2025

FRM®

EXAM PART I

Foundations of Risk Management

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FRM® | Financial Risk Manager

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PREFACE

On behalf of GARP's Board of Trustees, the FRM advisory committee, and GARP's FRM professional certification program staff. I want to thank you for your interest in and support of the FRM program.

The program's first offering in 1997 saw just over 100 candidates sit for the exam. During the past 27 years, hundreds of thousands of professionals have studied for and taken the FRM exam, with it now being the world's leading financial certification program.

The dynamic nature of the FRM program's curriculum means that it regularly and quickly responds to changes in the global financial marketplace. This ensures that its content and reach always address the risks and challenges of a fast-changing, complex, and globally connected financial system.

For example, for 2025, after much discussion and consideration, the FRM advisory committee made material changes to the program's 2025 market risk measurement and management content. The result is that about half of the subject readings in Market Risk Measurement and Management were updated.

But maintaining a current and highly relevant curriculum is not the sole focus of GARP's professional staff. GARP has focused considerable time and resources during the past year developing tools to assist a candidate in his or her exam program preparation. In addition to providing current content, a primary objective of ours is to ensure as much as possible that a candidate is making the best use of his or her valuable time in preparing for the exam.

In this regard, GARP offers FRM Part I candidates an electronic platform called GARP Learning. GARP Learning is a streamlined digital learning program that can be accessed via a mobile phone, tablet, or desktop computer. GARP Learning allows an FRM candidate to engage meaningfully in a self-directed fashion with the full FRM Part I curriculum. It provides the ability to monitor performance, identify strengths and weaknesses, and assists in creating a personalized study plan.

Supplemental to the support offered by the learning platform, candidates can also utilize end-of-chapter questions to test their understanding of the chapter's content immediately; and, importantly, take a full-length FRM Part I Practice Exam to gain familiarity with how topics are tested and how to pace oneself on the exam to ensure completion in the allotted time.

As you can readily see, we are committed to ensuring the FRM program retains its global reputation as being of the highest quality, and covering the concepts, issues, and challenges that financial risk management professionals must know, and in many cases master.

As always, we wish you the very best as you study for the FRM exams, and much success in your career as a risk management professional.

Yours truly,

Richard Apostolik

President & CEO

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The Building Blocks of Risk Management

Learning Objectives

After completing this reading, you should be able to:

- Explain the concept of risk and compare risk management with risk taking.
- Evaluate, compare, and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative risk assessment techniques, and enterprise risk management.
- Differentiate between expected loss and unexpected loss and provide examples of each.
- Interpret the relationship between risk and reward and explain how conflicts of interest can impact risk management.
- Describe and differentiate between the key classes of risks, explain how each type of risk can arise, and assess the potential impact of each type of risk on an organization.
- Explain how risk factors can interact with each other and describe challenges in aggregating risk exposures.

Risk, in the most basic sense, is the possibility that bad things might happen. Humans evolved to manage risks such as wild animals and starvation. However, our risk awareness is not always suited to the modern world (as anyone who has taught a child to cross the road knows). Behavioral science shows that we rely too much on instinct and personal experience, as biases skew our thought processes. Furthermore, even the way we frame risk decisions irrationally influences our willingness to take risk.

Even so, surprisingly sophisticated examples of risk management can be seen in early history. In ancient times, merchants and their lenders shared risk by tying loan repayments to the safe arrival of shipments using maritime loans (i.e., combining loans with a type of insurance). The insurance contract separated from the loan contract as early as the fourteenth century in northern Italy, creating the first standalone financial risk transfer instrument. From the seventeenth century onward, a more methodical approach to the mathematics of risk can be traced. This was followed by the development of exchange-based risk transfer in the form of agricultural futures contracts in the eighteenth and nineteenth centuries (Figure 1.2).

That methodical approach continued to evolve in the twentieth century and beyond, with major advances in financial theory in the 1950s; an explosion in risk management markets from the 1970s onwards; and the emergence of new instruments, such as cyber risk insurance, in the early twenty-first century. Risk management is an old craft but a young science—and an even younger profession.

