coupon Rate
The interest rate of a bond.

Credit Limit
The maximum amount of credit that a bank or other lender will extend to a debtor. In the securities industry, 'debtors' may include clients, counterparties, countries or business sectors. In addition, securities firms usually have limits that they apply to individual traders or trading books.

Credit Risk
The risk associated with one party not fulfilling its contractual obligations at a specific future date.

Crossing
The situation when a broker acts as agent on both sides of a given securities transaction. If the broker has a buy order and an equivalent sell order, it can 'cross' the orders. Under MiFID rules, crossing is only permitted if it results in best execution. Broker crossing networks are a form of MTF.

Cryptocurrency
A virtual medium of exchange that uses technology and cryptography to process currency transactions and to control creating new currency units. Normally, no physical coins or notes are created. All balances and transactions are stored electronically.

Crypto Tokens
Crypto tokens are assets that are stored on another cryptocurrency's blockchain. These digital assets can represent a wide range of areas covering traditional physical assets (such as art, real estate or other rare items) as well as digital assets (such as photos or images). Crypto tokens can be traded like a cryptocurrency.

Central Securities Depositories Regulation (CSDR)
The CSDR is a piece of EU regulation which aims to harmonise the authorisation and supervision of EU central security depositories (CSDs) as well as certain settlement aspects.

Custodian Bank
A bank, agent, or other organisation responsible for safeguarding a firm's or individual's financial assets. The role of a custodian in such a case would be the following: to hold in safekeeping assets, such as equities and bonds; to arrange settlement of any purchases and sales of such securities; to collect information on and income from such assets (dividends in the case of equities and interest in the case of bonds); to provide information on the underlying companies and their annual general meetings; to manage cash transactions; to perform foreign exchange transactions where required; and to provide regular reporting on all their activities to their clients.

Cyber Espionage
The theft of valuable information about products, services, patents, designs and other intellectual property, when it is facilitated by hacking or other forms of computer crime.

Cyber Security
The methods and processes used to protect computer systems' hardware, software and data from (a) damage (b) theft (c) unauthorised use and (d) disruption.

Dashboard
A digital dashboard, also known as an enterprise dashboard or executive dashboard, is a business management tool used to ascertain the status (or 'health') of a business enterprise through visual key business indicators. Digital dashboards use visual, at-a-glance displays of data pulled from disparate business systems to provide warnings, action notices, next steps and summaries of business conditions.

Data Dictionary
A centralised repository of information about data such as meaning, relationships to other data, origin, usage and format.

Data Protection Act (DPA) 1998
This UK Act details how personal data should be managed to protect its integrity and to protect the rights of the persons concerned. Superseded later by other government DPA legislation and has supplemented the EU GDPR regulations since May 2018.

Data Replication
The process of sharing information so as to ensure consistency between redundant resources, such as software or hardware components, to improve reliability, fault-tolerance or accessibility.

Deep Learning
A sub-set of machine learning which uses more complex and layered algorithms (called neural networks) to try to mimic how a human brain would operate.

Deliverable
The physical outcome of a task resulting from applying defined processes to a set of inputs. A deliverable is a measurable, tangible, verifiable item produced as part of a project.

Delivery versus Payment (DvP)
The simultaneous and irrevocable delivery of securities by a seller together with the payment of sale proceeds by a purchaser of securities on settlement date.

Depot
The account with a settlement agent which is used to record transactions and balances in a security.

Derivative Instrument
A financial contract whose value depends upon the value of an underlying instrument or asset (typically a commodity, bond, equity, index or currency, or a combination of these). Three classes of financial products fall under the heading of derivatives: derivative securities; exchange-traded derivatives; and over-the-counter (OTC) derivatives.

Designated Investment Exchange (DIE)
An overseas exchange that does not carry on a regulated activity in the UK and is not a regulated market. Overseas exchanges may apply to the FCA to be included on the FCA's list of designated investment exchanges.

Deutsche Börse Group
Owner and operator of the Frankfurt Stock Exchange, as well as Clearstream, Eurex Clearing and the Eurex derivatives exchange.

Digital Certificate
An electronic 'credit card' that establishes your credentials when doing business or other transactions on the web. It is issued by a certification authority (CA). It contains your name, a serial number, expiration date, a copy of the certificate holder's public key (used for encrypting messages and digital signatures) and the digital signature of the certificate-issuing authority so that a recipient can verify that the certificate is real.

Direct Market Access (DMA)
The automated process of routing a securities order directly to an execution venue, therefore avoiding intervention by a third party. Execution venues include exchanges, alternative trading systems and electronic communication networks.

Disruptive Innovation
An innovative technology which improves a product or service in ways that the market does not expect, typically by lowering the cost or designing for a different set of consumers.

Distributed Denial of Service (DDoS) Attack
A denial-of-service attack (DoS attack) or distributed denial-of-service attack (DDoS attack) is an attempt (usually by criminals) to make a computer or network resource unavailable to its intended users.

Distributed Ledger
A database that is shared and synchronised across multiple sites, firms or geographies. The participant at each node of the network can access the databases across the network as well as having their own identical copy of it. Any changes made across the ledger will be copied to all members within a few seconds.

Distributed System
A configuration which contains a number of hardware elements which are connected by some transmission technology.

Dodd-Frank
The Dodd-Frank Wall Street Reform and Consumer Protection Act is a United States law that was signed in July 2010 and was implemented in stages beginning in 2012. It was the most significant change to financial regulation in the United States since the 1930s. Dodd-Frank's consequences include the requirements for Legal Entity Identifiers (LEIs) and trade repositories.

Depository Trust & Clearing Corporation (DTCC)
The DTCC is a large American post-trade financial services company providing clearing and settlement services to the financial markets.

European Monetary Union (EMU)
On 1 January 1999, the euro became the official currency for 11 participating countries in the European Union (EU). In 2001, Greece also adopted the euro as its official currency. From that date forward, the respective foreign exchange operations, new public debt and all stocks and bonds on all stock exchanges in the participating member areas were quoted or issued in euros. Euro banknotes were first made available three years later. The euro is now used by 19 EU member states.

End-User Development (EUD)
A methodology to manage the designing and building of software applications.

Equity
Ownership interest in a corporation in the form of common or preferred stocks or ordinary shares.

Environmental, Social and Governance (ESG)
The purpose of ESG is to measure the sustainability and societal impact of an organisation. It consists of three (nonfinancial) measures – environmental, social and (corporate) governance.

Euroclear Bank
An ICSD for the international bond market. Based in Brussels.

Euroclear UK & Ireland Ltd (EUI)
The central securities depository for the UK and Ireland. Irish securities will be migrating to another CSD within the Euroclear group post Brexit – Euroclear Bank in Belgium.

European Banking Authority (EBA)
EU's banking regulatory agency, whose main responsibility is to ensure that the EU banking sector functions efficiently and in an orderly manner, which in turn ensures financial stability.

European Insurance and Occupational Pensions Authority (EIOPA)
The EU regulatory authority whose responsibility is to ensure stability and transparency in the insurance and pensions markets/system across the EU.

European Markets Infrastructure Regulation (EMIR)
The EMIR is an EU regulation for over-the-counter (OTC) derivatives, central counterparties and trade repositories. It was originally adopted by the EU legislature in July 2012 and came into force in August 2012.

European Securities and Markets Authority (ESMA)
The EU regulatory authority that contributes to safeguarding the stability of the EU's financial system by ensuring the integrity, transparency, efficiency and orderly functioning of securities markets, as well as enhancing investor protection.

European Supervisory Authorities (ESAs)
Pan-European financial services regulatory bodies, each with responsibility for a different financial sector, introduced in early 2011. The three ESAs are the European Securities and Markets Authority (ESMA), the European Banking Authority (EBA) and the European Insurance and Occupational Pensions Authority (EIOPA).

Financial Conduct Authority (FCA)
A UK regulator that took over the business conduct regulatory activities of the Financial Services Authority in 2013. The FCA focuses on regulation of all firms in retail and wholesale financial markets, as well as the infrastructure that supports these markets. In effect, it has responsibility for firms that do not fall under the scope of the Prudential Regulatory Authority (PRA) (approx. 55,000 firms). The FCA's role includes supervision of investment exchanges and monitoring firms' compliance with the Market Abuse Directive, with powers to investigate and prosecute insider dealing.

Financial Control Department (FCD)
The department of a securities firm that is responsible for managing the financial resources of the business.

Financial Policy Committee (FPC)
A committee established within the Bank of England, with responsibility for 'macro-prudential' regulation, or regulation of the stability and resilience of the financial system as a whole. This committee works alongside the two UK regulators, the Prudential Regulatory Authority (PRA) and the Financial Conduct Authority (FCA).

Financial Services and Markets Act 2000 (FSMA)
The Financial Services and Markets Act 2000 introduced a new structure for the regulation of the financial services sector in the UK which came into effect from midnight on 30 November 2001. It established a new regulatory regime, empowering the then Financial Services Authority (FSA) with broad responsibility for both the prudential and business conduct regulation of firms within the financial services sector.

Financial Services Authority (FSA)
Between 2001 and 2012, the FSA was the sole UK regulator for the financial services sector. In 2013 the FSA was superseded by two new regulators, the Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA).

FIX Protocol
The Financial Information eXchange (FIX) protocol was initiated in 1992 by a group of institutions and brokers interested in streamlining their trading processes. It is an open message standard controlled by no single entity, that can be structured to match the business requirements of each firm.

Foreign Account Tax Compliance Act (FATCA)
An Act passed by the US government in 2010 designed to combat tax evasion by US persons holding investments in offshore accounts.

Follow-the-Sun Model
A method of running a help desk where an incident that is reported during one time zone will continue to be worked on and handed over to others around the clock until it is resolved ready for the requestor to sign off and close on their return to the office.

Foreign Exchange (FX or Forex)
The simultaneous buying of one currency and selling of another, either for spot (ie, immediate) settlement, or for forward settlement (ie, settlement at a later date).

