A Core Curriculum for Insurance Supervisors

ICP 18A:
Risk Management Fundamentals

Basic-level Module
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About the Core Curriculum

A financially sound insurance sector contributes to economic growth and well-being by supporting the management of risk, allocation of resources, and mobilization of long-term savings. The insurance core principles (ICPs), developed by the International Association of Insurance Supervisors (IAIS), are key international standards relevant for sound financial systems.

Effective implementation of the ICPs requires skilled and knowledgeable insurance supervisors. Recognizing this need, the World Bank and the IAIS partnered in 2002 to develop a “core curriculum” for insurance supervisors. The Core Curriculum Project, funded and supported by various sources, accelerates the learning process of both new and experienced supervisors. The ICPs provide the structure for the core curriculum, which consists of a set of modules that summarize the most relevant aspects of each topic, focus on the practical application of supervisory concepts, and cross-reference existing literature.

The core curriculum is designed to help those studying it to:

- Recognize the risks that arise from insurance operations
- Know the techniques and tools used by private and public sector professionals
- Identify, measure, and manage these risks
- Operate effectively within a supervisory organization
- Understand the ICPs and other IAIS principles, standards, and guidance
- Recommend techniques and tools to help a particular jurisdiction observe the ICPs and other IAIS principles, standards, and guidance
- Identify the constraints and identify and prioritize supervisory techniques and tools to best manage the existing risks in light of these constraints.
Welcome to the ICP 18A: Risk Management Fundamentals module. This is a basic-level module on risk management that does not require specific prior knowledge of this topic. The module should be useful to new insurance supervisors and experienced supervisors who have not dealt extensively with the topic—or are simply seeking to refresh and update knowledge.

Start by reviewing the objectives below, which will give you an idea of what you will learn as a result of studying the module. Then answer the questions in the pretest to help gauge your prior knowledge of the topic. Proceed to study the module either independently or in a seminar or workshop. The amount of time required for self-study will vary but it is best to address it over a short time, broken into sessions on sections if desired.

To help you engage and involve yourself in the topic, we have interspersed the module with a number of questions for you to complete. These exercises are intended to provide a checkpoint from time to time so that you can absorb and understand the material more readily and can apply the material to your local circumstances. You are encouraged to complete each of these exercises before proceeding with the next section of the module. If you are working with others on this module, develop the answers through discussion and cooperative work methods. An answer key is provided in appendix II.

As a result of studying the material in this module, you will be able to do the following:

1. Define risk and its importance to the interests of various insurer stakeholders
2. Identify the key stakeholders in insurer risk management and their roles
3. Identify and categorize the sources of risk facing an insurer
4. Define the role and importance of corporate governance in risk management
5. Describe the typical contributions by the board of directors to an insurer’s risk management
6. Explain each of the steps of the risk management framework:
   a. Objective setting
   b. Risk identification
   c. Risk assessment
   d. Strategy planning
   e. Risk monitoring
   f. Controlling.

7. Provide examples of risk management objectives, specifying both the risk managed and the outcome desired
8. Explain why it is necessary to evaluate both probability and severity when assessing risk
9. Provide examples of risk avoidance, risk prevention, risk reduction, risk diversification, risk transfer, and risk retention
10. Describe various types of control activities that should be part of an insurer’s risk management process
11. Explain what is meant by the term “enterprise risk management” (ERM)
12. Discuss how the risk management process may vary between smaller and larger insurers and between insurers with simpler and more complex business profiles.
13. Summarize the requirements of ICP 18.

A companion module (18B) entitled “Management of Key Risks” discusses the major risk types prevalent in an insurer and the manner in which these risks are typically managed. It also describes the process of integrating and aggregating risk exposures across risk types, products, and geographies. Together, modules 18A and 18B provide a comprehensive introduction to risk assessment and management for an insurer.
Pretest

Before studying this module on risk management, answer the following questions. The questions are designed to help you gauge your existing knowledge of this topic. An answer key is presented in appendix II.

For each question, circle the correct response(s); there may be more than one correct response.

1. Which of the following are true statements for ICP 18, Risk Assessment and Management?

   a. An insurer should identify, understand, and manage the significant risks that it faces.
   b. All insurers should establish risk management functions and risk management committees.
   c. The ultimate responsibility for the development of best practices and the proper operation of the insurer rests with its senior management.
   d. The supervisory authority requires and checks that insurers have in place comprehensive risk management policies and systems.
   e. The risk management policies and risk control systems that should be used by an insurer are largely independent of the nature of the insurer’s business.
2. Which of the following pairs of insurance stakeholders and stakeholder interests are appropriately matched?

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Primary stakeholder interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Insurance supervisor</td>
<td>Insurer solvency</td>
</tr>
<tr>
<td>b. Insurer board of directors</td>
<td>Good governance</td>
</tr>
<tr>
<td>c. Insurer actuaries</td>
<td>Risk compliance</td>
</tr>
<tr>
<td>d. Insurer senior management</td>
<td>Risk appetite approval</td>
</tr>
<tr>
<td>e. Auditors</td>
<td>Independent review of controls</td>
</tr>
</tbody>
</table>

3. Which of the following pairs of key insurer risk categories and specific risk types are appropriately paired?

<table>
<thead>
<tr>
<th>Key risk category</th>
<th>Specific risk type</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Credit risk</td>
<td>Asset default risk</td>
</tr>
<tr>
<td>b. Underwriting risk</td>
<td>Asset-liability management risk</td>
</tr>
<tr>
<td>c. Market risk</td>
<td>Liquidity risk</td>
</tr>
<tr>
<td>d. Operational risk</td>
<td>Systems risk</td>
</tr>
<tr>
<td>e. Underwriting risk</td>
<td>Counterparty risk</td>
</tr>
</tbody>
</table>

4. Which of the following are true statements about the "objective-setting" phase of risk management?

a. Risk tolerance is the acceptable level of variation around objectives, aligned with risk appetite.

b. Risk appetite is the amount of risk—on a broad level—an entity is willing to accept in pursuit of value.

c. Risk management objectives mainly use quantitative terms (for example, earnings at risk, risk limits).

d. Setting risk appetite requires managing the competing interests of various stakeholders.

e. Responsibility for setting objectives rests with senior management.

5. Which of the following general risk management strategies are matched with an appropriate description?

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Avoid</td>
<td>Reinsure, hedge, or outsource risk</td>
</tr>
<tr>
<td>b. Retain</td>
<td>Expand and diversify exposure</td>
</tr>
<tr>
<td>c. Reduce</td>
<td>Mitigate or cap exposure</td>
</tr>
<tr>
<td>d. Transfer</td>
<td>Eliminate, stop, prohibit, or sell risk</td>
</tr>
<tr>
<td>e. Exploit</td>
<td>Accept and self-insure risk</td>
</tr>
</tbody>
</table>
6. Which of the following are true statements?

   a. Systematic risk affects the entire economy and cannot be diversified by the insurer.

   b. Systemic risk is the same as systematic risk.

   c. Uncertainty risk is diversifiable.

   d. The risk of extreme events, beyond the normal volatility of cash flows, needs special consideration because the resulting fluctuations may be so extreme as to threaten solvency.

   e. Volatility risk is generally diversifiable.
A. Importance of risk management

What is risk?

“All of life is the management of risk, not its elimination,” said Walter Wriston, former chairman of Citicorp. According to the Institute of Actuaries of Australia (IAAust), “risk is inherent in all areas of human endeavor...risk is present in everyday commercial and personal activities...risk results from the presence of more than one potential outcome from a course of action” (IAAust 2003, 109). The ability to understand risk, measure it, and weigh its consequences has enabled our modern, complex, and highly integrated world to function. Liquid capital markets, insurance, and pensions—as well as engineering achievements and many more examples—could not exist without risk management, probability theory, statistics, and financial economics.