How we think about risk is the biggest determinant of whether we recognize risks, assess them properly, measure them using appropriate risk metrics, and succeed in managing them.

This introductory chapter looks at the definitions of risk, the classic risk management process, the principal types of risk, and the tools used to track risk and make decisions. We isolate 10 risk management building blocks along the way (Figure 1.1).[1]

Most risk management disasters are caused by the failure to properly recognize and/or deal with one or more of these fundamental building blocks, rather than the failure of some sophisticated risk management technique. Centuries-old financial institutions have been bankrupted because their risk management procedures ignored a certain type of risk, misunderstood connections between risks, or did not follow the classic steps in the risk management process.

1. The risk management process
2. Identifying risk: knowns and unknowns
3. Expected loss, unexpected loss, and tail loss
4. Risk factor breakdown
5. Structural change: from tail risk to systemic crisis
6. Human agency and conflicts of interest
7. Typology of risks and risk interactions
8. Risk aggregation
9. Balancing risk and reward
10. Enterprise risk management (ERM)

Figure 1.1 **Ten risk management building blocks.**

1.1 TYPOLOGY OF RISKS AND RISK INTERACTIONS

Risk is a wild animal, circling the campfire in the dead of night. But what kind of animal is it?

Figure 1.3 sets out a typology of risks in the financial industry.[2] Given the variety of business models that firms pursue, corporate risks take many forms. However, most firms face risks that can be categorized within the risk typology discussed in this chapter.

This kind of typology has many uses. It can help organizations drill down into the risk-specific factors within each risk type, map risk management processes to avoid gaps, and hold staff accountable for specific risk domains.

Indeed, Figure 1.3 relates quite closely to how risk functions are organized at many banks and large corporations, where there are often particular functions for market risk, credit risk, etc. Many of these risk functions worked quite independently of one another until an effort to build a more unified risk management approach began in the mid-1990s.

Each key risk type demands a specific set of skills and its own philosophical approach. For example, most banks treat market and credit risks as a natural part of their business. They recognize that risk scales alongside reward and actively pursue risky assets

[1] Not every risk practitioner will agree with our choice. The building blocks are not discussed in order of importance, and not every firm needs to develop a sophisticated approach to each building block, but we would argue that an awareness of each of our 10 building blocks is a good place to start thinking about risk management.

[2] For a more detailed description of financial risks see M. Crouhy, D. Galai, and R. Mark, *The Essentials of Risk Management*, 2nd ed. (Ch. 1, App.), McGraw Hill, 2014.

c.1750 BC—Code of Hammurabi records Babylonian maritime loan insurance.

Roman era—Burial societies cover funerary expenses with regular premiums.

Early medieval period—Early guilds support members who suffer financial loss.

1300s—Shipping insurance matures in Genoa.

1583—First recorded life insurance policy in London

1650s—Blaise Pascal and Pierre de Fermat lay foundation of probability theory.

1666—Great Fire of London inspires early fire insurance companies.

1688—Lloyds (of London) coffee house first mentioned

1690s–early 1700s—Development of mortality tables in London

Late 1600s—early 1700s—Jakob Bernoulli describes law of large numbers/statistical inference.

1730—Japanese rice futures traded in Osaka (world's first futures).

1730—Normal distribution and standard deviation described by Abraham de Moivre.

1762—First life insurer to calculate premiums in scientific manner (forerunner of Equitable Life)

1764—Publication of Thomas Bayes' 1750s work (Bayesian statistics)

1846—Cologne Re: first dedicated reinsurance company

1864—Chicago Board of Trade lists first US standardized futures contracts (corn).

1875—Francis Galton, British statistician, describes regression to the mean.

1900—Louis Bachelier models Brownian motion to investigate financial assets.

Early 1900s—Lloyds underwriters collect catastrophe risk data for pricing, for example, hurricane records.

1921—Frank Knight explores 'Risk, Uncertainty and Profit'.

1950s–1960s—Large corporations self-insure; "risk manager" used for widened insurance purchaser role.