Foreign Financial Institution (FFI)
An organisation such as a securities or investment firm that, while not a resident of the United States, still has to comply with certain regulations of the US Foreign Accounts Tax Compliance Act (FATCA).

Form Grabbing
This is software that has the same purpose as illegal keystroke logging – it intercepts data submitted to web browsers, collects it before it passes over the internet and passes it to criminals.

Fountain Model
A methodology to manage the designing and building of software applications.

FpML (Financial products Markup Language)
An XML message standard for the OTC derivatives industry.

Free of Payment (FoP)
A settlement methodology where the movement of cash and the movement of securities are NOT inextricably linked to one another. In other words, FoP is the opposite of Delivery-versus-Payment (DvP).

Friend-Shoring
Friend-shoring involves outsourcing activity to countries that are friendly with the firm's home country.

General Clearing Member (GCM)
A futures and options exchange member that is also a member of the exchange's clearing house, and which clears trades done by other exchange members, who are known as non-clearing members.

General Ledger
The general ledger, sometimes known as the nominal ledger, is the main accounting record of a business which uses the double-entry book-keeping convention. It will usually include accounts for such items as current assets, fixed assets, liabilities, revenue and expense items, gains and losses.

Hacking
The process of gaining unauthorised access to computer systems for the purpose of stealing and/or corrupting data.

Hedging
The purchase or sale of a commodity, security or other financial instrument for the purpose of offsetting the profit or loss of another security or investment. Thus, any loss on the original investment will be hedged, or offset, by a corresponding profit from the hedging instrument.

Help Desk
A section of the technology department that takes requests from users to deal with systems problems and/or out-of-the-ordinary requests, logs them, prioritises them, and hands them on to the appropriate individuals for action.

His Majesty's Revenue & Customs (HMRC)
The tax-collecting agency of the UK government.

Hybrid System
An exchange trading system that uses both an order queue and market makers.

ICE Futures and ICE Clear
ICE Futures provides exchange-trading and clearing services in a number of different markets (such as exchange-traded futures/options and OTCs) across North American, Europe, Abu Dhabi and Singapore.

Identity Fraud
The process of stealing personal information so that the criminal is able to pose as the person or organisation whose identity has been stolen.

Infrastructure as a Service (IaaS)
A cloud computing model where the provider offers basic infrastructure, such as network, servers, storage, and processing power.

Innovation Outsourcing
The development of new business applications by an outsource provider.

Insider Dealing
Illegal share dealings by employees or directors of a company where they have used confidential price-sensitive information – material non-public information – for their own gain or for the gain of their associates. A form of market abuse.

Insourcing
Insourcing (internal outsourcing) occurs where a company sets up an operation to carry out work that would otherwise have been contracted out. It usually implies the centralisation of a service that would have previously been decentralised, and may also imply that the insourced service is now provided offshore.

Internal Revenue Service (IRS)
The tax-collecting agency of the US government.

International Bank Account Number (IBAN)
An internationally agreed system of identifying bank accounts across national borders to allow cross-border transactions with reduced risk of errors.

International Capital Market Association (ICMA)
A Swiss-based organisation with the status of a designated investment exchange in the UK. The ICMA promotes by-laws, statutes, rules and recommendations for market practices in the bond markets.

International Central Securities Depository (ICSD)
See Central Securities Depository.

International Organisation for Standardisation (ISO)
A UN-sponsored organisation that sets international standards that can be used in any type of business, which are accepted around the world as proof that a business can provide assured quality.

Investment Exchange
A corporation or mutual organisation which provides facilities for brokers and traders to trade company stocks and other securities, including bonds, derivatives and physical commodities such as precious metals and agricultural products.

Investor Self-Servicing
A capability that allows investors to service themselves (such as entering orders and producing reports) without speaking to anyone. This capability is typically provided by websites, mobile/tablet applications and voice recognition software.

IP Protocol
The internet protocol suite is the set of communications protocols that implement the protocol stack on which the internet runs. It is sometimes called the TCP/IP protocol suite, after the two most important protocols contained within: the Transmission Control Protocol (TCP) and the Internet Protocol (IP).

International Swaps and Derivatives Association (ISDA) Master Agreement
A standardised contract (drafted by ISDA) to enter into OTC derivatives transactions. This means it contains general terms and conditions (such as provisions relating to payment netting, tax gross-up, tax representations, basic corporate representations, basic covenants, events of default and termination) but does not, by itself, include details of any specific derivatives transactions the parties may enter into. The ISDA Master Agreement is a pre-printed form which will not be amended itself (save for writing in the names of the parties on the front and signature pages). However, it also has a manually produced schedule in which the parties are required to select certain options and may modify sections of the Master Agreement if desired.

International Securities Identification Number (ISIN)
The ISIN is a code that represents, for example, Sony Corporation ordinary shares. If the security is listed on more than one exchange, there is only one ISIN code. Most custodians and clearing houses identify securities by the ISIN code on messages.

Iterative/Incremental
A methodology to manage the designing and building of software applications.

Joint Application Development (JAD)
A methodology to manage the designing and building of software applications.

Key Performance Indicator (KPI)
Critical items in a service level agreement (SLA) that are capable of being measured.

Keystroke Logging
Sometimes referred to as keylogging. This is the action of recording (or logging) the keys struck on a keyboard, typically in a covert manner so that the person using the keyboard is unaware that their actions are being monitored. It has legitimate uses in studies of human-computer interaction and in software testing, where a set of keystrokes can be recorded in order that the exact keystrokes can be repeated in later tests. However, criminals often install keylogging applications as viruses or Trojans on computers in order to capture personal details.

LCH ltd
LCH is a British clearing house group (CCP) that serves major international exchanges, as well as a range of OTC markets. Its parent organisation is the London Stock Exchange Group (LSEG).

Legal Entity Identifier (LEI)
A unique global identification code that enables identification of all legal entities (who process financial transactions regardless of whether they are a financial firm or not) across borders. It is based on the ISO standard 17442.

Liabilities
All the claims against a corporation. Liabilities include accounts, wages and salaries payable; dividends declared payable; accrued taxes payable; and fixed or long-term liabilities, such as mortgage bonds, debentures and bank loans.

London Stock Exchange (LSE)
The largest formal market for securities in the UK; the LSE facilitates deals in equities, bonds and some derivatives such as exchange-traded funds and covered warrants.

Long Position
See Position.

MA-CUG
(Member Administered Closed User Groups) Companies not eligible for the Standardised Corporate Environment (SCORE) model can join SWIFT by registering in a closed user group set up and managed by their financial institution (ie, the financial institution elects which customers can participate). Within the MA-CUG, a corporate can communicate only with its bank, which decides which kinds of messages and files (payments, treasury, reporting, securities) can be exchanged. If a corporate wishes to communicate with several banks it can register in multiple MA-CUGs, resulting in similar multi-banking capabilities as SCORE.

Machine Learning
Machine learning is a discipline of artificial intelligence (AI) that allows technology systems to automatically learn and improve from experience without being explicitly programmed. The process involves the technology system obtaining historic data (or 'observations' to use the technical name). This data can be structured (such as database records) or unstructured (such as images and voice recordings). This data is then processed to look for patterns which then allow better future decisions to be made.

Malware
Malware (short for malicious software) is software which is designed to gain surreptitious access to computer systems in order to disrupt normal operation or gather private information that may be used illegally.

Margin
The cash or collateral that a holder of a position in securities or in exchange-traded derivatives is required to post to cover potential adverse movements in the value of the position.

Mark-to-Market (MTM)
An accounting procedure by which assets are 'marked', or recorded, at their current market value, which may be higher or lower than their purchase price or book value.

Market Abuse
An offence introduced by FSMA 2000 judged on what a 'regular user' would view as a failure to observe the required standards. The offence includes abuse of information, misleading the market and distortion of the market.

Market Maker
A sell-side firm that has accepted the obligation to quote both a buy and a sell price in a financial instrument or commodity, hoping to make a profit on the turn or the bid/offer spread.

Matching Engine
A form of trade agreement where both parties input their trade details to the matching engine database. The matching engine then compares the two trade reports and provides them to both parties in real time.

Maturity Ladder
A form of cash flow projection.

Markets in Financial Instruments Directive (MiFID)
The Markets in Financial Instruments Directive (MiFID) originally introduced a single market and regulatory regime for investment services across the member states of the EEA in 2007. In January 2018, MiFID II, a revised and extended set of regulations was introduced.

Money Laundering
The process of turning 'dirty' money (money derived from criminal activities) into 'clean' money (money that appears to be legitimate).

Multilateral Trading Facility (MTF)
A term introduced by MiFID which describes a system that brings together multiple parties that are interested in buying and selling financial instruments, and enables them to do so.

National Competent Authority (NCA)
National Competent Authority with respect to regulation. For example, the UK's FCA.

Near-Shoring
A form of offshoring where the business process is relocated to lower-cost foreign locations but these locations are in close geographical proximity to the customer's country of business.

Nominal Ledger
See General Ledger.

Nominal Owner
A person or group that holds legal title to a security or piece of real estate but is not the true beneficial owner.

Non-Clearing Member (NCM)
A firm that is a member of a futures and options exchange but not its associated clearing house. The non-clearing member relies on general clearing members to clear its trades on the relevant exchanges.

Nostro
The account with a settlement agent which is used to record transactions and balances in cash amounts. Nostro means 'our account with you'.

Novation
The substitution of one party to a contract by another party; in particular novation occurs at the point when the central counterparty assumes the responsibility to register a trade.

Offshoring
Offshoring is defined as the movement of a business process performed by a company in one country to the same or another company in another, different country. Almost always work is moved to benefit from the lower cost of operations in the new location.

Omgeo
As part of the DTCC, Omgeo provides services for the central matching of fixed income and equity transactions to streamline trade flows, decrease risk and increase efficiency.

Operational Risk
The risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.

Open Finance
'Open finance' is the term employed to describe the extension of open banking data-sharing principles to enable organisations to access customer data across a range of financial sectors (including savings and investments).