There are many definitions of risk. Sometimes risk management processes and techniques seem aimed at minimizing downside events. The IAIS Glossary defines risk as being “used to indicate a condition of the real world in which there is a possibility of loss; also used by insurance practitioners to indicate the property insured or the peril insured against.”

Although it is natural for supervisors to focus on risk's downside effects, it may also have upside effects. A useful definition was published in 1995 by Standards Australia and Standards New Zealand in a Standard on Risk Management (ASNZS 4360:1995): “Risk—the chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood.”
Indeed, the 1995 Standard states that “risk management is as much about identifying opportunities as avoiding or mitigating losses.” In his book about enterprise risk management, James Lam (2003) states, “Risk management is not only about reducing downside potential or the probability of pain, but also about increasing upside opportunity or the prospects for gain.”

**Why is risk management important?**

Risk is the *raison d'être* for insurance. It is through insurance contracts that customers seek to transfer various financial uncertainties to the insurer in exchange for a set of premiums levied by the insurer. Life insurance contracts provide protection in the event of death, longevity, disability, critical illness, or health care costs. Contracts for other types of insurance (non-life insurance) afford protection against costs or losses to property (for example) owing to contingencies such as fire, theft, accident, and storms. Therefore, the estimation of the amount and timing of policyholder payments and the present value of claim payments (taking account of the future costs to administer these obligations) are subject to risk. It is vital that insurers manage the risks inherent in the insurance contracts they assume.

The ability of a financial service entity such as an insurer to meet its obligations now and in the future is of prime importance. Like any business, the business of insurance involves many functions to be successful. The execution of these business functions also entails risk. In this regard, ICP 18 states:

Some risks are specific to the insurance sector, such as underwriting risks and risks related to the evaluation of technical provisions. Other risks are similar to those of other financial institutions, for example, market (including interest rate), operational, legal, organizational, and conglomerate risks (including contagion, correlation, and counterparty risks).

As described by the International Actuarial Association (IAA 2004, 25),

The overall management of an insurer includes the following types of functions:

- The design, pricing, marketing, sales and underwriting of its insurance policies
- The selection of assets backing the policies
- The estimation of the size and volatility of the liabilities associated with those policies
- The determination of the insurer's capital needs
- Claims management
- The updating of all these elements over time as more data and other information becomes available or because the underlying risk processes change
- An adequate/sound disclosure/communication process to key stakeholders (e.g., management, supervisors, policyholders, and investors)
- Future financial condition analysis that provides a prospective multi-scenario view of the company as a whole.

The IAA illustrates these steps in a diagram (figure 1), similar to the one used by the Institute of Actuaries of Australia to describe the “actuarial control cycle.” The diagram illustrates that the operations of an insurer are bounded by the business environment in which it operates (legal, social, competitive, client, economic, governmental, and tax aspects) as well as by the professionalism of its employees.

According to the IAA, risk is inherent in the execution of each step pictured in the diagram. The assessment of these risks, as well as the risks inherent in insurance contracts, “is key to the operations of an insurer” (2004, 26). Actuaries specialize in the financial measurement and management of risk and contingent events and provide valuable assistance in the assessment of risk at many points in an insurer’s “control cycle.”

An insurer can manage many risks, but systematic risks or systematic elements of risks may not be directly within the insurer’s control. Systematic risks are faced by the entire economy. They may include business cycles, a prolonged downturn in interest yields, or a sharp and prolonged drop in equity values.

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**Figure 1. Actuarial control cycle**

[Diagram of the actuarial control cycle showing interconnections between business environment, solvency, risks, capital, experience, design, pricing, assets, liabilities, and professionalism.]
Sound risk management by financial sector companies is essential to overall financial system stability. This has been illustrated by the wave of corporate scandals in a variety of business sectors, including insurance. These scandals highlight the need for good corporate governance and risk management.

Also of concern to financial system stability are systemic risks. Systemic risks represent the danger that specific local problems may spread to affect the entire financial system. Increased globalization, concentration, complexity, and competitiveness in the insurer and reinsurer market heighten insurer exposure to systemic risk.

The IAIS Glossary defines risk management as “a scientific approach to the problem of dealing with the pure risks facing an individual or an organization in which insurance is viewed as simply one of several approaches for dealing with such risks.”

A comprehensive risk management program to manage all of a company’s risks can be referred to as enterprise risk management (ERM). ERM is used in this module with this meaning. General discussions of risk issues in this module use the term “risk management.” Important features of ERM include risk limits and risk management policies established by the board of directors, regular reporting of risk at the appropriate level in the company, and oversight by risk officers who are independent of business unit heads.

Risk management can be viewed as the first line of defense in a company or as a way to prevent the emergence of situations that could imperil the company. Capital supplements risk management; risk management cannot be expected to eliminate all downside effects of risks, so capital is required to help the company meet obligations even in the face of adversity. If a supervisory authority has confidence that a company’s risk management program is very sound and effective, it may be appropriate to reflect this confidence in the calculation of required capital.

**Key sources of insurer risk**

As noted in the preceding section, insurers are subject to risks inherent in their core business as well as to the general business risks applicable to any business. In the rapidly developing field of risk management, there is no single globally accepted manner of naming and categorizing insurer risks. However, there is growing convergence in defining the key broad categories of insurer risk:

- Underwriting
- Credit
- Market
- Operational
- Liquidity
- Strategic.
Underwriting risks are frequently referred to as insurance or technical risks. They consist of the perils (mortality, longevity, morbidity, fire, weather, collision, etc.) underwritten by the insurer. Credit risk results from the possibility that a counterparty (bond issuer, mortgage borrower, reinsurer, etc.) will fail to make payments (will default on obligations) when they are due. Market risks result from the insurer's exposure to financial variables such as equity prices, investment yields, and asset-liability management risk. Frequently, liquidity risks are considered part of a broader definition of market risks. The combination of credit and market risks is sometimes referred to as “investment” or “asset” risks.

The first three categories are recognized explicitly in the calculation of capital adequacy and solvency requirements in many jurisdictions. The last three categories are important insurer risks for which other forms of supervisory assessment (other than capital requirements) may be more appropriate. Insurance supervisors have identified operational risk (loss due to the failure of people, processes, or systems) as an important cause underlying insurer failures. As a result there is considerable current debate and research into the best supervisory approaches (for example, insurer ERM, capital requirements, supervisory review) for operational risk.

Insurer risks often involve many internal dependencies, thus requiring an integrated approach to risk or solvency assessment. Insurance products such as linked and participating life are specifically designed and managed with the asset and liability risks modeled together in an integrated fashion, although each risk is listed as if it existed in isolation. In addition, there are other important considerations for combining the effects of the various risks across the whole company. The Sharma report (London Working Group 2003), which studied insurance company failures or near failures, concluded that the final cause is always a realization of some concrete risk, but in most cases the real cause occurs much earlier and is more abstract. The Sharma report introduced the concept of a causal chain of events leading to failure.

In modeling risk, special attention is required for key components of risk. The modeling tools described later must reflect the following components of risk resulting from each peril:

- Volatility
- Uncertainty
- Extreme events.

Volatility

Volatility is the risk of random fluctuations in either the frequency or severity of a contingent event, such as the risk that the rolling of one die will be different from its expected (or average) result of 3.5. [If the contingent events are uncorrelated with each other] this risk is “diversifiable,” meaning that the volatility of the average
claim amount declines as the block of independent insured risks (or the number of rolls of the die) increases. (IAA 2004, 27)

Modern financial theory suggests that in fully efficient markets—if all costs are ignored—volatility uncorrelated with other cash flows would not be valued in calculating the fair value of a set of projected future cash flows. An insurer can go into bankruptcy because of diversifiable risk, and policyholders should be protected against that risk. Capital is therefore required to absorb the fluctuations arising from volatility risk.