1952—Diversification and modern portfolio management: Harry Markowitz

1961–1966—Capital Asset Pricing Model: William Sharpe and John Lintner

1970s—Decade of market liberalization and price and interest rate volatility

1972 —CME currency futures contracts

1973—Chicago Board of Trade (CBOT) options on stocks; Chicago Board Options Exchange (CBOE) created

1973—Black-Scholes option pricing formula

Mid 1970s—Treasury bill and bond futures

1979–1980—OTC currency options and swaps

Early 1980s—Growth of early OTC markets; first interest rate swaps

1983—Interest rate caps and floors

1987—Commodity swaps; average options; and other path-dependent options

1988—Basel Accord (Basel I) banking reform, focused on credit risk

1990—Collateralized loan obligations

Early 1990s—Credit derivatives develop, for example, credit default swaps

1993—CBOE volatility index (VIX)

1994—J.P. Morgan publishes value-at-risk (VaR) methodology (RiskMetrics)

1994–1995—Classic cases of derivative misuse, for example, Orange County, Barings Bank

1996—Market Risk Amendment for Basel I

1998—Russia financial crisis, LTCM near collapse

1998–1999—Synthetic CDOs (collateralized debt obligations); CDOs of CDOs (CDO squared)

2001—Terrorist attacks on World Trade Center (9/11); Enron collapse, corporate scandals

2002—Sarbanes-Oxley Act (SOX) to prevent fraudulent accounting

2004—Basel II (including operational risk capital)

2004–2006—VIX futures, options

2007–2009—Global Financial Crisis

2009—Contingent convertible bonds (CoCos)

2010—Basel III ongoing (including liquidity risk)

2010—Dodd–Frank Act

2011 onwards—Fast development of cyber risk transfer market

2016—Solvency II reform in effect for insurance industry

2017—Finalized Basel III reforms released

Figure 1.2 **Risk management timeline.**

Note: The dates in this timeline are sometimes an approximation; in particular, the development date of various OTC risk transfer instruments can be open to debate.

(e.g., particular credit segments). An increase in operational risks, on the other hand, does not lead to greater reward, so banks avoid these risks when they can. Below we look at the key risk types in turn, but first a word of warning. Risk typologies must be flexible because new risks are always emerging. A banking industry risk typology made in the early 1990s may have not considered rogue trading risk or even the entire operational risk class. As of 2020, "new" forms of operational risk are again climbing