Operational Resilience
Requirements published by the Bank of England, PRA and FCA in March 2020 to strengthen firms' operational resilience in the financial services sector.

Order-Driven System
An exchange trading system that does not rely on market makers. A member firm which wishes to buy a given financial instrument at a given price submits an order to the system, while at the same time other member firms which wish to sell submit orders to the system. These are matched and executed in the electronic order book.

Organised Trading Facilities (OTFs)
Any facility or system that is not an MTF or regulated market, operated by an investment firm or market operator, in which multiple third-party buying and selling interests in financial instruments are able to interact in the system in a way that results in a contract. Introduced by MiFID II.

Outsourcing
The delegation of any business operation from internal production to an external entity which specialises in the management of that operation.

Over-the-Counter (OTC) Market
A decentralised market for financial instruments not listed on an exchange where market participants trade over the telephone, fax or electronic network. There is no central exchange providing a trading system. CCPs, however, may exist.

Phishing
A type of cybercrime designed to trick computer users into disclosing personal financial details.

Platform
An online service designed to enable both financial advisers and retail investors to manage their investment portfolios.

Platform as a Service (PaaS)
A cloud computing model where the provider offers the infrastructure (as IaaS above), but will also offer the operating system, manage security and perform backups.

Portfolio
In the context of software development, a portfolio is a suite of projects being undertaken by a function. In the context of investment management, a portfolio is a collection of investments held by an institution or a private individual. The term is sometimes also used as an alternative to ‘book’ or ‘trading book’.

Position
The net total of all the purchases of a security, less all the sales of the same security. When the position is positive it is said to be a ‘long’ position; when it is negative it is said to be a ‘short’ position.

Primary Market
The process of bringing securities to the market and raising funds for the issuer.

PRINCE
A methodology to manage projects of any kind, including those related to software development and implementation.

Production Outsourcing
The maintenance and support of technology applications that have already been developed.

Programme
A group of projects that are managed together.

Project
A set of inter-related and controlled activities, with start and finish dates, undertaken to achieve a unique objective conforming to specific requirements, including the restraints of time, cost and resources.

Project Brief
A document produced in the early stages of a project that describes, in outline, what the project is attempting to achieve and the business justification for doing it.

Project Management
The discipline of organising and managing resources (eg, people) in such a way that the project is completed within defined scope, quality, time and cost constraints.

Project Management Institute (PMI)
Similar to PRINCE, another methodology to manage projects of any kind, including those related to software development and implementation.

Project Manager
The individual responsible for delivering a project.

Project Sponsor
Normally, the senior executive who instigated a business change and who is responsible to the business for the success of a project. See also Senior Responsible Owner.

Prudential Regulation Authority (PRA)
Since 2013, the Prudential Regulation Authority (PRA) has been the UK regulator responsible for prudential regulation of financial firms that manage significant risks on their balance sheets – in other words, it will be responsible for the regulation and supervision of 'significant' individual firms including all deposit-taking institutions, insurers and other prudentially significant firms.

Panel of Takeovers and Mergers (PTM) Levy
A charge automatically imposed on investors, and collected by their brokers, when they sell or buy shares with an aggregate value in excess of £10,000. The charge is £1, and the money raised goes to finance the Panel on Takeovers and Mergers (PTM).

Put Option
A put option gives the buyer (or holder) the right (but NOT the obligation) to sell the underlying instrument at a specified price on or before a given date.

Quote-Driven Systems
A stock exchange trading system where some of the exchange's member firms take on the obligation of always making a two-way price in each of the stocks in which they make markets. These firms are, therefore known as 'market makers'.

Rapid Application Development (RAD)
A methodology to manage the designing and building of software applications.

Recognised Clearing House (RCH)
A clearing house that is recognised as such by the Bank of England.

Recognised Investment Exchange (RIE)
An investment exchange in the UK that is recognised by the FCA.

Recognised Overseas Investment Exchange (ROIE)
An investment exchange located outside the UK that admits UK firms as members and is recognised by the FCA.

Reference Data
Information about the firm, its trading parties, clients and the instruments it trades. Alternatively defined as the store of information that is used to determine the appropriate actions necessary to ensure successful processing of a trade. Also known as static data.

Reference Data Repository (RDR)
A system that consolidates the firm's view of reference data and feeds it to all the other systems in the configuration.

Regulatory Trade Reporting
An obligation conferred on investment firms to make public certain details of in-scope transactions.

Relational Database
A collection of data items organised as a set of formally described tables from which data can be accessed or reassembled in many different ways without having to reorganise the database tables.

Repo
Repos – sale and repurchase agreements – are transactions where Party A lends money to Party B providing that Party B provides Party A with collateral, most usually in the form of government bonds.

Request for Proposal (RFP)
A request for proposal (RFP) is an invitation for suppliers, through a bidding process, to bid on a specific product or service. An RFP is usually part of a complex sales process, also known as 'enterprise sales'.

Robo-Advisors
Robo-advisors are a new type of financial adviser that provide investment services online (such as allocation and management of assets) based on a set of computerised rules and/or algorithms with a minimal amount of human involvement.

Sale and Repurchase Agreement
See Repo.

Scamming
A low-tech alternative to phishing, it is usually carried out by phone. The caller simply invents a plausible story to persuade the recipient to disclose confidential information that belongs to either the target itself or to customers of the target.

Standardised Corporate Environment (SCORE)
The Standardised Corporate Environment (SCORE) is based on a closed user group, administered by SWIFT, where corporates can interact with any number of financial institutions with whom they have a relationship.

Secondary Market
The marketplace for trading in existing securities.

SEDOL Code
SEDOL stands for Stock Exchange Daily Official List, a list of security identifiers used in the UK and Ireland for clearing purposes. The codes are assigned by the London Stock Exchange, on request by the security issuer. SEDOLs serve as the ISIN for all securities issued in the UK and are, therefore, part of the security's ISIN as well.

Sell-Side Firms
Investment banks and stock exchange firms that execute orders on behalf of investors.

Senior Managers & Certification Regime (SMCR)
A piece of regulation from the FCA that improves personal accountability by naming individuals, and making them personally responsible, for key aspects of a firm's activity.

Senior Responsible Owner (SRO)
The executive responsible for ensuring that a project or programme of change meets its objectives and delivers the projected benefits. See also Project Sponsor.

Service Level Agreement (SLA)
A service level agreement (SLA) is that part of a service contract in which a certain level of service is agreed upon. The level of service in this context refers to both the quality of the service and the time deadlines for performing the service. It may also specify penalties to be paid by either party if the level of service provided fails to reach the minimum standards in the agreement for an extended period of time.

Service Level Management (SLM)
Definition of a service catalogue; identifying, negotiating, monitoring and reviewing service level agreements (SLAs).

Settlement Agents
CSDs, ICSDs and custodian banks may be collectively referred to as 'settlement agents'.

Settlement Date
The date that a deal actually does settle, as distinct from the value date which is the date upon which it should settle.

Shareholders' Equity
Assets less liabilities.

Short Position
See Position.

Social Media
The collective of online communications channels and tools focused on community-based input, interaction, content-sharing and collaboration. The most commonly known social media platforms are Facebook, LinkedIn and Twitter. However, there are various applications to run social media internally within organisations.

Software as a Service (SaaS)
A cloud computing model where the provider offers the infrastructure (per IaaS) and the operating system (per PaaS), but they will also offer all of the application software.

Software Development Life Cycle (SDLC)
A process of developing information systems or applications through the completion of defined steps or phases.

Software Maintenance
Software maintenance is an ongoing process, and it includes the continuing support of end users, the correction of errors and updates of the software over time.

SPAN
Standard Portfolio Analysis of Risk (SPAN) is a system for calculating initial margin requirements for futures and options on futures. It was developed by the Chicago Mercantile Exchange in 1988. SPAN is a portfolio margining method that uses grid simulation. It calculates the likely loss in a set of derivative positions (also called a portfolio) and sets this value as the initial margin payable by the firm holding the portfolio. In this manner, SPAN provides for offsets between correlated positions and enhances margining efficiency.

Spiral Model
A methodology to manage the designing and building of software applications.

Spyware
Software that gathers information about a person or organisation without their knowledge, and may send such information to a third party. Most spyware is installed by using deceptive tactics (such as bundling itself with desirable software).

Stamp Duty
A UK tax payable by buyers (but not sellers) of most equity shares listed on the UK markets.

Static Data
See Reference Data.

Stock Exchange
See Investment Exchange.

Stock Exchange Automated Quotations (SEAQ)
A quote-driven trading system operated by the LSE.

Stock Exchange Electronic Trading System (SETS)
A trading system operated by the London Stock Exchange. See also SETSqx.

Stock Lending
The process of the lending of securities by one party to another. The terms of the loan will be governed by a 'Securities Lending Agreement' which requires that the borrower provides the lender with collateral, in the form of cash, other securities or a letter of credit of value equal to or greater than the loaned securities. As payment for the loan, the parties negotiate a fee, quoted as an annualised percentage of the value of the loaned securities. If the agreed form of collateral is cash, then the fee may be quoted as a 'rebate', meaning that the lender will earn all of the interest which accrues on the cash collateral, and will 'rebate' an agreed rate of interest to the borrower.

Stock Lending Intermediary (SLI)
A specialist intermediary that provides liquidity to the stock lending and repo markets.

Stock Record
A system of double-entry book-keeping that accounts on one side for the ownership of securities, and on the other side for the location of the stock.

Straight-Through Processing (STP)
See Automation.

Structured Query Language (SQL)
The standard user and application program interface to a relational database.

Swaps
Derivative products that are used to alter the exposure of investment portfolios, or any series of cash flows. The most common kind of swap is an interest rate swap.

Society for Worldwide Interbank Financial Telecommunications (SWIFT)
SWIFT is an industry-owned utility that operates a secure telecommunications network, and also designs message standards for communications between market players.