The providers of capital require some reward for putting their capital at risk. The cost of insurance includes an allowance for the cost of this capital, the costs of administration, and the costs of spreading the risk—and sometimes a “rent” that gives the insurer an additional profit because of the relatively inefficient markets for valuing insurance risks. Insurers can make these charges for the volatility component of risk because policyholders cannot otherwise diversify this risk away.

**Uncertainty**

The IAA (2004, 28) defines uncertainty as

the risk that the models used to estimate the claims or other relevant processes are mis-specified or that the parameters within the models are mis-estimated. Uncertainty risk is non-diversifiable since it cannot be (relatively) reduced by increasing portfolio size.

Using the die example above, if the die actually has two 5s on it and no 6 (or a different number of sides), then the estimate of 3.5 based on a normal die has mis-specified the expected value. Since insurance companies often have unique underwriting standards and market niches, they may be expected to have unique risk parameters. The experience of one group may not be indicative of the future experience for another group, and the experience of the whole population may not be appropriate for an individual company.

Included in uncertainty are three key elements:

1. The model itself may be incorrect (that is, no parameters may exist that make the model an adequate description of reality). This is usually referred to as ‘model error risk.’ This can occur when the distribution itself is misunderstood (as when the actual process is lognormal and one assumes it is normally distributed) or when a key driver or relationship is wrong. However, this introduction of model
error may be a deliberate choice in order to have a simpler, more usable model, with an acceptable error tolerance.

2. Even if the model of a cash flow process is correct, and the underlying model is appropriate, the parameters need to be estimated. Parameter risk is the error in this estimation, which exists because

   a. The number of observations on which best estimates are based is limited, because the observation period is too short
   b. The volatility of the observations makes estimation less certain
   c. The period over which the observations were made may not include certain calamitous events that, in fact, should be reflected in the parameters of the distribution
   d. The observations contain contaminated data.

3. In addition, the risk structure (parameters) can change over time or be uncertain for other reasons. This possibility too needs to be considered in modeling the risks. Sometimes called structural risk, examples of this possibility include a new court ruling that changes the interpretation of policy language, a new medical breakthrough, or a new disease. This risk is sometimes incorporated into the model through ‘structural’ distributions of parameters.

For example, all these uncertainty elements contribute to estimates of the likelihood of an earthquake in the New Madrid area of the United States (St. Louis to Memphis along the Mississippi River). A significant uncertainty relates to whether such an earthquake is a 1 in 100 years event or a 1 in 1,000 or more years event.

**EXTREME EVENTS**

As described by the IAA,

Extreme events have also been described as high-impact, low-frequency events for the company as a whole. For any risk, one or more extreme events can cause fluctuations to be much greater than might be expected to arise from normal (modeled) fluctuations…. These are one-time shocks from the extreme, adverse tail of the probability distribution that are not adequately represented by extrapolation from more common events and for which it is usually difficult to specify a loss value, and thus an amount of capital to hold. For example, a contagious disease process may affect many persons simultaneously, nullifying the usual assumption of independence among persons; or, a rumor or dramatic public statement might lead to a severe liquidity shortfall scenario at an insurance company. Another possibility is that an event occurs which has an extremely low probability of occurrence. Using
the dice example again, there would be a very low chance that two dice end up leaning against each other with no clear result of the roll (2004, 28).

The risk of extreme events, beyond normal volatility of cash flows, needs special consideration. The premiums received for the coverage will inflate profits in normal years but be balanced by abnormal losses, when the resulting fluctuations may be so extreme as to threaten solvency. These risks therefore require separate and explicit management strategies.

**Stakeholder perspectives on risk**

Insurer stakeholders consist of any group that participates in the success of an insurer. A partial list of some of the more important stakeholders includes

- Policyholders
- Boards of directors
- Senior management
- Employees
- Contracted sales representatives
- Insurer risk management specialists
- Insurance supervisors and regulators
- Financial sector supervisors
- Supranational organizations
- The accounting profession (including auditors)
- The actuarial profession
- Debt holders
- Investors
- Rating agencies.

Each stakeholder participates in a unique aspect of the operations of an insurer. Each stakeholder benefits from the ongoing success of the insurer. Each has an important perspective on insurer risks. Figure 2 illustrates one possible grouping of these stakeholders according to similar interests.
The principal interest of insurers’ customers (policyholders) lies in the fulfillment of the products sold to them. They purchase insurance products to protect themselves from catastrophic losses, to mitigate risks, and to access various professional financial services.

At a basic level, customers certainly expect that the contractual obligations between the customer and the insurer will be met (that is, regular specified premium payments are made in exchange for certain specified policy benefits if certain contingencies arise) and that the insurer will remain financially viable during the term of the products purchased.

However, the customer-insurer relationship is frequently more complex, involving the concept of reasonable expectations by the policyholder (customer). For example, many insurance products involve a considerable element of service on the part of the insurer, especially in the adjudication of claims (for non-life insurance). Other products involve a considerable degree of risk sharing between the customer and the insurer (equity-linked products). In both cases, the reasonable expectations of the customer must be considered by the insurer as it manages its risks. In other words, customers need to be treated fairly. In summary, customers expect that insurers will act as prudent managers of their risks and that they (as customers) will be treated fairly.
**INSURER PERSONNEL**

Effective risk management is more than just a system of controls and processes. Having the right people and a culture that fosters implementation are at least as important. The responsibility for the success of an insurer rests with all its personnel, including the board of directors, senior management, sales associates, and administrative, underwriting, investment, actuarial, legal, accounting, and management staff.

The risk management culture of an insurer begins with the direction provided by its board of directors. The board sets the firm’s risk objectives and overall risk appetite, on the recommendation of senior management. Effective risk management is demonstrated through appropriate board-approved policies, principles, risk inventories, and risk management decisions that are implemented by insurer personnel.

Leading insurers tend to use best practices in corporate governance, business, and risk management. They focus on limiting extreme risk and determining an appropriate balance between risk and reward. They seek an optimal risk-adjusted return in their activities. It is generally expected that the assumption of greater risk is undertaken with the expectation of greater return. However, greater risk involves greater possible volatility in results, possibly causing severe financial hardship to the insurer and its stakeholders. Although the adoption of a conservative approach to risk should lead to more stable returns, such returns may be uncompetitive in the marketplace. Consequently, insurers typically develop their business plans with an aim to limiting earnings volatility while generating competitive returns on equity (ROE).

**INSURANCE SUPERVISORS**

Insurance supervisors are charged with a variety of responsibilities, the specifics of which vary from jurisdiction to jurisdiction. These responsibilities typically include safeguarding policyholders and fostering a supervisory framework that contributes to public confidence in a competitive financial system. This may mean ensuring that insurers under their supervision are not subject to an undue level of risk and that risks—especially systemic ones—are identified and controlled.

The IAIS in 2003 revised *Insurance Core Principles and Methodology* to help guide insurance supervisors. ICP 18, Risk Assessment and Management, states that “the supervisory authority requires insurers to recognize the range of risks that they face and to assess and manage them effectively.” Note that it is important to distinguish between an insurer’s role in assuming various risks to which its policyholders are subject and its need to manage all the risks—including but not limited to the risks it is insuring—to which it is subject as a business. Other ICPs, particularly ICPs 19–23, set out principles for managing specific types of risks that relate to an insurer’s insurance activities.

In the IAIS’s *Principles on Capital Adequacy and Solvency* (January 2002), Principle 10 speaks of the importance of risk management and the need for capital adequacy and solvency regimes to be supplemented by risk management systems.
In October 2005 the IAIS approved a policy paper entitled *A New Framework for Insurance Supervision: Towards a Common Structure and Common Standards for the Assessment of Insurer Solvency* (Framework paper). The Framework paper describes the rationale for and the contents of a framework for insurance supervision. The IAIS at the same time approved *Towards a Common Structure and Common Standards for the Assessment of Insurer Solvency: Cornerstones for the Formulation of Regulatory Financial Requirements* (Cornerstones paper). The Cornerstones paper sketches the contours of the common structure and standards, highlighting some critical cornerstones for the formulation of regulatory financial requirements. These cornerstones are intended to form the basis for the standards for assessing insurer solvency that are to be developed. Both documents highlight the importance of insurer risk management for insurer supervisors. The *Guidance Paper on Public Disclosures by Insurers* (IAIS 2002a) provides guidance on appropriate types of risk disclosures, including risk exposures and how they are managed.