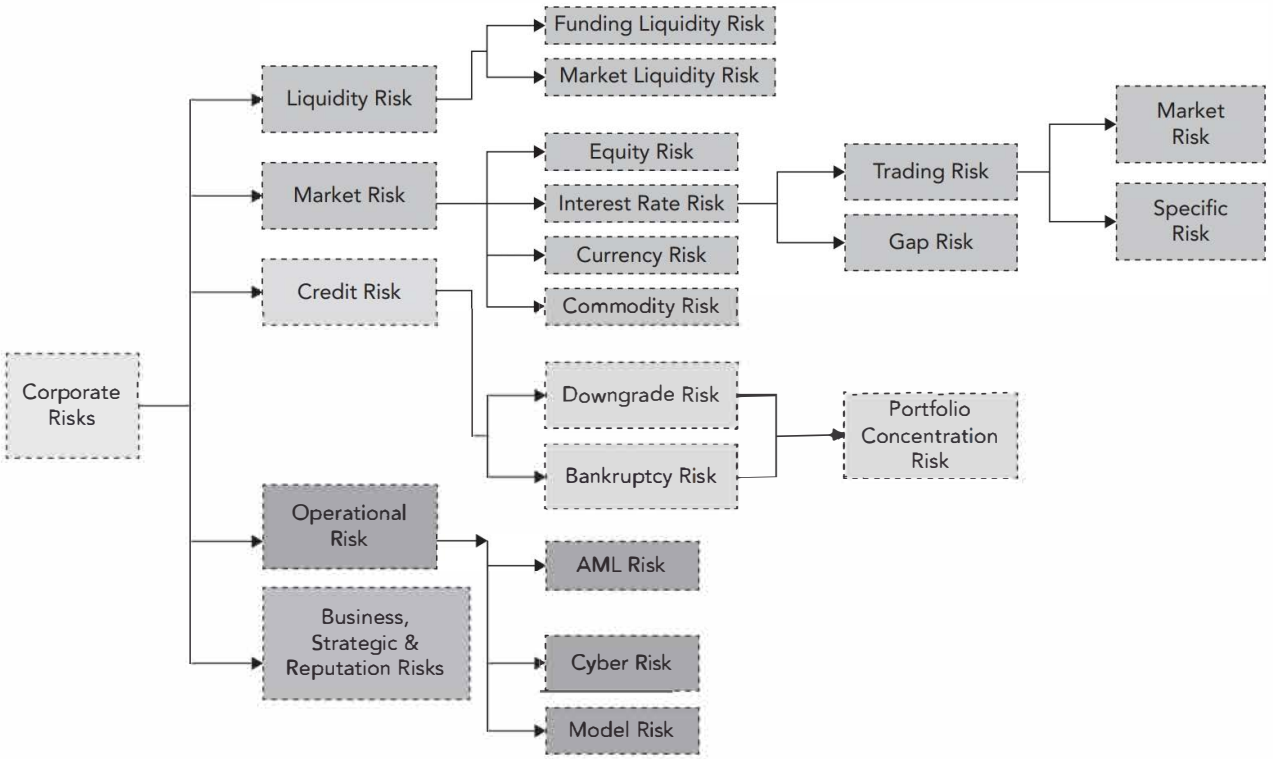

Figure 1.3 **A typology of risks for the banking industry.**

up the risk manager's watch list: cyber risk (particularly the risk of hackers stealing and destroying data and compromising systems) and data privacy risk.[3]

Furthermore, the risk types interact with one another so that risk flows. During a severe crisis, for example, risk can flow from credit risk to liquidity risk to market risk, (which was the case during the global financial crisis of 2007–2009). The same can occur within an individual firm: the "fat finger" of an unlucky trader (operational risk) creates a dangerous market position (market risk) and potentially ruins the standing of the firm (reputational risk). That is why a sophisticated understanding of risk types and their interactions is an essential building block of risk management.

Market Risk

Market prices and rates continually change, driving the value of securities and other assets up and down. These movements create the potential for loss, as price volatility is the engine of market risk.

Market risk takes many forms depending on the underlying asset. From a financial institution's perspective, the key forms are equity risk, interest rate risk, currency risk, and commodity price risk.

Each of these markets has its own risk management tools and methodologies, and we give examples of corporate applications and strategies in Chapter 2. However, across all these markets, market risk is driven by the following.

- *General market risk:* This is the risk that an asset class will fall in value, leading to a fall in the value of an individual asset or portfolio.
- *Specific market risk:* This is the risk that an individual asset will fall in value more than the general asset class.

Market risk can be managed through the relationships between positions. The diversification benefits of a large equity portfolio, for example, form the bedrock of investment risk management.

However, market risk also arises from these relationships. For example, an equity portfolio designed to track the performance of an equity market benchmark might fail to track it perfectly—a special form of market risk. Likewise, a position intended to balance out, or hedge, another position or market price behavior might do so imperfectly—a form of market risk known as basis risk.

For risk managers, this mismatching of price movements is often a bigger problem than any single market risk exposure. For example, a commodity risk manager might decide to use crude

[3] New risks tend to be born out of a fundamental change in market and industry practice. Bank rogue trading risk rose out of the growth of the derivatives industry and a rise in proprietary trading; bank liquidity risk during the global financial crisis arose out of insidious changes in bank funding strategies and leverage; legal risk in the period since the crisis has been exacerbated by a new wave of class action lawsuits and claims for compensation (not to forget some poor bank behavior); and cyber risk is a product of the digital revolution.

oil futures to hedge the price of jet fuel based on the historical relationship between crude oil price movements and jet fuel price movements. However, the hedge may fail due to an adverse change in the historical relationship between the price movement of these two commodities that renders the hedge ineffective, or worse, results in a greater loss than if no hedge was placed.