SWIFT Gateway
A term used to describe software applications that are used to access the SWIFT network and which have SWIFTNet Link embedded within them.

SWIFTAllianceTM
A SWIFT Gateway product supplied by SWIFT.

SWIFTNet Link
A suite of software products, developed by SWIFT that ensures technical interoperability between SWIFT users by providing the minimal functionality required to communicate over these services. It is supplied both to SWIFT member firms directly, and also to software vendors who are able to embed it in their own products.

SWIFTNet PKI
The security component of SWIFTNet Link that uses digital certificates to provide the highest levels of authentication of institutions, end users and servers.

Systematic Internaliser (SI)
Under MiFID rules, a firm that executes orders from its clients on own account.

Trade Agreement
The processes of trade confirmation, affirmation and allocation.

Trade Date
The date that a deal is carried out.

Trading Book (or Book)
A portfolio of financial instruments held by a brokerage or bank. The financial instruments in the trading book are purchased or sold to facilitate trading for their customers, to profit from spreads between the bid/ask price, or to hedge against various types of risk.

Trojan Virus
A Trojan, or Trojan horse virus, is a computer program that appears to be legitimate, but it actually results in unauthorised access to the victim computer's files.

Underlying Instrument
An underlying instrument is a security or other type of financial product (such as a stock index or a commodity/asset) whose value determines the value of a derivative investment or product. For example, if you own a stock option, the stock you have the right to buy or sell according to the terms of that option is the option's underlying instrument. Underlying instruments may also be called underlying product, underlying interest, underlying investment or the cash instrument.

Value at Risk (VaR)
Value at risk is a measure of how the market value of an asset or of a portfolio of assets is likely to decrease over a certain time period (usually over one day or ten days) under usual conditions. It is typically used by securities trading houses or investment banks to measure the market risk of their asset portfolios (market value at risk), but is actually a very general concept that has broad application.

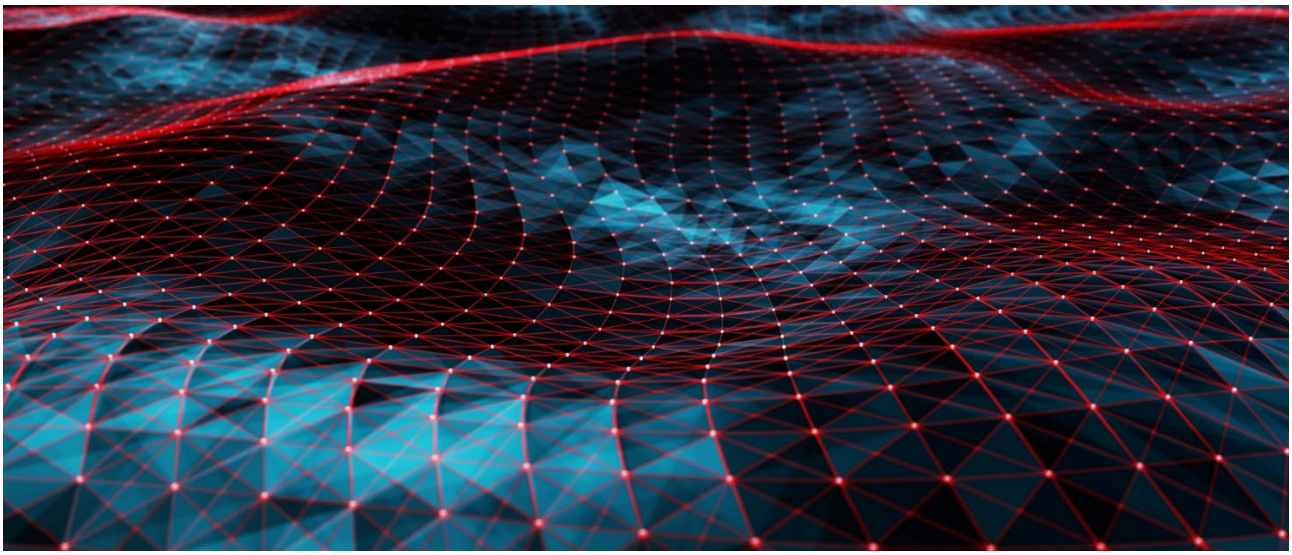
Value Date
The date that a deal is expected to settle, ie, the date that the seller delivers securities and the buyer pays for them.

Waterfall Model
A methodology to manage the designing and building of software applications.

Worms
A subset of viruses. A worm is a computer program that replicates, but does not infect, other files. Instead, a worm installs itself once on a computer and then looks for a way to spread to other computers.

XBRL
Extensible Business Reporting Language. An XML message standard for exchanging information about corporate data such as balance sheets and profit and loss accounts between the company concerned and its auditors, regulators, customers, research analysts and other interested parties.

XML
Extensible Markup Language (XML) – A flexible way to create common information formats and share both the format and the data on the world wide web, intranets, and elsewhere. XML is a formal recommendation from the World Wide Web Consortium (W3C) similar to the language of today's web pages, the Hypertext Markup Language (HTML).



Multiple Choice Questions

The following additional questions are for learning and revision purposes. Whilst they are based on the syllabus, they do not necessarily replicate actual examination standard questions and are included to test your knowledge and understanding of the relevant sections of the workbook.

Please note that, as part of exam security, hand-held calculators are not allowed in CISI exam venues. Candidates must use the onscreen calculator for all CISI CBT exams in all languages in the UK and internationally.

1. **Which of the following statements most accurately describes the purpose of a maturity ladder?**

   A. It provides the firm with a cash flow projection for the following business day
   B. It tells them whether they should use stock loans or repos to attract funding
   C. It tells them which bank accounts are currently overdrawn
   D. It provides the firm with information that shows them how much funding they need, or the excess funds that are available at each individual nostro account

2. **When a sell-side firm acts as principal, its revenue consists of:**

   A. Commission
   B. The difference between the buying price and the selling price
   C. A specially negotiated fee
   D. A fixed percentage of the deal value

3. **On the value date of the end leg of a stock lending transaction, which of the following occurs?**

   A. The securities are returned to the lender, the collateral is returned to the borrower, the lender is paid a fee, the borrower is paid interest on the collateral
   B. The lender delivers the securities to the borrower in exchange for collateral
   C. The lender receives a lending fee and interest on the collateral; the lender retains the collateral
   D. Both the securities and collateral are placed with a trustee for netting and the difference is paid to the lender

4. **Which of the following is a form of iterative/incremental software development?**

   A. Waterfall model
   B. End-user development
   C. Fountain model
   D. Agile model

5. **Which of the following is a statutory objective of the Financial Conduct Authority?**

   A. Promote the safety and soundness of the firms that it regulates
   B. For insurers, to contribute to the securing of an appropriate degree of protection for policyholders
   C. Ensuring that investors do not lose money
   D. Ensuring that the financial markets function well

6. **Mark-to-market is?**

   A. A measure of how the market value of an asset or of a portfolio of assets is likely to decrease over a certain time period
   B. The calculation of realised trading profit
   C. A method of calculating an investor's liability to capital gains tax
   D. A method of recording the value of assets at their current market value

7. **With which element of technology performance would you associate the following risks: duplication, delivery risk, complexity risk, 'scope creep'?**

   A. Maintaining business as usual
   B. Disaster recovery
   C. Database management
   D. Introducing business change

8. **Data proximity is a concern that many firms have about cloud computing. Data proximity means that:**

   A. the firm's data may be held on the same premises as that of a competitor
   B. the firm does not know where the data is held
   C. the firm's data may be held on the same database as that of a competitor
   D. the firm is unable to tell its regulator where its data is held

9. **A sell-side firm is obliged by which regulations to have in place a 'best execution' policy in relation to trades undertaken for its clients?**

   A. Pillar I of Basel II
   B. MiFID II
   C. The Capital Adequacy Directive
   D. Pillar III of Basel II

10. **DaimlerChrysler shares are listed on stock exchanges in seven countries. How many ISIN codes are allocated to DaimlerChrysler shares?**

    A. One
    B. Seven
    C. Four
    D. Three

11. **Which of the following is a wholesale market activity associated with an investment bank?**

    A. Execution-only stockbroking
    B. Life assurance
    C. Mergers and acquisitions
    D. Private banking

12. Why would a firm implement a Reference Data Repository?

A. To allow clients to access their own records
B. To be able to use a matching engine
C. To cut software development and maintenance costs
D. To ensure consistency of data across applications

13. What role does a matching engine play in the trade agreement process?

A. It sends a confirmation of each trade to a retail investor so they can match the details to their own records
B. It matches the details of an OTC trade agreement with the standard ISDA Master Agreement
C. It matches transactions and balances in the depot account with those in the nostro account
D. It matches the details reported by the two parties to a trade made on an investment exchange

14. Financial products Markup Language is:

A. an XML message standard for the financial sector
B. a message standard for the OTC derivatives industry
C. an XML message standard for the OTC derivatives industry
D. a new SWIFT message standard for the OTC derivatives industry

15. Pillar I of Basel II calculates a firm's minimum overall capital ratio as the capital requirement divided by the sum of its exposure to which three risks?

A. Operational + market + credit
B. Market + credit + systemic
C. Operational + market + systemic
D. Market + credit + liquidity

16. You have made the decision to outsource the development of a new business application. Which of the following is likely to be the most suitable method of outsourcing this work?

A. Near-shoring
B. Inshoring
C. Offshoring
D. Best-shoring

17. Which of these items is not contained in the header message of a SWIFT FIN (MT series) message?

A. The first transaction record
B. The destination BIC code
C. The sender's BIC code
D. The message type

18. The source code for a particular application cannot be found. Which of the following techniques have been developed to prevent this type of problem?