The European insurance supervisors (CEIOPS), in *Prudential Supervision of Insurance Undertakings* (2002), reviewed the causes of insurer failures (and near misses) in Europe. Figure 3 sets out the model of failure they developed. It illustrates that

- Analysis of the full causal chain of events in an insurer failure is necessary to improve supervisory practice
- Review of solvency needs to be broad and encompass governance and risk management
- Solvency requirements and trigger levels need to be linked to a firm’s risk exposures.

It is also important to note the role of supranational organizations such as the World Bank and the International Monetary Fund in fostering financial stability. In 1999 these

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**Figure 3. Importance of risk management**

- **Underlying causes—internal** (management, governance, and ownership)
  - Inadequate or failed internal procedures
  - Inappropriate risk decisions
  - Incorrect evaluation of financial outcomes
- **Underlying or trigger causes—external** (wider changes as well as event- or insurance market-specific changes)
  - Financial outcomes
  - Policyholder harm
- **Risk appetite decision**
two organizations jointly developed the Financial Sector Assessment Program (FSAP) to promote the soundness of financial systems in member countries by

- Determining system strengths and vulnerabilities
- Determining how key sources of risk are being managed
- Ascertaining developmental and technical assistance needs
- Assessing risks to macroeconomic stability.

In addition to these perspectives, insurance supervisors can refer to relevant risk management materials produced by other supervisors. For example, the Office of the Superintendent of Financial Institutions in Canada (OSFI) has used a risk-based supervisory framework, including assessment of insurers’ risk management, since 1999. The Australian Prudential Regulation Authority (APRA) has produced *Prudential Standard GPS 220 for General Insurance* on the topic of risk management.

Useful guidance on various aspects of risk management is also available in several papers produced by the Joint Forum (Basel Committee for Banking Supervision, IAIS, International Organization of Securities Commissions). These papers include

- Liquidity risk (in development)
- Credit risk transfer (March 2005)
- Outsourcing in financial services (February 2005)
- Financial disclosure (May 2004)
- Trends in risk integration and aggregation (August 2003)
- Operational risk transfer across financial sectors (August 2003)
- Risk management practices and regulatory capital cross-sectoral comparison (November 2001).

Another supranational organization, the Organization for Economic Cooperation and Development (OECD), produced in 2003 a comparative study of solvency frameworks and key risks faced by insurers, entitled “Assessing the Solvency of Insurance Companies.”

**Professionals**

The sound operation of insurance companies requires the skills and experience of many specialists (actuaries, accountants, auditors, lawyers, underwriters, investment specialists, etc.). The work of specialists may be more likely to be performed in the public interest when they are members of a professional body that takes responsibility for certifying their technical abilities and enforces rules of professional conduct and standards of practice.
According to ICP 1, the following are conditions for effective insurance supervision:

There is a reliable, effective, efficient, and fair legal and court system (a body of ethical, professional, and trained lawyers and judges) whose decisions are enforceable. Alternative dispute mechanisms operate within an appropriate legal framework. Accounting, actuarial, and auditing standards are comprehensive, documented, transparent, and consistent with international standards. Accounting and actuarial standards are applied and disclosed in a manner that allows current and prospective policyholders, investors, intermediaries, creditors, and supervisors to properly evaluate the financial condition of insurers.

The accounting profession, through COSO (Committee of Sponsoring Organizations of the Treadway Commission), produced a report entitled *Enterprise Risk Management—Integrated Framework* (2004). It defines the essential components of risk management, suggests a common language, and provides clear direction and guidance for ERM.

The actuarial profession (represented globally by the International Actuarial Association or IAA) has produced a report entitled *A Global Framework for Insurer Solvency Assessment* (2004), which sets out principles and methods for a global risk-based solvency framework, starting from a coherent risk framework. Actuaries frequently assume specific roles with respect to the risks undertaken by an insurer, including the role of chief risk officer (CRO), because of their risk management training and experience.

**Investors**

Many insurers are owned by shareholders, and several types of investors and investor advisers may have interests in such insurers. Some investors may have a direct equity investment in the insurer (through common or preferred shares). Others may have invested in one of several types of debt offerings by the insurer. Various rating agencies offer their professional advice to investors regarding the financial strength and earnings outlook for each insurer.

Access to investor capital contributes to the operation of a healthy insurance market. Without adequate capital, insurers cannot afford to take on new risks or provide customers with competitive products that meet their needs.

In general, investors and their advisers seek evidence that an insurer is profitable and has good financial strength and good growth prospects. Accordingly, they expect (indeed, they are increasingly vocal with boards and financial sector regulators) insurers to adhere to good governance practices, especially sound enterprise risk management.
They also expect insurance supervisory authorities to maintain an orderly and efficient market for insurance in their jurisdiction.

**Global trends in risk management**

Formal risk management is fairly new in the insurance sector but is gathering momentum. ICP 18, Risk Assessment and Management, was included only in 2003.

Many insurer boards of directors in developed nations (especially for the larger insurers and those with a global presence) have adopted formal systems of responsibility for risk management. Risk management may well be only an emerging practice for smaller insurers or in less well developed insurance markets.

Increasingly, ERM is expected by supervisors and boards in response to various international developments. International Financial Reporting Standards, the Basel II requirements for banks and their subsidiaries, anti-money laundering regulations, and the Sarbanes-Oxley corporate governance requirements figure prominently. Insurers are often setting up separate risk committees of boards and assigning overall management responsibility for ERM to a CRO who reports to the chief executive officer (CEO) or the board of the insurer.

In recent years, leading insurers have developed economic approaches for determining their embedded value, or economic capital. This trend toward the use of economic approaches, initially developed for assessing the true or fair value of the business, is spreading to the valuation of assets, liabilities, and even regulatory capital. The use of economic approaches to assessing risk greatly simplifies the task of introducing ERM to an insurer.

With continued consolidation and globalization in the insurance industry, there is a need to ensure fair competition among insurers (a level playing field). This includes the need for enhanced risk disclosure and common meaningful reporting to increase market discipline.

The comprehensive and systematic approach to risk management described in this module may be far from the actual situation in some jurisdictions (even for some large insurers, but especially for smaller insurers). The foreign operations of a large global insurer may have different risk management capabilities than would be expected of a local insurer. Insurance conglomerates may have set up a global risk management framework for a mix of reasons (for example, for better internal control but also to meet regulatory requirements of more advanced insurance regulators).

For jurisdictions or insurers wishing to introduce ERM, significant value can be gained even without access to sophisticated tools. The following sections will outline each key step in ERM for an insurer. For both insurers and supervisors, there exists an abundant library of resource materials on ERM, although much of the material published to date is not specific to the insurance industry. Both groups can also refer to the experiences of their peers. For an insurer, ERM must start at the top with its board. The board must ensure that an appropriate risk culture is in place; review and approve
the risk appetite recommendations of senior management; and ensure that effective
risk management measures are being communicated and implemented throughout the
insurer.

What roles should supervisors play?

Perhaps the fundamental objective of insurance supervision is protecting the interests
of policyholders. For insurers to fulfill their contractual promises to their policyholders,
they must remain solvent, which requires them to manage their risks. The ultimate re
sponsibility for risk management rests with the board.