Credit Risk

Credit risk arises from the failure of one party to fulfill its financial obligations to another party. Some examples of credit risk include

- A debtor fails to pay interest or principal on a loan (bankruptcy risk or default risk);
- An obligor or counterparty is downgraded (downgrade risk), indicating an increase in risk that may lead to an immediate loss in value of a credit-linked security; and
- A counterparty to a market trade fails to perform (counterparty risk), including settlement or Herstatt risk.[4]

Credit risk is driven by the probability of default of the obligor or counterparty, the exposure amount at the time of default, and the amount that can be recovered in the event of a default. These levers can all be altered by a firm's approach to risk management through factors such as the quality of its borrowers, the structure of the credit instrument, and controls on exposure. The structure of the credit instrument involves whether the credit instrument is collateralized or not, the type of collateral if it is collateralized, the priority of the creditor in the case of bankruptcy, and inclusion of protective covenants in the loan agreement that impose restrictions on the borrower so as to protect the lender.

The exposure amount is clear with most loans but can be volatile with other kinds of transactions. For example, a derivative transaction may have zero credit risk at the outset because it has no immediate value in the market. However, it can quickly become a major counterparty credit exposure as markets change and the position of one counterparty gains at the expense of the other counterparty.

Traditionally, the probability of default of an obligor is assessed through identifying and evaluating a selection of key risk factors. For example, corporate credit risk analysis looks at key financial ratios, industry sectors, etc. Meanwhile, the risk in whole portfolios of credit risk exposures is driven by obligor concentration (i.e., the exposure to each obligor relative to the portfolio's value) as well as the relationship between risk factors. The portfolio will be a lot riskier if:

- It has a small number of large loans rather than many smaller loans;
- The returns or default probabilities of the loans are positively correlated (e.g., borrowers are in the same industry or region);
- The exposure amount, probability of default, and loss given default amounts are positively correlated (e.g., when defaults rise, recovery amounts fall).[5]

Risk managers use sophisticated credit portfolio models to uncover risk arising from these combinations of risk factors.

Liquidity Risk

Liquidity risk is used to describe two quite separate kinds of risk: funding liquidity risk and market liquidity risk.

Funding liquidity risk is the risk that covers the risk that a firm cannot access enough liquid cash and assets to meet its obligations. Funding liquidity risk threatens all kinds of firms. For example, many small and fast-growing firms find it difficult to pay their bills quickly enough while still having sufficient funds to invest for the future.

Banks have a special form of funding liquidity risk because their business involves creating maturity and funding mismatches. One example of a mismatch is that banks aim to take in short-term deposits and lend the money out for the longer term at a higher rate of interest. Sound asset/liability management (ALM), therefore, lies at the heartening of the banking business to help reduce the risk. There are various techniques involved in ALM, including gap and duration analyses.[6]

Of course, banks sometimes get it wrong, with disastrous consequences. Many of the banks that failed during the 2007–2009 global financial crisis had built up large maturity mismatches and were vulnerable to the wholesale funding market's perception of their creditworthiness.

Market liquidity risk, sometimes known as trading liquidity risk, is the risk of a loss in asset value when markets temporarily seize up. If market participants cannot, or will not, take part in the market, this may force a seller to accept an abnormally low price, or take away the seller's ability to turn an asset into cash and funding at any price. Market liquidity risk can translate into funding liquidity risk overnight in the case of banking institutions too dependent on raising funds in fragile wholesale markets.

It can be very difficult to measure market liquidity risk. Measures of market liquidity in a normal market, for example, might look at

[4] Named after the failure of Herstatt bank in Germany. The bank, a participant in the foreign exchange markets, was closed by regulators in 1974. The timing of the closure caused a settlement failure because Herstatt's counterparties had already paid their leg of foreign currency transactions (in Deutsche Marks) only to find the defunct Herstatt unable to pay its leg (in US dollars).

[5] These concepts will be explored later in this book.