A. Software development life cycle
B. Change control methodology
C. Availability management
D. Service level management

19. User acceptance testing is carried out to ensure that:

A. users understand how to use the new software
B. all defects are identified and, if there are defects, then these defects are acceptable to the user community
C. the software conforms to the agreed specifications without exception
D. the software will provide the necessary throughput rate

20. Which of the following is the ISO standard for software evaluation?

A. ISO 9000
B. ISO 9001
C. ISO 9001:2000
D. ISO 9126

21. The term 'consideration' is used for both equity trades and bond trades. Bond trades have an extra component used in calculating the consideration, in addition to those relating to equity trades. What is this extra component?

A. Maturity date
B. Maturity value
C. Trade currency
D. Accrued interest

22. What is the default frequency of production of periodic statements of account for retail clients of an investment firm if there is no trading activity?

A. Every three months
B. Every six months
C. Annually
D. As often as the client requests it

23. What is the main function of a trade repository?

A. To collect records of OTC derivatives trades in order to provide regulators with information about firms' risk exposure

B. To store records of securities trades in order that a regulator can periodically check firms' compliance with the conduct of business regulations

C. To fulfil the reporting and transparency requirements of multilateral trading facilities and systematic internalisers under MiFID II

D. To store records of all securities trades so that regulators can monitor the markets to track insider dealing and other forms of market abuse

24. Which regulator has the responsibility to enhance the protection of investors and reinforce stable and well-functioning financial markets in the European Union (EU)?

A. The Basel Committee

B. The European Securities Markets Authority

C. The European System of Financial Supervision

D. The European Banking Authority

25. When stock is loaned, the lender loses the ownership rights to which one of the following?

A. Dividend proceeds

B. Voting rights

C. Corporate action proceeds

D. Coupon proceeds

26. Which of the following items of information usually shown on a general ledger account report is NOT reference data about the account concerned?

A. The name of the account

B. The currency of the account

C. The date of the opening balance of the account

D. A unique alphanumeric code that identifies the account

27. In an equity trade, the number of shares multiplied by the price of the share is known as the:

A. consideration

B. principal amount

C. trade quantity

D. trade extension

28. You are told that the price of a sterling-denominated bond is 87. This means:

A. £87 per bond
B. £87 per £1000 face value of the bond
C. 87 pence per bond
D. 87% of the face value

29. Market makers play a key role in which type of order-handling system within an investment exchange?

A. Quote-driven system
B. Order-driven system
C. Algorithmic trading system
D. Multilateral trading facility

30. In relation to disaster recovery, what is 'log shipping'?

A. An automated procedure for backing up databases on two servers in different locations
B. An approach to maintaining system availability whereby all transactions are written to the production server and a standby server at different locations simultaneously
C. Maintaining a spare server at a standby location that is configured similarly to the primary server and is running the same version of the operating system, database and application software, with all the same service packs applied
D. A testing method aimed at determining the feasibility and compatibility of back-up facilities and procedures and ranking critical needs and functions

31. Regression testing is:

A. a cursory examination of all of the basic components of a software system without reference to the internal workings to ensure that they hang together
B. a technique of black box testing where the input values are set to the extreme ends of, and just outside of, the input domains to evaluate the cause and handling of errors during system functionality
C. a phase where the current functionality of the software is tested to ensure that any new changes have not caused an impact
D. a software testing technique where the inputs of a program are loaded with random data – if there are fails then possible defects have been identified

32. A firm that holds a position with a central counterparty is asked to supply collateral to the CCP when:

A. the market value of its positions with the CCP shows potential losses
B. it starts to trade with a new counterparty
C. the market value of its positions with the CCP shows potential profits
D. it develops a new interface to the CCP's systems

33. Which of the following is NOT an example of reference data?

A. Security name
B. Public holiday calendar
C. Exchange rate to base currency
D. Base currency

34. Before a buy-side firm places an order, what must it ensure, in order to fulfil its requirement for what is known as 'pre-trade compliance'?

A. That the trade is in line with the firm's conflicts of interest policy
B. That full disclosure of fees, commissions and transaction charges has been made to the client
C. That the investment is compatible with the investor's time horizon and risk appetite
D. That the investment complies with MiFID II requirements on best execution

35. Which of the following statements about the MT500 series of messages is true?

A. It deals with securities messages and is based on ISO 7775
B. It deals with foreign exchange and money market messages and is based on ISO 15022
C. It deals with foreign exchange and money market messages and is based on ISO 7775
D. It deals with securities messages and is based on ISO 15022

36. Which of the following is NOT a principle of the EU or UK General Data Protection Regulation (GDPR)?

A. Lawfulness, fairness and transparency
B. Purpose limitation
C. Data minimisation
D. Data backups

37. Which of the following trade agreement methods is normally used in the foreign exchange market?

A. Use of a matching engine
B. Confirmation, affirmation and allocation
C. Mutual exchange of confirmations
D. SWIFT messaging

38. Structured Query Language is a programming language designed to:

A. insert, update, delete or query data transmitted by a real-time messaging layer
B. insert, update, delete or query data held in a relational database
C. produce queries about unmatched items to ensure consistency in a distributed system
D. ensure consistency within a server network by improving fault tolerance and reliability

39. Why was the Senior Managers Regime implemented?

A. To ensure that all parties (eg, clients, regulators and other key stakeholders) are aware of the senior management of the firms they interact with.

B. To ensure that all senior management have a clear job description that outlines their roles, responsibilities as well as any constraints

C. To ensure that senior managers are held to account where they are at fault for misconduct that falls within their area of responsibility

D. To ensure that all senior management roles within firms are filled by suitably qualified and experienced individuals

40. Which of the following is the most accurate description of a digital 'dashboard'?

A. A digital display of a business's profit and loss account

B. A business management tool used to visually ascertain the status of a business enterprise by reporting on key performance indicators

C. A digital display showing the value of a client's holdings

D. A business management tool used to give a visual snapshot of the performance of servers and networks

41. The purpose of vendor management software packages is to:

A. plan meetings with vendors

B. automate the administration of contracts and centralise information

C. evaluate the financial status of potential vendors and chart comparison tables

D. monitor service level agreements

42. Which of the following models assumes that software development is a sequential process – the first job must be completed before the second job may be started?

A. End-user development

B. Agile model

C. Waterfall model

D. Spiral model

43. What is the primary objective of FATCA?

A. SEC registration

B. To identify US-resident holders of US investments

C. To replace the QI regime

D. To identify US residents investing in offshore accounts

44. Which of the following statements most accurately describes the circumstances when a settlement agent will settle a trade?

A. When the seller's instructions match the buyer's instructions

B. When the seller has the stock to deliver, the buyer has sufficient cash or collateral to pay for it and the seller's instructions match the buyer's instructions

C. When value date has been reached, the seller has the stock to deliver, the buyer has sufficient cash or collateral to pay for it and the seller's instructions match the buyer's instructions

D. When value date has been reached and the seller has the stock to deliver

45. What is the purpose of an explosion table?

A. It allows users to select to which general ledger accounts individual entries are posted

B. It allows users to set up and maintain individual general ledger accounts

C. It allows users to set up and maintain individual sub-accounts for each security and currency

D. It allows firms to use the double-entry book-keeping convention to record stock quantities and balances

46. Allocation is the process of:

A. a sell-side firm sending a confirmation to a fund manager

B. a fund manager indicating agreement to a confirmation received from a sell-side firm

C. a fund manager advising the sell-side firm of the identities of investors

D. a buy-side firm sending a confirmation to a sell-side firm

47. When managing a help desk, which of the following is normally a level 1 responsibility?

A. Analysing a customer's problem and proposing a solution

B. Informing analysts of problem repercussions and the likely timescale to return to a normal production environment

C. Reviewing the status of problems that have been escalated

D. Monitoring and status-tracking of all incidents

48. Which of the following is a key principle of automation?

A. Trade processing should consist of logical stages which all happen simultaneously

B. Clerical staff should all be trained in the same system and their input should be cross-checked by a single manager

C. A transaction, once entered into a firm's system, should never have to be rekeyed, and an automated interface between systems should avoid errors caused by manual entry

D. The only time clerical intervention is needed is when making a record of a trade after it has completed satisfactorily

49. Why do firms struggle to produce accurate and timely data?

A. Data feeds are very costly to subscribe to and firms cannot afford these costs
B. Data is often received in different formats that are challenging to combine
C. Data feeds can only be received overnight which means the data is often out of date quickly
D. Data feeds only contain price information which means all other required data needs to be manually loaded

50. Which of the following activities are typically not covered by investor self-servicing?

A. Account opening and/or closing
B. Complex problem resolution
C. Valuation and statement production
D. Entering and processing trades

51. Why is post-trade compliance necessary?

A To ensure that client holdings are correctly updated in a book of records
B. To ensure that all trades are correctly matched with the opposing counterparty in the market
C. To ensure that the correct commission is attached to any trades and/or the client holdings
D. To ensure that holdings do not breach any pre-agreed investment objectives and constraints

52. What is the main cause of technology risk for firms?

A. The wide range of instruments that firms need to trade
B. The constant flow of new regulation that firms must comply with
C. The complexity of the operating model that firms use
D. The market need to outsource non-core functionality

53. Who controls Bitcoin?

A. It is controlled by all its users across the globe
B. It is controlled by a company called 'Blockchain'
C. It is controlled by a consortium of LiteCoin, PeerCoin and NameCoin
D. It is controlled by a combination of USA, Far East and European regulators

54. What is the key difference with respect to robo-advisor services?

A. It is provided online
B. It is provided by automated rules and/or algorithms
C. It is provided using a large amount of human involvement
D. It is provided by data scientists

55. What are the three elements of ESG?

A. Environmental, sustainability and governance
B. Environmental, social and governance
C. Environmental, social and green investing
D. Environmental, socialism and governance

Answers to Multiple Choice Questions

1. D Chapter 6, Section 3.1

Once the instructions have been sent out, both parties have to ensure that they will have the cash available to pay for their purchases, and the stock available to deliver for their sales. Therefore, most settlement systems incorporate a cash flow projection module that shows them how much funding they need. Sometimes, this module is referred to as a maturity ladder or a cash ladder.