The supervisory authority's role is to encourage and ultimately enforce appropriate
risk management by the board. This approach can be called “responsive regulation.”
(Braithwaite is perhaps the leading theorist in this area. His views on this matter are
largely summarized in the first three chapters of Ayres and Braithwaite [1992].) To be
effective, supervision should therefore be risk-based rather than solely compliance-
based. This means that understanding the risks faced by an insurer and the manner
in which those risks are managed is a major focus of supervision. Early identification
of emerging risks and systemwide issues enables the supervisory authority to fulfill its
responsibility to policyholders while fostering industry best practices. One of those best
practices is the development of ERM by insurers. As stated in the explanatory note to
ICP 18,

Supervisors play a critical role in the risk management process by reviewing the
monitoring and controls exercised by the insurer. The supervisory authority de
velops prudential regulations and requirements to contain these risks. While the
supervisor puts such requirements in place with the intention of ensuring en-
hanced practices by insurers, the ultimate responsibility for the development of
best practices and the proper operation of the insurer must always rest with the
board of directors.

ICP 18 also states several essential, or advanced, criteria for insurer risk assessment
and management as follows:

a. The supervisory authority requires and checks that insurers have in place com-
prehensive risk management policies and systems capable of promptly identi-
fying, measuring, assessing, reporting, and controlling their risks (refer to ICP
10, Essential Criteria d).
b. The risk management policies and risk control systems are appropriate to the
complexity, size, and nature of the insurer’s business. The insurer establishes an
appropriate tolerance level or risk limit for material sources of risk.
c. The risk management system monitors and controls all material risks.
d. Insurers regularly review the market environment in which they operate, draw appropriate conclusions about the risks posed, and take appropriate actions to manage adverse impacts of the environment on the insurer's business.
e. Larger insurers establish a risk management function and a risk management committee. (advanced criterion)

Commonly, supervisory authorities that apply risk-based supervision adjust the level and frequency of supervisory scrutiny of an insurer, depending on the authority's assessment of the risks posed to policyholders of the insurer. Insurers that are well managed relative to their risks will receive less intensive supervision. Not all areas will need review each year. Supervision includes reviews of major risk management control functions such as financial analysis, internal audit, risk management, senior management, and board oversight.

It is important for the supervisory authority to define clearly what it means by “risk-based supervision.” For example, one meaning might be “the risk posed to the supervisor in the event of a troubled or insolvent insurer.” However, this module uses the interpretation of risk-based supervision described in the preceding paragraph.

The introduction of a risk-based supervisory approach has significant implications for:

- The manner in which the supervisory authority performs its duties
- The competencies, skills, and experience required by supervisory staff
- The relationship between the insurer and supervisor
- The types of disclosure routinely provided by the insurer to the supervisor.

With risk-based supervision the supervisory authority adopts a manner of operation that entails ex ante (early) detection rather than reliance on compliance and ex post (after the fact) reviews or disclosures. To be successful in early detection, the supervisory authority will need to recruit and train staff with the competencies, skills, and experience to discuss key issues with risk experts and senior managers of insurers. They will be seeking to understand the insurers’ key risks and how they are managed, and to assess the quality of the insurers’ decision makers and risk managers.

Supervisors play a critical role in the risk management process by promoting the benefits of risk management to insurers and by reviewing and monitoring the risk management practices of insurers. Supervisors should also review the strategies pursued by insurers, the role of the board in developing these strategies and evaluating the risks that they pose, and the policies adopted to manage the risks. Supervisors should be especially concerned in the event that a board seems unwilling or incapable of implementing appropriate risk management practices. Such situations pose considerable risk to policyholders, and the supervisor should be prepared to escalate use of its legal
powers to ensure that the insurer and its board take corrective action. (See ICP 14, Preventive and Corrective Measures.)

Supervisors should promote the adoption of appropriate risk management practices, both through interactions with individual insurers and by issuing prudential standards or guidance in risk management (such as APRA’s Prudential Standard GPS 220 for General Insurance). More often supervisors are also using risk-based capital measures for solvency assessment, and some jurisdictions are beginning to allow the use of internal risk models in the calculation of required capital. (See ICP 23, Capital Adequacy and Solvency.)

The next section will introduce the reader to the general risk management framework for managing any type of risk.

**Commonly used terms**

**Enterprise risk management.** In its “Overview of Enterprise Risk Management,” (CAS 2004) the Casualty Actuarial Society describes ERM as “the discipline by which an organization in any industry assesses, controls, exploits, finances, and monitors risk from all sources for the purposes of increasing the organization’s short- and long-term value to its stakeholders.”

In Enterprise Risk Management—Integrated Framework, (2004) COSO defines ERM as “a process, effected by an entity’s board of directors, management, and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risks to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.”

**Non-systematic risk.** Non-systematic risk is also known as diversifiable risk or specific risk. It can be reduced or eliminated by aggregating entities that are less than 100% positively correlated with respect to a given risk factor. An entity could be, for example, a financial security, a liability, a corporation, an asset class, or a person’s life. In these examples, the risks could be default, policyholder withdrawals, bankruptcy, return volatility, or mortality, respectively.

**Risk.** The IAIS Glossary defines risk as being “used to indicate a condition of the real world in which there is a possibility of loss; also used by insurance practitioners to indicate the property insured or the peril insured against.”

The 1995 Standard on Risk Management (ASNZS 4360:1995) released by Standards Australia and Standards New Zealand states that “risk management is as much about identifying opportunities as avoiding or mitigating losses.”

**Risk-based supervision.** Risk-based supervision means that the level and frequency of supervisory scrutiny depend on the supervisory assessment of the risks posed to
policyholders of the insurer. Insurers that are well managed relative to their risks will require less supervision.

**Risk management.** The IAIS Glossary defines risk management as “a scientific approach to the problem of dealing with the pure risks facing an individual or an organization in which insurance is viewed as simply one of several approaches for dealing with such risks.”

The 1995 Standard on Risk Management (ASNZS 4360:1995) released by Standards Australia and Standards New Zealand states that “risk management is as much about identifying opportunities as avoiding or mitigating losses.”

In *Enterprise Risk Management* (2003), James Lam states “Risk management is not only about reducing downside potential or the probability of pain, but also about increasing upside opportunity or the prospects for gain.”

**Systematic risk.** Systematic risk is also known as non-diversifiable risk or market risk. It is the residual risk that cannot be eliminated by aggregating or pooling the same risk within a given market, but may be further reduced if the underlying risk is aggregated with other imperfectly correlated risks in the same market or other imperfectly correlated markets. For example, the relationship between a stock’s return and the return of the stock market as a whole represents this stock’s systematic risk.

**Systemic risk.** Systemic risk represents the danger that specific problems will spread more broadly to affect the entire financial system in a jurisdiction. Examples affecting the banking sector in the past have included liquidity and lending crises that have rapidly escalated from local country problems to international crises. A flu pandemic and the failure of a sufficiently large global reinsurer are examples of problems that might have systemic implications for the insurance industry.
Exercises

For each of the following questions, circle the correct response(s); there may be more than one correct response. If you are working with others on this module, develop the answers through discussion and cooperative work methods.

1. Which of the following statements about risk are true statements?
   
a. Risk management is only about reducing downside potential or the probability of pain.
   
b. Key components in the modeling of risk for each peril are volatility, uncertainty, and extreme events.
   
c. Uncertainty is the risk of random fluctuations in either the frequency or severity of a contingent event.
   
d. Volatility is the risk that the models used to estimate claims or other relevant processes are mis-specified or that the parameters within the models are mis-estimated.
   
e. Extreme events may not be adequately represented by extrapolation from more common events, and it is usually difficult to specify a loss value for them.
   
f. It is important to distinguish between an insurer’s role in assuming various risks to which its policyholders are subject and its need to manage all its risks—including but not limited to the risks it is insuring—to which it is subject as a business.