[6] See M. Crouhy, D. Galai, and R. Mark, *The Essentials of Risk Management*, 2nd ed. (Ch. 8), McGraw Hill, 2014.

BOX 1.1 BANK OPERATIONAL RISK: MEASURE OR MANAGE?

No one doubts the importance of operational risk, but its measurement remains challenging. The banking industry embarked on the project in the late 1990s, mainly because it seemed logical to set capital aside for operational risk alongside that set aside for credit and market risks. The industry built extensive loss databases along with a set of risk measurement tools including statistical analysis, scorecard systems, sets of key risk indicators, and scenario analysis approaches.

However, many banking regulators remained skeptical about whether these tools could support accurate risk capital allocation. The Basel Committee signaled a change of direction in 2016.[7] It would continue to encourage banks to understand their operational risk using a variety of tools, but capital allocation would be based on a simpler standardized approach using weighted bank size with a multiplier based on a bank's record of larger operational risk losses.

However, this will not dampen bank efforts to manage operational risk. Operational risk includes the massive legal threats and claims for compensation that have plagued banks since the 2007–2009 global financial crisis. It includes the growing threat of cyber risk and the threat of penalties and lawsuits over data privacy infringements. In all its guises, operational risk remains one of the biggest threats to banks and other large corporations, even if it is impossible to properly measure its true cost.

the number or volume of transactions and at the spread between the bid-ask price. However, these are not necessarily good indicators that a market will remain liquid during a time of crisis.

Operational Risk

Operational risk can be defined as the "risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events."[8] It includes legal risk, but excludes business, strategic, and reputational risk.

That is a deliberately broad definition, and it includes everything from anti-money laundering risk and cyber risk to risks of terrorist attacks and rogue trading. The outbreaks of rogue trading in the 1990s helped persuade regulators to include operational risk in bank capital calculations.

Looking beyond the banking industry, we might include many corporate disasters under the operational risk umbrella. These include physical operational mishaps and corporate governance scandals, such as the crisis at energy giant Enron in 2001. The management of operational risk is the primary day-to-day concern for many risk managers outside the financial industry, often through insurance strategies.

The definition and measurement of operational risk continues to be problematic, however, especially in the financial industry (Box 1.1).

Business and Strategic Risk

Business risks lie at the heart of any business and includes all the usual worries of firms, such as customer demand, pricing decisions, supplier negotiations, competition, and managing product innovation.

Strategic risk is distinct from business risk. Strategic risk involves making large, long-term decisions about the firm's direction, often accompanied by major investments of capital, human resources, and management reputation.

Business and strategic risks consume much of the attention of management in non-financial firms, and they are clearly also a key concern in financial firms. However, it is not obvious how they relate to the other risks that we discuss or fit within each firm's risk management framework. For example, today banks and other financial institutions are facing competition from so-called financial technology [FinTech] companies. Bank management must decide whether to develop those same services internally, acquire those companies, or partner with FinTech companies.

A sudden fall in customer demand, the failure to launch the right kind of new product, or a misplaced major capital investment can threaten a firm's survival. Responsibility for these risks lies with the firm's general management. So what is the role of the risk manager?

The answer lies in three observations.

1. First, the firm's management needs to define its appetite for risk in a holistic manner that embraces the risk of significant business and strategic decisions. Firms can be very conservative with respect to credit risk, yet very entrepreneurial with respect to business risk. However, the logic for that divergence needs to be articulated by management.
2. Second, the chief risk officer and supporting team may have specific skills they can bring to bear in terms of quantifying aspects of business and strategic risk. Credit experts, for example, often become involved in managing supply chain risk. As we discuss in a later chapter, new techniques such as macroeconomic scenario analysis can be adopted to improve business and strategic decisions.

[7] Basel Committee, Standardised Measurement Approach for Operational Risk, March 2016: https://www.bis.org/bcbs/publ/d355.pdf. The move built on earlier proposals in 2014.

[8] Basel Committee on Banking Supervision, Principles for the Sound Management of Operational Risk, June 2011, https://www.bis.org/publ/bcbs195.pdf, page 3, footnote 5.