2. B Chapter 4, Section 3.2.1

The sell-side firm has to decide whether to fill this order as an agent or as principal. It has to make its decision according to the MiFID II rules explained in chapter 2. If it is filling the order as an agent, then it will forward the order to an investment exchange and charge the investor a commission. If it is filling it as principal, then it will not forward the order to an exchange, but it will (assuming the order is to buy) sell the investor the required quantity of the instrument from its own 'book' or position, ie, it will sell the investor stock that is owned by the sell-side firm. The opposite is true if the order is to sell: the sellside firm will buy the stock from the investor and add it to its own position or book. In the case of principal orders, the sell-side firm's revenue consists of the difference between the buying price and the sellingprice, instead of a commission.

3. A Chapter 6, Section 2.1.1

On the value date of the end leg, the securities are returned to the lender and the collateral is returned to the borrower. At the same time, the lender is paid a lending fee, and the borrower is paid interest on the collateral.

4. D Chapter 9, Section 3.2

Several different iterative/incremental models have been developed to overcome the drawbacks of the waterfall model. 'Incremental development' is a scheduling and staging strategy in which the various parts of the system are developed at different times or rates, and integrated as they are completed. 'Iterative development' is a rework scheduling strategy in which time is set aside to revise and improve parts of the system. A typical difference is that the output from an increment is released to users, whereas the output from an iteration is examined for further modification before release. Common iterative/ incremental models include prototyping, the Spiral Model and the Agile Model.

5. D Chapter 2, Section 1.2.2

The FCA focuses on regulation of all firms in retail and wholesale financial markets, as well as the infrastructure that supports these markets. It also has responsibility for the firms that do not fall under the PRA's scope (approximately 60,000 firms). The FCA's role includes:

- supervision of investment exchanges and monitoring firms' compliance with the MAD
- powers to investigate and prosecute insider dealing
- responsibility for overseeing the FOS, the CFEB and the FSCS, and
- working closely with the FPC and PRA.

Its statutory objective is to ensure that the relevant markets function well.

6. D Chapter 4, Section 6.2.1

Mark-to-market (MTM) is an accounting procedure by which assets are 'marked', or recorded, at their current market value. Its aim is to provide a realistic value of a portfolio's current financial situation. This current market value may be higher or lower than their purchase price, or their book value, and any differences will result in a performance impact and an adjustment to the unrealised profit/loss for the client. Firms will need systems to ensure they can calculate the MTM figures as and when required.

7. D Chapter 8, Section 2.2

Risks that need to be managed when delivering business change within the technology function include:

- aligning technology strategy with the business strategy
- aligning the solution to the strategic business drivers
- managing and monitoring risks of introducing the change to the business
- providing visibility of risks and issues to responsible stakeholders
- risk of over- (and under-) spend
- risk of 'reinventing the wheel' – ie, implementing duplicate systems
- delivery risk – ie, delivering late, or not delivering what is required
- complexity risk – ie, the end solution becomes so complex that it increases cost and impacts delivery
- scope expansion risk – ie, the scope grows and grows (also known as 'scope creep'), and
- managing external parties, eg, clients or suppliers.

8. C Chapter 9, Section 6.2.3

Most of the concerns about the cloud are concerned with data security and related issues, including data proximity – the customer will never know whether its data is held in the same databases as those of its competitors, or what dangers this presents.

9. B Chapter 2, Section 1.4.3

Article 21 of the MiFID II regulations places an obligation on the sell-side firm to get the lowest available price for its customer when the customer is buying, and the highest available price when the customer is selling. This is known as 'best execution'.

10. A Chapter 5, Section 1.4.2

An ISIN code is a code that represents one company's ordinary shares. Even if the security is listed on more than one exchange, there is only one ISIN code.

11. C Chapter 1, Section 2.2

Investment banks provide advice to, and arrange finance for, companies who want to float on the stock market, to raise additional finance by issuing further shares or bonds, or carry out mergers and acquisitions. They also provide services for those institutions which might want to invest in shares and bonds, for example, pension funds and asset managers.

12. D Chapter 5, Section 1.3

One of the problems involved in managing the technology infrastructure of a large institution is that there may be a great number of individual business applications in the configuration, all of which hold some of this bulky amount of reference data, and some of the information may be duplicated across the different systems. Where there is duplication of reference data, there is a danger that errors or inconsistencies may arise.

13. D Chapter 5, Section 2.2.1

Matching engines provide a further level of automation of the trade agreement process. They have been provided by investment exchanges and clearing houses for many years to automate the process of confirmation matching between member firms. Both parties input their trade details, and the matching engine compares the two trade reports. It also sends reports to the regulator.

14. C Chapter 6, Section 5.7

FpML (Financial products Markup Language) is an XML message standard for the OTC derivatives industry. The standard is managed by the ISDA on behalf of a community of investment banks that make a market in OTC derivatives. The standard is freely licensed, so any firm that trades the instruments that it supports may use it in its own software.

15. A Chapter 2, Section 3.6.3

The first pillar provides improved risk-sensitivity in the way that capital requirements are calculated for three major components of risk that a bank faces: credit risk, market risk and operational risk. In turn, each of these components can be calculated in two or three ways of varying sophistication. Other risks are not considered fully quantifiable at this stage.

16. C Chapter 10, Section 5.1.2

Near-shore centres do not, in general, attract a high proportion of 'innovation outsourcing' work. This is because new application development usually needs a very large number of man-hours, and the 'classic' offshore locations have a significant competitive advantage over the near-shore locations in terms of personnel and premises costs.

17. A Chapter 6, Section 5.4.3

Within the header line of a FIN message, you will see three things: the BIC code of the receiver; the message type; and the BIC code of the sender.

18. B Chapter 8, Section 5.1

Changes may be required as a result of process improvement or bug fixes. New software releases sometimes cause as many problems as they are designed to solve, and change control procedures are an essential method of minimising this type of risk. These procedures are processes designed to prevent software or hardware objects from being amended without auditability and review of the impact by all interested parties. Symptoms of poor change control practices include:

- The latest version of the source code cannot be found.
- A difficult defect that was fixed at great expense suddenly reappears.

- A developed and tested feature is mysteriously missing.
- A fully tested program suddenly does not work.
- The wrong version of the code was deployed.
- The wrong version of the code was tested.
- There is no traceability between the software requirements, documentation and code.
- Programmers are working on the wrong version of the code.
- The wrong versions of the configuration items are being used as the baseline.
- No one knows which modules comprise the software system delivered to the customer.

19. B Chapter 9, Section 5.1

Software testing is a value judgment or risk management exercise. It is not possible to produce a complex application that is completely free of defects. The number of defects in a complex application can be large; some of them will be critical and some less so. The purpose of testing is, therefore, to gain a level of confidence in the software so that the organisation is confident that the software has an acceptable defect rate; where defects do exist, they are documented and there are adequate work rounds available to the users.

20. D Chapter 9, Section 5.7

ISO 9126 is an international standard for the evaluation of software. The standard is divided into four parts which address, respectively, the following subjects:

- quality model
- external metrics
- internal metrics, and
- quality in use metrics.

21. D Chapter 1, Section 3.2.4

The trade elements of a bond trade are slightly more complicated, because the accrued interest must also be accounted for. Bond issuers usually pay coupons annually or semi-annually. The coupon is paid to the investor who holds the bond on the record date. Even if that investor only bought the bond a few days before the record date, it will receive from the issuer the coupon for the entire coupon period, and the investor that held the bond for the earlier part of the coupon period will receive nothing. For this reason, when bonds are bought and sold on the secondary market, the accrued interest on the bond for the coupon period is also exchanged at the same time.

22. C Chapter 5, Section 4.1

Statements must be sent to clients every six months, but the client is entitled to insist on one being sent every three months. Where there are no transactions in the period, an annual statement is permitted.

23. A Chapter 3, Section 3.6

A trade repository or swap data repository is an entity that centrally collects and maintains the records of OTC derivatives. The purpose of trade repositories is to provide regulators with visibility into the risk exposures of firms and counterparties.

24. B Chapter 2, Section 1.3

The European System of Financial Supervision (ESFS) is an institutional architecture of the EU's framework of financial supervision created in response to the financial crisis of 2007–08. First proposed by the European Commission (EC) in 2009, it replaced three existing Committees of Supervisors with three new authorities called European Supervisory Authorities (ESAs): the European Banking Authority (EBA); the European Insurance and Occupational Pensions Authority (EIOPA); and the European Securities and Markets Authority (ESMA).

ESMA's mission is to enhance the protection of investors and reinforce stable and well-functioning financial markets in the EU. As an independent institution, ESMA achieves this mission by building a single rulebook for EU financial markets and ensuring its consistent application and supervision across the EU. ESMA contributes to the supervision of financial services firms with a pan-European reach, either through direct supervision or through the active coordination of national supervisory activity.

25. B Chapter 6, Section 2.2.1

Under UK law, the 'borrower' of the securities becomes the nominal owner (or legal owner) of them. The rights of the 'lender' are protected, however, as it remains the beneficial owner. What this means, in practice, is that the borrower receives all dividends, coupons and any other corporate action proceeds that are paid during the period of the loan. However, the borrower, in effect, holds the assets in trust for the lender, and has an obligation to repay any proceeds received of this kind to the lender. It also means that the borrower acquires (and, therefore, the lender loses) the right to vote at company meetings, which is how hedge funds are able to use borrowed stock to influence the companies whose shares have been borrowed. If the lender wishes to vote, then they must recall the securities.

26. C Chapter 7, Section 3.2

The information that is held in a technology system about an individual general ledger account should include reference data items, balance information items and transaction information items. Reference data items include a unique alphanumeric code to identify the account; the name of the account; a code to represent the type of the account, ie, bank account and expense account; and the identity of the currency in which postings are made for this account. The date of the opening balance is a balance information item.

27. B Chapter 1, Section 3.2.4

The number of shares multiplied by the price is known as the principal amount.