2. Which of the following pairs of insurance stakeholder and stakeholder interest are appropriately matched?

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Primary stakeholder interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Local insurance supervisor</td>
<td>Policyholders protected from undue loss</td>
</tr>
<tr>
<td>b. Supranational organizations</td>
<td>Financial system stability</td>
</tr>
<tr>
<td>c. Policyholders</td>
<td>Economic value added</td>
</tr>
<tr>
<td>d. Rating agencies</td>
<td>Policyholders’ reasonable expectations</td>
</tr>
</tbody>
</table>

3. Which of the following are true statements?
   
a. All company personnel must view risk management as a key to improving their effectiveness.
   
   
c. Overall management responsibility for ERM is always assigned to the chief financial officer (CFO), who reports to the CEO or the board of the insurer.
   
d. The FSAP program was developed solely by the World Bank, to promote the soundness of financial systems in member countries (for example, system strengths and vulnerabilities, key sources of risk, risks to macroeconomic stability).
4. **Which of the following are global trends affecting insurers?**
   
a. Many boards of directors of large global insurers in developed nations have assumed responsibility for risk management as a best practice, but it may well be only an emerging responsibility for smaller insurers or for less well developed insurance markets.

b. There is a lack of convergence on the need for economic approaches to risk assessment between emerging international insurance accounting standards, ERM, and solvency assessment.

c. The continued consolidation and globalization in the insurance industry is driving up the need for market discipline.

d. For jurisdictions or insurers wishing to introduce ERM, significant value can be gained only with access to sophisticated tools.

5. **What roles can supervisors play?**
   
a. Understanding the risks faced by an insurer and the manner in which those risks are managed is a major focus of supervision.

b. Supervisors play a critical role in the risk management process by reviewing the monitoring and controls exercised by the insurer.

c. The supervisory authority develops prudential regulations and requires companies to contain these risks.

d. Increasingly, supervisors are relying on ex post (after the fact) reviews or disclosures rather than using risk-based supervision with an ex ante (early) detection manner of operation.

e. Supervisors should leave the review of insurer strategies to the board but insist on a compliance checklist verifying that all risks have been addressed.

f. Boards unwilling to implement appropriate risk management practices pose considerable risk to policyholders, and the supervisor should be prepared to ensure the board takes corrective action.
B. Risk management framework

Overview

This section outlines the main elements of a risk management framework for insurers. As mentioned in section A, a comprehensive risk management program can be referred to as enterprise risk management (ERM). There is no single definition of ERM; two are set out below.

In “Overview of Enterprise Risk Management” (CAS 2004), the Casualty Actuarial Society describes ERM as “the discipline by which an organization in any industry assesses, controls, exploits, finances, and monitors risk from all sources for the purposes of increasing the organization's short- and long-term value to its stakeholders.”

In Enterprise Risk Management—Integrated Framework, COSO (Committee of Sponsoring Organizations of the Treadway Commission) (2004) defines ERM as “a process, effected by an entity's board of directors, management, and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risks to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.”

It is important to understand some of the differences in definition. Both definitions indicate that ERM is a discipline or process by which the organization or enterprise seeks to manage its risks. Note, however, that the two definitions differ in their focus. The CAS definition has a “short- and long-term value to shareholder” focus whereas the COSO definition refers to “reasonable assurance regarding the achievement of entity objectives.”

![Figure 4. Risk management cycle](image-url)
Whichever definition is chosen, the general risk management framework (see figure 4; IAA 2004, 113) begins with the board of directors and senior management of the insurer setting appropriate corporate governance policies and practices. This ensures that the proper processes and controls are in place to measure and manage risk throughout the insurer. Next, the board and senior management establish the objectives for the risk management process by setting the overall risk tolerances and the risk appetite for the insurer.

The remainder of this section outlines the general framework for managing any risk: identify risks, assess risks, plan strategies, monitor, and exercise control activities.

**Corporate governance**

Corporate governance is an essential element of risk management. It defines the relationships among the various participants in determining the direction and performance of an insurer. It provides top-down leadership regarding expectations for risk management within the insurer. ICP 9, Corporate Governance, provides the following definition:

Corporate governance refers to the manner in which boards of directors and senior management oversee the insurers’ business. It encompasses the means by which members of the board and senior management are held accountable and responsible for their actions. Corporate governance includes corporate discipline, transparency, independence, accountability, responsibility, fairness, and social responsibility. Timely and accurate disclosure on all material matters regarding the insurer, including the financial situation, performance, ownership, and governance arrangements, is part of a corporate governance framework. Corporate governance also includes compliance with legal and regulatory requirements.

An alternative expression of the meaning of corporate governance was provided by the Honorable Justice Owen in his report on the reasons for and the circumstances surrounding the failure of the HIH insurance group:

Corporate governance—as properly understood—describes the framework of rules, relationships, systems, and processes within and by which authority is exercised and controlled in corporations. Understood in this way, the expression “corporate governance” embraces not only the models or systems themselves but also the practices by which that exercise and control of authority is in fact effected. (HIH Royal Commission 2003)
The board is the focal point of the corporate governance system. It is ultimately accountable and responsible for the performance and conduct of the insurer.

Corporate governance practices within corporations in general, not just insurers, have changed considerably in the past decade. Numerous corporate scandals in many industries caused significant damage and loss to important stakeholders. These scandals demonstrated weakness in board and senior management review of company operations. They resulted in investigations, reports, and new initiatives by regulators, stock exchanges, and investors—all focused on improved corporate governance.

The insurance industry has not been immune to these events, as evidenced by various insurer scandals, failures, or near misses (HIH in Australia, Equitable in the United Kingdom, and AIG in the United States, etc.) and the commissions of enquiry into some of them. In 2002 the CEIOPS produced *Prudential Supervision of Insurance Undertakings*, which investigated the causes of various European insurer failures. Among the report's conclusions: the causal chain of events leading to failures began with internal causes owing to poor or inexperienced management, or a business strategy set at the group rather than the local level. It also demonstrated that the review of solvency needs to be broad and encompass governance and risk management.

In his report on HIH, the Honorable Justice Owen found that poor corporate governance practices were an important cause of the demise of that insurer. He noted that

> It is the board's responsibility to understand, test, and endorse the company's strategy. In monitoring performance, the board needs to measure management proposals by reference to the endorsed strategy, with any deviation in practice being challenged and explained. This is what the HIH board failed to do. (HIH Royal Commission 2003, 16)

Further, he stated that

> A board that does not understand the strategy may not appreciate the risks. And if it does not appreciate the risks it will probably not ask the right questions to ensure that the strategy is properly executed. This occurred in the governance of HIH. Sometimes questions simply were not posed; on other occasions the right questions were asked but the assessment of the responses was flawed. The absence of a well understood strategy compounds the difficulties that arise in opportunistic development. (HIH Royal Commission 2003, 16)

Recognizing the importance of corporate governance, ICP 9 states that “the supervisory authority requires and verifies that the insurer complies with applicable corporate governance principles.” ICP 9 provides a comprehensive list of a board's governance responsibilities, including the following:
[The board] satisfies itself that the insurer is organized in a way that promotes the effective and prudent management of the institution and the board's oversight of that management. The board of directors has in place and monitors independent risk management functions that monitor the risks related to the type of business undertaken. The board of directors establishes audit functions, actuarial functions, strong internal controls, and applicable checks and balances.

In summary, through corporate governance, the board sets the foundation and culture for the management of risk across the enterprise. The independence and involvement of the board and the tone set by management have a critical influence on the internal environment.

Two additional trends involving corporate governance are worthy of note. First, there is a growing trend for insurers to use a CRO to assume responsibility for the day to day aspects of risk management. The CRO will typically report either to the CEO or to a board-level risk committee. Second, societal expectations in many developed jurisdictions are pushing boards to move their corporate governance practices from mere compliance to become more proactive in addressing stakeholder expectations. Both trends need to be considered by supervisors as they review an insurer’s corporate governance.