3. Third, business decisions generate large exposures in other risk management areas, such as credit risk and commodity price risk. As a result, financial risk managers must be involved at the start of business planning. For example, it may be impossible to fund the construction of a power station without having some form of energy price risk management strategy in place. Meanwhile in the financial industry, expanding a credit business will increase credit exposures and may necessitate the deliberate lowering of credit standards. Banks that fail to coordinate business, strategic, and risk management goals do not survive for long.

Reputation Risk

Reputation risk is the danger that a firm will suffer a sudden fall in its market standing or brand with economic consequences (e.g., through losing customers or counterparties).

Reputation risk usually comes about through a failure in another area of risk management that damages confidence in the firm's financial soundness or its reputation for fair dealing. For example, a large failure in credit risk management can lead to rumors about a bank's financial soundness. Rumors can be fatal in themselves. Investors and depositors may begin to withdraw support in the expectation that others will also withdraw support. Banks need to have plans in place for how they can reassure markets and shore up their reputations.

A reputation for fair dealing is also critical. Large firms are expected to behave in certain ways. If a firm misrepresents a product's risks, it can lose important customers.

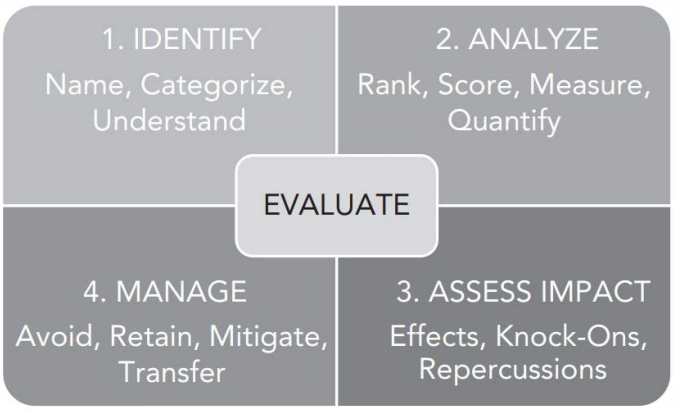

Figure 1.4 The risk management process.

Reputation with regulators is particularly important to financial institutions. Regulators wield considerable informal as well as formal power. A bank that loses the trust of a regulator may become the subject of extensive examinations and/or its activities may be criticized or curtailed.

1.2 THE RISK MANAGEMENT PROCESS

We take risks in pursuit of reward, whether that reward is food, shelter, or digital currencies. But the key questions are twofold: (1) is the risk commensurate with the reward, and (2) could we lower the risk and still get the reward? Our attempt to address

BOX 1.2 BRAINSTORMING AND TRIAGING RISKS

The first steps toward risk identification and triage take some classic forms.

- *Brainstorming:* This could include discussions with representatives from different business divisions to discuss the risk exposures they face and scenarios that could negatively impact their divisions. The most obvious approach is to put the key professionals (e.g., business leaders, audit professionals, etc.) in a room and talk to them. What is your personal professional nightmare? What else could go wrong, why would it go wrong, and how badly could it go wrong? What are the root causes and what are the consequences (e.g., in terms of triggering further risks)? Who is accountable?
- *Structured interviews, questionnaires, and surveys:* These are an attempt to push that initial inquiry out to a wider group of professionals within the company or throughout the industry. They should include open-ended questions.
- *Industry resources:* Unless the activity is unique, there will be industry resources available in the form of checklists, professional and regulatory standards, industry surveys, and expert opinions. These resources should be used to enrich the brainstorming process.
- *Loss data analysis:* Brainstorming often identifies many potential risks. The analyst will next want to look at how the wider industry categorizes each risk and at any internal and external loss records available, to gauge the frequency and severity of loss events and how they relate to specific risk factors.
- *Basic risk triage:* Not every risk is quantifiable in an exact way, but risk managers should be able to determine a given risk's frequency and severity.
- *Hypothetical what-if analysis:* Initial research may suggest worst-case scenarios that the brainstorming team can be asked to consider.
- *Front line observation:* There is no substitute for going to the business line or function and looking at how things are done. Have front-line staff been included in the risk information gathering process?
- *Following the trail:* How are key processes conducted and what are the risks associated with them? Can we see weaknesses or gaps in the process? Can we track our worst nightmares backwards through the process?

these questions gives rise to our first building block: the classic risk management process (Figure 1.4).