28. D Chapter 5, Section 1.4.3

Some shares are traded in whole currency units, but some are traded in penny units. Hence 'buy 100 @ 98' may mean either 98.00 or 0.98 per share. A bond price, on the other hand, is a percentage of face value, hence 'buy 1,000 @ 98' means buy 1,000 @ 98% of 1,000.

29. A Chapter 3, Section 2.3

A quote-driven system is one where some of the exchange's member firms take on the obligation of always making a two-way price in each of the stocks in which they make markets. These firms are known as market makers.

30. C Chapter 8, Section 4.2.5

Dependent upon the evaluation of the criticality of each application, may include:

- Warm sites – implementing a range of automated procedures to maintain same data on the two servers in the different locations. Typically, this involves some form of automatic synchronisation between the databases, such as is provided by 'log shipping'. Log shipping essentially consists of automating and integrating the process of backing up, copying and restoring the database from the primary server to the secondary server. This maintains the secondary server's database as an identical copy of the primary server's database apart from a small time latency of between 5 and 15 minutes.

31. C Chapter 9, Section 5.2.1

After modifying software, either for a change in functionality or to fix defects, a regression test re-runs previously successful tests on the modified software to ensure that the modifications have not unintentionally caused a regression of previous functionality. Regression testing can be performed at any or all of the above test levels.

32. A Chapter 3, Section 3.4.1

Whenever a member firm's positions show potential losses it must make a margin payment to the clearing house. In this way the clearing house is protected against default by the member firm. As an alternative to paying the margin call in cash, the member firm may choose to deposit securities with a value exceeding the amount of the margin call with the clearing house. The cash or securities used to meet the call are known as collateral.

33. C Chapter 5, Section 1

The exchange rate is not static as it changes regularly; reference data refers to essentially static facts.

34. C Chapter 4, Section 3.1.1

Before a buy-side firm places an order on behalf of its client, it needs to ensure that the order is compatible with the client's investment objectives. These include time horizon, risk appetite, and any other considerations that the investor has made the firm aware of. This is known as pre-trade compliance.

35. D Chapter 6, Sections 5.4.1 & 5.4.2

The messages that will commonly be used by securities firms will be found in the MT100, 200, 300 and 900 series (for managing firms' cash activities) and the MT500 series (for managing firms' securities business). The ISO standard that governs all the series, except for the MT500 series, is ISO 7775. This standard was developed during the 1980s. In the late 1990s SWIFT and its members realised that the original ISO 7775 messages were too restrictive, did not reflect the full complexity of modern trading instruments, and were still too ambiguous to ensure that full automation could be achieved. Thus, was born the ISO 15022 standard, based on a data dictionary approach.

36. D Chapter 2, Section 2.2

Both UK and UK GDPR outlines a set of key data protection principles that must be followed when collecting, processing and storing personal data:

- **Lawfulness, fairness and transparency** – firms need to make sure their data collection practices do not break the law and nothing is being hidden from the data subject. This means firms need to clearly state in their privacy policy the type of data that is being collected and why it is being collected.
- **Purpose limitation** – firms should only collect personal data for clearly stated purposes and only retain it for as long as it is required for meet that purpose.
- **Data minimisation** – firms must only process the personal data that they need to achieve their processing purposes.
- **Accuracy** – the Regulation states that '*every reasonable step must be taken*' to delete or fix any data that is inaccurate or incomplete. Furthermore, individuals have the right to request that inaccurate or incomplete data be erased or rectified within 30 days.
- **Storage limitation** – firms must delete personal data when it is no longer necessary.
- **Integrity and confidentiality** – the rules state that personal data must be:

  '*processed in a manner that ensures appropriate security of the personal data, including protection against unauthorised or unlawful processing and against accidental loss, destruction or damage, using appropriate technical or organisational measures*'.

37. C Chapter 5, Section 2.1

When the sell-side firm is dealing with a market counterparty, there are two possible practices: mutual exchange of confirmations; or use of a matching engine. The mutual exchange of confirmations method of trade agreement is used extensively in matching confirmations for foreign exchange and money market trades, as well as trades in OTC derivatives, such as swaps.

38. B Chapter 8, Section 1.2.4

The standard method to interface with relational databases is using Structured Query Language (SQL). There are SQL statements to obtain, insert, update and delete rows from tables – as well as creating, deleting and altering tables and columns.

39. C Chapter 2, Section 3.3

Rules on individual accountability have been introduced to improve professional standards and culture within the UK financial services sector, which will make it easier for firms and regulators to be clear about who is responsible for what.

40. B Chapter 8, Section 3.3.3

KPIs for a given system or suite of systems that support a business line can be presented in a 'dashboard' to give a health evaluation of the technology systems supporting the business. Where an area is below what is expected it will be given a low mark or highlighted by an alert. Dashboards can be used to initiate discussion around business strategy and ongoing investment required to support the business.

41. B Chapter 10, Section 6.3.2

Traditionally, it has been seen as an art. However, as configurations become larger and more complex, many firms now use a more formalised approach. There are now vendor management software packages on the market that support this process. They usually automate the administration of contracts and centralise all associated information into one central repository that is globally accessible via a web browser. These products enable organisations to monitor their spending, terminate contracts at the correct time, monitor and track their costs against benefits gained, and ensure that more informed decisions are made based on quantifiable facts and figures.

42. C Chapter 9, Section 3.1.1

In the waterfall methodology, there are sequences of phases where the output of each phase becomes the input of the next. Where there is a problem with the previous phase of delivery, the solution is returned to the previous phase and rework occurs before the waterfall continues.

43. D Chapter 2, Section 3.7.1

FATCA was enacted in March 2010 and came into force in January 2013. It is an important development in US efforts to combat tax evasion by US persons holding investments in offshore accounts.

44. C Chapter 6, Section 1.5.1

The settlement agent will settle the trade, provided that:

1. the value date has been reached
2. the seller has the stock to deliver
3. the buyer has the cash or credit to pay for it, and
4. the seller's instructions match the buyer's instructions.

45. A Chapter 7, Section 3.2.2

Most systems build the business rules for a decision of which account to post to by using an 'explosion table'.

The table enables Finance Department users to specify – in each of the first six columns – different combinations of:

- **transaction type** – eg, equity, bond, foreign exchange
- **operation** – eg, buy, sell, lend, borrow, profit, loss
- **amount code** – a code to represent each of the relevant money amounts involved in the transaction
- **account type** – eg, security position, security client, security P&L
- **market code** – a code to represent a particular market, such as the LSE, NYSE.

In the last three columns, the user is able to specify (for each of the combinations entered in the first six columns):

- which distinct account code to use for each combination
- the rule for deciding which sub-account to use: '@currencyid' means use the unique code that represents the currency being debited or credited on each posting event

- the rule for deciding which sub-sub-account to use: '@securityid' means use the unique code that represents the security being traded on each posting event, and '@clientid' means use the unique code that represents the client from whom the securities were bought or sold.

46. C Chapter 4, Section 3.3.1

As part of the order flow process, the fund manager will check the confirmation received from the sellside firm. If it disagrees with the details, it takes the matter up with the sell-side firm, otherwise it is said to affirm the confirmation. At the same time, the fund manager also advises the sell-side firm of the allocation details of this order. The fund manager itself has placed this order on behalf of its own clients (or funds) – there may be just one of them or there may be many. At this stage the fund manager notifies the sell-side firm of the details of who its clients are and how many shares are to be allocated to each client..

47. D Chapter 8, Section 3.3.4

The level 1 resource is responsible for: receiving, recording, prioritising and tracking service calls; monitoring and status-tracking of all incidents; escalation and referral to other parts of the organisation; first line support; and closing incidents with confirmation from the requestor. Answer A is level 2 (analyst); answer B is level 3 (service specialist); and answer C is the responsibility of level 4 (management).

48. C Chapter 1, Section 4.1

One of the most important principles of automation is that the transaction is entered into the firm's systems only once. As most investment firms need to record the transaction into more than one system, there need to be automated interfaces between all systems that need to store records of the order or trade. Clerical intervention should only be managed by exception, ie, when something goes wrong. The stages should happen in a logical order, not simultaneously.

49. B Chapter 1, Section 5.1

Firms can struggle to receive data from multiple sources in a similar and compatible format. Therefore, work is often required to realign this data, and once the data has been received, the complexity of the operating and technology platforms can hinder the efficiency of processing it.

50. B Chapter 4, Section 5.2

Self-servicing activities tend to be repeatable or codified processes that can be driven by a set of clearly defined business rules. Any complex problem or issue resolution will still need to be performed by speaking to a person.

51. D Chapter 6, Section 7.1

Post-trade compliance is essential to ensure the portfolio does not veer (either purposively or accidentally) from the pre-agreed portfolio constraints.

52. C Chapter 8, Section 6.1

This complexity creates a business risk because (a) the configuration is costly and complex to run and maintain on a day-to-day basis and (b) the complexity means making changes to the configuration is challenging.

53. A Chapter 9, Section 6.4.2

Nobody owns the Bitcoin network or the various software applications that underpin it. Bitcoin is controlled by all its users across the globe.

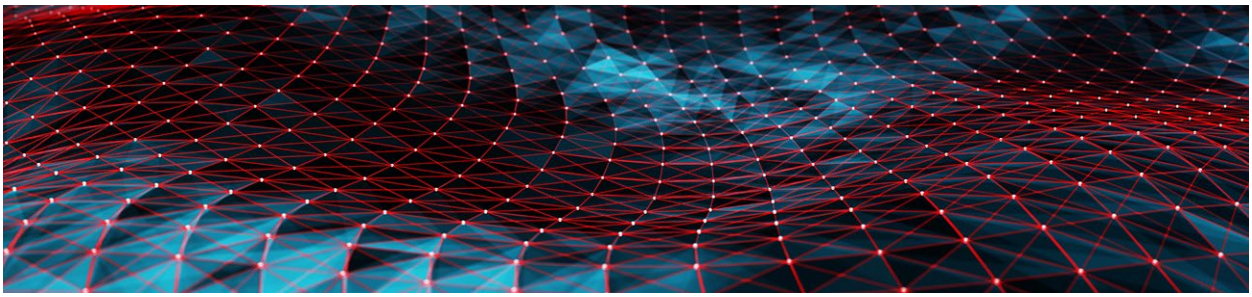
54. B Chapter 1, Section 2.8

Robo-advisors are a new type of financial adviser that provide investment services online (such as allocation and management of assets) based on a set of computerised rules and/or algorithms with a minimal amount of human involvement.