**Objective setting**

The process of establishing objectives is essential in the development of any business strategy. Since ERM and the consideration of risks should be an integral part of an insurer’s operation, the setting of risk-related objectives is vital. Typically, these objectives are developed by senior management with input from the business units and are subject to board approval.

The most important risk-related objectives are the determination of the risk appetite and risk tolerance of the insurer. Risk appetite is a high-level view of the risks the insurer is willing to accept in pursuit of value. Risk tolerance is the acceptable level of variation around profit targets, aligned with the risk appetite. Both quantitative and qualitative terms (for example, earnings at risk and reputation risk) can be used to define these objectives.

Some key risk-related questions that should be raised as part of this process are

- What risks will the organization not accept?
- What risks will the organization take on new initiatives?
- What risks will the organization accept for competing objectives?

Some examples of possible risk appetite statements:
We will underwrite only risks within our core competencies and key markets. Therefore, we will not underwrite risks outside countries A, B, and C. Within those three countries we will focus on products X, Y, and Z.

- Investment in real property will be permitted only up to 10% of the market value of total assets.
- Aggregate risk exposure to a California earthquake should be limited to $x.

Some examples of risk tolerance statements:

- The average credit quality of marketable securities should be single A quality, and no more than x% of the portfolio by market value should rated lower than BBB.
- The business units are expected to earn competitive returns on regulatory required capital; volatility in the insurer’s ROE is targeted to be less than y%.

Establishing the risk appetite inevitably means managing the competing interests of different stakeholders. For example, supervisors will naturally focus on scenarios likely to cause failure while product managers may focus more on risk/reward tradeoffs—maximizing return while minimizing downside risks.

**Identify risks**

With the requisite corporate governance and risk objectives in place, the insurer must identify those internal and external risks that could affect strategy and the achievement of objectives. Of course, risks can produce favorable results (opportunities) as well as
adverse impacts (see definition of “risk management” in section A, under commonly used terms).

The identification of risks is the result of both bottom-up and top-down processes. The specifics of the risk classification chosen may vary, although a classification system that follows the MECE principle (mutually exclusive and comprehensively exhaustive) facilitates analyses of risks. Also, the presence of different classification approaches will confuse stakeholders and those who implement ERM.

As noted earlier, insurers are subject to risks inherent in their core business as well as to general business risks applicable to any business. In the rapidly developing field of risk management, there is no single globally accepted manner of naming and categorizing insurer risks. However, there is growing convergence on defining the key broad categories of insurer risk. They could be categorized under the following major headings:

- **Underwriting.** Insurance companies assume risk through the insurance contracts they underwrite. The risks of underwriting are associated both with the perils covered by the specific line of insurance (fire, death, motor accident, windstorm, earthquake, etc.) and with the risk mitigation processes used to manage the insurance business.

- **Credit.** Credit risk is the inability or unwillingness of a counterparty to fully meet its on- and/or off-balance sheet contractual financial obligations. The counterparty could be an issuer, a debtor, a borrower, a broker, a policyholder, a reinsurer, or a guarantor.

- **Market.** Market risk results from the volatility and uncertainty inherent in the market value of future cash flows from insurer assets and liabilities. Market risk is thus driven by exposure to movements in the level of financial variables. These variables include stock prices, interest rates, exchange rates or commodity prices, and the exposure of options in either the assets or liabilities to movements in underlying pricing variables such as movements in the actual or implied volatility of prices and options.

- **Operational.** The risk of loss resulting from inadequate or failed internal processes, people, systems, or external events.

- **Liquidity.** The risk that events will require the insurer to attempt to liquidate asset holdings prematurely on short notice and under unfavorable terms. A trigger for liquidity risk could be market risk, but other operational and policyholder behavior risk factors could also be triggers.

- **Strategic.** The risk to the insurer resulting from its business strategies, the competing strategies of its competitors, the changing preferences of its customers, or the changing role of the insurance business within the wider business of financial services.
It is not always easy to make a clear distinction between these major risk types. For example, it is possible for some operational risk failures (say, in insurance risk selection or claims management) to be identified through worsened underwriting experience rather than explicitly as operational risks. As noted in the definitions above, it can also be difficult to differentiate liquidity risk from market risk. Partly for this reason, liquidity risk is frequently considered together with market risk.

Underwriting, credit, and market risks are frequently the most readily identifiable insurer risks and, as we shall see in the next section, they are the risks that are most readily assessed quantitatively. However, with the growing recognition of the importance of operational risk, insurance stakeholders are enhancing their abilities, both quantitatively and qualitatively, to identify and assess risk in this area. It is currently difficult for insurance stakeholders to identify strategic risks or their impacts on an insurer. Nevertheless, they remain an important consideration for insurer boards as they review the strategic plans of their companies. Module 18B, Management of Key Risks, focuses on each of these major risk types and the manner in which they are typically managed.

Risk identification should be an ongoing and comprehensive process throughout an insurer, involving all levels of staff and all business functions. It should be a combination of both bottom-up risk identification and top-down support and guidance on procedures for reporting and categorizing risk. Business units, functional areas, and management (right up to and including the board) must be aware of the risks inherent in their business. Larger insurers can naturally be expected to develop more formal and structured processes in this regard than smaller insurers. However, cultivation of the appropriate culture throughout the insurer, to constructively and openly identify possible risks, is the primary goal for all insurers. The absence of such a culture is a key warning signal to insurance supervisors.

**Assess risks**

Before risk can be managed, its impact and behavior need to be clearly understood or assessed. Assessment involves the consideration of a risk’s impact through a combination of its

- Probability (likelihood of occurrence)
- Severity (size in the event it does occur).

This is a basic starting point for assessing risks of any type. Using this approach, a simple probability versus severity diagram can be prepared (figure 6). Such a diagram can be useful in portraying the top risks of the insurer so that management can appreciate their relative severity and probability (frequency). In turn, this appreciation can lead to a discussion of the most effective strategies for managing the top risks.
A shortcoming of this type of diagram is that it portrays risks as subject to a unique probability of occurrence and a unique severity. Most of an insurer's key risks (underwriting, credit, market, operational, etc.) are much more complex. For example, probabilities of death vary by such underwriting criteria as age, sex, and smoking status. For disability insurance sold to individuals, both the incidence rate and the recovery rate (a determinant of severity) vary significantly by underwriting criteria.

Although this simple diagram may help in categorizing the low probability/low severity and high probability/high severity risks, it is less helpful in the assessment of other risks. For example, how should the insurer react to low probability risks with a high severity?

This type of diagram also does not assist the understanding of risk dependencies within an insurer. One of those dependencies for a life insurer involves the effect of policyholder behavior on the value of policy liabilities, as policyholders react to their insurer's investment performance versus that of competitors or external markets in general.

For each type of insurance coverage that they sell, insurers sell large numbers of policies under which the risks insured are largely independent of the risks insured under any other policy. This independence is important in making it possible to develop a statistical graph of the probability distribution of losses. Such a distribution provides much useful information. The distribution allows the mean or “weighted average expected” value to be determined. We can also observe from the probability distribution that for a given degree of certainty (or confidence level), the randomly occurring actual result...
will occur within a specific distance of the mean value. This is most useful in the determination of conservative liability values for financial statement or solvency purposes.

For those skilled in risk assessment, considerable complexity and richness of information lie within the source data for such a distribution. Consider ordinary mortality risk, for example. It is standard practice for an insurer (and, in many jurisdictions, the insurance industry as a whole) to regularly collect mortality data so as to study rates of mortality by age and gender (among other possible criteria). If that mortality study combines data from several calendar years and is now 5 years old, what can we say about the mortality experience of tomorrow or 10 years from now? Is there an underlying trend of mortality improvement that should be recognized? Or is the variation in the results between calendar years simply owing to normal randomness or volatility? Has the study period been unusual in that there were no catastrophic events (such as flu epidemics) in that period? Were the data sufficient in a statistical sense (that is, fully credible) or should the experience of a particular insurer be weighted with that of the industry?