During this process, the risk manager attempts to: identify the risk (e.g., Box 1.2), analyze and measure the risk, assess the effects of any risk event, and finally manage the risk.

Identifying the risk can be just as important as its size in determining the appropriate risk management strategy. Across the corporate world, some risks are regarded as natural to a business and others as quite foreign. Manufacturers, for example, often accept and manage the operational risks of complex factory processes but try to avoid or transfer large market or credit risks. Investors often react badly to mishaps concerning risk types they believe are unnatural to a firm (e.g., a loss from a speculative derivatives position held by a non-financial corporation).

The risk management process culminates in a series of choices that both manage risk and help to define the identity and purpose of the firm.

- *Avoid* Risk: There are risks that can be sidestepped by discontinuing the business or pursuing it using a different strategy. For example, selling into certain markets, or off-shoring production, might be avoided to minimize political or foreign exchange risks.
- *Retain* Risk: There are risks that can be retained within the firm's risk appetite. Large risks can be retained through mechanisms such as risk capital allocation, self-insurance, and captive insurance.
- *Mitigate* Risk: There are risks that can be mitigated by reducing exposure, frequency, and severity (e.g., improved operational infrastructure can mitigate the frequency of some kinds of operational risk, hedging unwanted foreign currency exposure can mitigate market risk, and receiving collateral against a credit exposure can mitigate the severity of a potential default).
- *Transfer* Risk: There are risks that can be transferred to a third party using derivative products, structured products, or by paying a premium (e.g., to an insurer or derivatives provider).

As the risk taker improves its risk management strategy, it will begin to avoid or mitigate non-essential or value-destroying risk exposures, which in turn will allow it to assume more risk in areas where it can pursue more value-creating opportunities for its stakeholders. Investment in risk management thus allows farmers to grow more food, metals producers to produce more metal, and banks to lend more money. Risk management allows firms to excel.

In modern economies, risk management is therefore not only about corporate survival. It is critically important to the broader processes of specialization, scaling, efficiency, and wealth creation.

This explains why risk never really goes away. Risk management success is a platform for greater endeavors. The risk manager is constantly identifying, evaluating, and managing risks to achieve the right balance between creating value and exposing the firm to undue risk. However, identifying and analyzing risk in a fast-changing world remains a major challenge.

Figure 1.5 **Risk managers face the unknown and unexpected.**

1.3 IDENTIFYING RISK: KNOWNS AND UNKNOWNS

One of the easiest mistakes to make is to focus on risks that are known and measurable while ignoring those that are unknown or sets out.

Figure 1.5, our *second building block*, sets out a fundamental classification of known versus unknown risk that considers a classic paper on risk by economist Frank Knight,[9] and the much-quoted words of Donald Rumsfeld, former United States Secretary of Defense:

"There are things we know that we know. There are known unknowns . . . But there are also unknown unknowns."[10]

Rumsfeld said this when trying to encapsulate the danger of terrorists using weapons of mass destruction. His point was that humans tend to focus on the risks for which they have data and ignore potentially larger risks that are unknown or poorly understood. Yet those risks exist and must be managed.

Some of the distinctions in Figure 1.5 are much older than Rumsfeld's quote. In his famous 1921 paper, Knight

[9] F. Knight, *Risk, Uncertainty, and Profit* (New York: Houghton Mifflin, 1921).

[10] Donald Rumsfeld, US Secretary of Defence, press conference, NATO HQ, Brussels, 6 June 2002, responding to a question regarding terrorism and weapons of mass destruction and the possible inadequacy of intelligence information: https://www.nato.int/docu/speech/2002/s020606g.htm