These rules/algorithms are developed by financial firms with the assistance of data scientists and are coded in software. Therefore, complex, cost-effective, thoroughly tested and reliable technology is required to support robo-advisors.

55. B Chapter 4, Section 2.2

The purpose of ESG is to measure the sustainability and societal impact of an organisation. It consists of three (non-financial) measures covering environmental, social, and governance.



Syllabus Learning Map

Syllabus Unit/Element		Chapter/Section
Element 1	**Technology in Investment Management**	**Chapter 1**
	On completion, the candidate should:	
1.1.1	Know the role of the following participants within the financial services sector: • retail banks and building societies • investment banks • asset owners • fund managers • wealth managers • platforms • financial advisers • robo-advisors • custodians • third-party administrators (TPAs) • trade venues	2
1.2.1	Know the elements of a secondary market equity trade	3.2.4
1.3.1	Know the elements of a secondary market bond trade	3.2.4
1.4.1	Understand the importance of automation	4
1.5.1	Understand the criticality of data management: • accuracy • timeliness	5

	• security	
Element 2	**The Regulatory Framework**	**Chapter 2**
	On completion, the candidate should:	
2.1.1	**Understand the regulatory framework**	**1.1**
2.2.1	**Know the function of UK and European regulators in the financial services sector:** • **Markets in Financial Instruments Directive II (MiFID II)**	**1.2**
2.3.1	**Know the significance of the European Data Protection Regulation (GDPR and similar data protection regimes in other jurisdictions):** • **principles** • **non-compliance**	**2**
2.4.1	**Understand how firms are using technology to comply with regulation**	**3**
2.5.1	**Know the major technology implications of the following rules:** • **FCA-specific regulation including Client Asset Sourcebook (CASS), Conduct of Business Sourcebook (COB), Senior Management Arrangements, Systems and Controls (SYSC)** • **Senior Managers & Certification Regime (SM&CR)** • **Approved Persons Regime (APER)** • **Markets in Financial Instruments Directive II (MiFID II)** • **Basel II & III** • **Foreign Account Tax Compliance Act (FATCA)** • **Dodd Frank** • **European Market Infrastructure Regulation (EMIR)** • **Central Securities Depositories Regulation (CSDR)**	**3**

	• Know Your Customer (KYC)	
Element 3	**Technology and the Functional Flow of Financial Instruments**	**Chapter 3**
	On completion, the candidate should:	
3.1.1	**Understand the function and connectivity of investment exchanges, multilateral trading facilities, organised trading facilities, systematic internalisers, and funds platforms:** • classification • economic functions • order handling systems • connectivity	**2**
3.2.1	**Understand the function and connectivity of central counterparty services**	**3**
3.3.1	**Know the function and connectivity of trade repositories**	**3.6**
3.4.1	**Understand the functionality of external real-time information sources:** • pre-trade price and liquidity discovery • analytics • post-trade information dissemination • transaction report/publication	**4**
Element 4	**The Role of Technology in Trade Capture**	**Chapter 4**
	On completion, the candidate should:	
4.1.1	**Understand the investment decision support process**	**2**
4.2.1	**Understand the implications of environmental, social and governance (ESG) investing**	**2**

4.3.1	Understand the technology support requirements of order placing and filling, including: • order entry (agency, principal and third-party orders) • pre-trade compliance, including mandates • best execution • Treating Customers Fairly • transaction capture • client connectivity including Direct Market Access • communication via electronic media • pooling, allocation and aggregation of a single order across two or more investors/funds • dealing systems • charges, fees and expenses	3
4.4.1	Understand the purpose and consequences of algorithmic trading	4
4.5.1	Understand the features of investor self-servicing	5
4.6.1	Understand the basic technology characteristics of risk mitigation for the following trade capture functions: • risk management • transaction capture • best execution	6
Element 5	**The Role of Technology in the Pre-Settlement Phase**	**Chapter 5**
	On completion, the candidate should:	
5.1.1	Understand the technology alignment to pre-settlement phase key risk indicators, including: • reference data • standing settlement instructions • client and counterparty agreements	1

5.2.1	Understand the technology implications of the trade agreement process	2
5.3.1	Understand the role of matching engines	2.2
5.4.1	Understand the technology requirements for reporting to regulators: • wholesale vs retail	3
5.5.1	Understand the technology requirements for reporting to customers: • wholesale vs retail	4
Element 6	**The Role of Technology in the Settlement and Post-Settlement Phases**	**Chapter 6**
	On completion, the candidate should:	
6.1.1	Understand the technology requirements for transaction settlement instructions	1
6.2.1	Understand the purposes of stock lending and repos, their technology implications and the importance of asset segregation	2
6.3.1	Understand the technology requirements for cash funding (positioning)	3
6.4.1	Understand the function of technology within the settlement process: • trade capture systems • operations systems • financial control systems	4
6.5.1	Know the function of the following standards: • SWIFT • FIX • FpML • XBRL	5

6.6.1	Understand the function of technology within reconciliation procedures, including: • reconciliation requirements and record keeping • ensuring cash and stock movements are recorded • journal movements • corporate actions (including dividends, bonus issues and rights issues)	6
6.7.1	Understand the technology implications of post-trade compliance	7
Element 7	**The Impact of Technology on Financial Control**	**Chapter 7**
	On completion, the candidate should:	
7.1.1	Know the role of the financial control function	1
7.2.1	Understand the relationship between the trade capture, settlement operations and the financial control function	2
7.3.1	Know the purpose of the general ledger	3
7.4.1	Know the components of a general ledger account	3.2
7.5.1	Know how account selection parameters are maintained	3.2.2
7.6.1	Know the purpose of the stock record	4
Element 8	**Technology Management**	**Chapter 8**
	On completion, the candidate should:	
8.1.1	Know the typical roles and responsibilities within the technology department	1.1
8.2.1	Know the importance of ensuring technology strategy matches the corporate strategy	1.1
8.3.1	Know the typical building blocks of a technology infrastructure	1.2
8.4.1	Understand the roles and uses of relational databases, distributed systems and real-time messaging	1.2

8.5.1	Understand the technology governance relating to: • measuring technology performance • managing change • benefits realisation	2
8.6.1	Understand the importance of cyber security	3.1
8.7.1	Understand the concept of management and support of applications	3.2
8.8.1	Understand the function of Service (Help) Desks and Follow-The-Sun Model	3.3
8.9.1	Know the purpose of Service Level Agreements (SLAs) and Key Performance Indicators (internal and external)	3.3.3
8.10.1	Understand prioritisation levels and the responsibilities of support teams	3.3.4
8.11.1	Understand the technology implications of Disaster Recovery (DR) and Business Continuity Planning (BCP): • planning • risk assessment • priorities for processing and operations • recovery strategies • data collection • written plan • testing criteria and procedures	4
8.12.1	Understand the technology implications of operational resilience	4
8.13.1	Understand the importance of change control procedures	5
8.14.1	Understand the nature and management of technology risk	6
8.15.1	Understand the challenges of separate systems	1

Element 9	Managing Business Change	Chapter 9
	On completion, the candidate should:	
9.1.1	Understand the purpose and benefits of project planning and control	1
9.2.1	Understand the importance of project governance	1
9.3.1	Understand the key stages of a Software Development Life Cycle (SDLC) including: • project planning • feasibility study • systems analysis • requirements definition • systems design • code generation • development • integration and testing • acceptance, installation, deployment • maintenance	2
9.4.1	Understand the different software development methodologies, including: • waterfall methodologies • Iterative/incremental methodologies • other methodologies	3
9.5.1	Know the following different methodologies used in technology delivery: • PRINCE2 • PMI • ISO	4, 5.7
9.6.1	Understand the need for testing and its importance to quality assurance, including: • testing strategies • test stages • techniques • cycles	5

	• test reporting	
9.7.1	Know the impact of disruptive innovation and FinTech initiatives: • cloud computing • big data • cryptocurrencies • blockchain/distributed ledger technology • artificial intelligence • machine learning • open finance	6
Element 10	**Technology Services Procurement**	**Chapter 10**
	On completion, the candidate should:	
10.1.1	Understand the buy vs build decision and implications and varieties of open source software	2
10.2.1	Know the advantages and disadvantages of outsourcing	3
10.3.1	Know the advantages and disadvantages of insourcing	4
10.4.1	Know the advantages and disadvantages of offshoring, near-shoring, best-shoring	5
10.5.1	Understand the vendor relationship, including: • the vendor selection process • vendor assessment • task order/work order/contract negotiation and finalisation • effective vendor management and oversight • exit planning	6
10.6.1	Understand the technology implications and risks for outsourced and vendor arrangements	6.5

Examination Specification
Each examination paper is constructed from a specification that determines the weightings that will be given to each element. The specification is given below.

It is important to note that the numbers quoted may vary slightly from examination to examination as there is some flexibility to ensure that each examination has a consistent level of difficulty. However, the number of questions tested in each element should not change by more than plus or minus 2.

Element Number	Element	Questions
1	Technology in Investment Management	4
2	The Regulatory Framework	6
3	Technology and the Functional Flow of Financial Instruments	3
4	The Role of Technology in Trade Capture	4
5	The Role of Technology in the Pre-Settlement Phase	5
6	The Role of Technology in the Settlement and Post-Settlement Phases	5
7	The Impact of Technology on Financial Control	5
8	Technology Management	8
9	Managing Business Change	6
10	Technology Services Procurement	4
Total		50