These are the types of questions that a skilled risk specialist must be able to answer. Actuaries, who have this training, are relied upon extensively by insurers and supervisors alike.

Risk assessment requires study of the volatility, uncertainty, and catastrophic elements of each risk. Risk assessment also requires that the underlying root cause or drivers of each risk be clearly understood.

For purposes of communication and decision making throughout the insurer, a risk measure must be selected for each risk. A consistent methodology should be used for all risks to facilitate consistent communication throughout the insurer, but also because of the significant degree of dependency between insurer risks (for example, investment performance can affect the level of policy benefits as well as policyholder behavior).

Risk measures are usually designed to quantify the impact of a risk (or combination of risks) over a specific time period at a high confidence level (say, 99%). Banks have used a statistical measure called Value at Risk (VaR) as part of the Basel Accord capital requirements. A 99% VaR risk measure is equal to the 99th percentile of the cumulative loss distribution for a given risk. It is most important that risk measures be carefully selected and approved at an appropriate (senior) level within the insurer for several reasons:

- Accurate portrayal of the insurer’s risk, especially in extreme (“tail” risk) circumstances, requires appropriate risk measures.
- In most circumstances, more than one risk measure is needed to get the full picture.
- Management behavior will focus on improving the metric, with possibly unexpected and unintended adverse consequences.
There is considerable research on appropriate statistical measures of risk. For example, “coherent” risk measures are preferred by many for their favorable mathematical properties. A coherent risk measure used by the insurance industry and recommended by the IAA in its 2004 report is Tail Value at Risk (TVaR). Figure 7 from the report (2004, 36) illustrates the two risk measures.

In layman’s terms, TVaR is equal to VaR plus the expected shortfall beyond the degree of confidence selected. A danger in using VaR is that two risks could share the same VaR result but their TVaR could be substantially different because of the shape of the tail of each distribution. Again, in layman’s terms, TVaR will identify which risk has greater solvency risk while VaR will not.

The sophistication of the risk measures used by insurers to assess their risks will vary considerably from simple standardized formulaic techniques to sophisticated stochastic models that require highly trained specialists to run them. For risks that are well understood in the industry, are fairly simple, and are not material to the insurer, simple standardized formulaic requirements are likely appropriate. For complex risks with considerable “tail” risk, it is inappropriate for the insurer to assume these risks without having appropriate advanced expertise and systems to assess and manage these risks on a regular basis. A smaller insurer can use standardized approaches for its simpler risks, but it should be required to use appropriate (advanced) expertise for any complex risks that it assumes.

The supervisory authority should work with the insurance industry to determine guidelines for appropriate types of risk measures and assessment.
**Plan strategies**

After identifying and assessing all key risks, the insurer can begin planning appropriate strategies to manage them. As a result of the risk assessment process, the consequences and sources of each risk should be well defined and all risk dependencies identified.

The need to manage risk will be driven by some combination of the insurer’s risk appetite and risk tolerances, the tradeoff between risk and reward for potential risk responses, and the degree to which a response will reduce the risk’s severity and probability.

The general strategies for managing risk can be put in five major categories (IAA 2004, 117):

- **Avoid**—eliminate, stop, prohibit or sell the risk exposure
- **Retain**—accept and self-insure the risk exposure (e.g., by integrating it with other risks or by diversifying risks)
- **Reduce**—mitigate or cap portions of the risk exposure
- **Transfer**—reinsure, hedge, securitize or outsource the risk exposure
- **Exploit**—expand and diversify the risk exposure.

The insurer will try to select the optimal strategy from these major categories. The following are some examples.

- **Avoid.** Using this strategy, the insurer might avoid underwriting certain products (such as disability insurance) to certain markets (such as to blue collar workers) or through certain distribution channels (such as avoiding “tied” sales agents). This strategy might be pursued when the insurer has examined the business strategy and discovered that the business to be avoided has been (or is likely to be) unprofitable, risky, or contrary to other more important business objectives.

- **Retain.** Perhaps the most natural risk management strategy is simply to retain or self-insure the risk in question. This strategy would be pursued when the insurer is confident in its ability to manage the risk in question at a fair price for any capital employed to assume the risk. There are advantages in assuming large numbers or amounts of similar risks, in that the “law of large numbers” will result in lower aggregate risk measure or diversification of risk in comparison with a simple summation of the individual risk measures.

- **Reduce.** An insurer may simply decide to take on a lesser amount of a given risk. This situation might arise when the insurer is confident in its ability to manage the risk in question at a fair price but the amount of the risk assumed is approaching the insurer’s appetite for that risk.

- **Transfer.** The transfer of risk through reinsurance is one of the most popular forms of risk management. Direct writing insurers obtain coverage from other...
insurers (reinsurers) to limit the amount of risk retained, and perhaps to take advantage of the reinsurer’s expertise in specialized markets or with certain risks or products with which the direct insurer may not have experience. Reinsurance allows the direct insurer to underwrite larger risks than it might otherwise. Other means of transferring risk include hedging investment risks and outsourcing various administrative functions. It is important to note, however, that risk transfer does not eliminate risk, because residual risk—counterparty risk—is substituted in place of the original risk.

- **Exploit.** An insurer may find that a particular type of risk or product not previously assumed by the insurer provides a natural hedge or a diversification opportunity. In this case the insurer might embark on a deliberate plan to assume more of that risk in order to lower its overall risk exposure. An example of a natural hedge against longevity risk would be the maintenance of both life insurance and life annuity lines of business.

Strategies for managing risk entail the exchange of one set of consequences for another. The risk preferences of the insurer will determine the strategy or combination of strategies. For example, transferring risk through reinsurance will entail some combination of the following consequences:

- The risk volatility and uncertainty of underwriting will be reduced.
- The profitability of the block of business will be affected (up or down, depending on the specific circumstances).
- The insurer’s counterparty risk will increase.

Whichever strategies are adopted to manage risks, the insurance supervisor should expect the insurer to demonstrate

- A sound level of understanding of the underlying risks, as well as the risks entailed in the strategies adopted
- An appropriate level of expertise to manage the strategy adopted, consistent with the complexity of the risks and strategies.

**Monitor risks**

With a set of risk strategies in place, the insurer will need to monitor the gross (that is, before reinsurance) and net effects (that is, net of reinsurance) of the risks it has assumed. This will ensure that the risks remain within the risk appetite and risk tolerances of the insurer and that the chosen risk strategy is delivering the desired results (such as improved ROE).
The frequency of monitoring will depend on the size and sensitivity of the risk being managed. For example, a $500 million hedge program on a portfolio of equities would likely deserve monitoring by dedicated staff and daily reporting to senior management. A reinsurance treaty involving purely mortality risk on a stable block of in-force business would likely need only monthly monitoring.

To routinely monitor risks, the insurer will need to build appropriate support systems that can supply the necessary data in a reliable, auditable, and cost-effective manner. The insurer will need to build in appropriate checks and balances to ensure the data's reliability.

To be actionable, the key data used to monitor the insurer's risk positions—as well as the ability of each key process to operate within given tolerances—should be assembled on a routine and timely basis for action at an appropriate level within the insurer. One way of communicating this information to a variety of audiences for discussion and action is through the regular production of a "risk dashboard" (perhaps weekly or monthly). Care will need to be taken to ensure that all decisions or adjustments in the insurer's risk positions or risk strategies take into account all relevant information about possible risk dependencies and that all who would be affected are properly informed. The risk dashboard enables the insurer to be proactive in managing its risks.

The dashboard would cover the following types of topics:

I. Insurer or Group Overview
   - Risk and exposures
   - Scenario analysis

II. Exposure, risk, and limits
   - Underwriting risk
   - Credit risk
   - Market and asset-liability management risk
   - Operational risk
   - Liquidity risk

III. Watchlist

IV. Recommendations

Deliverables from this process include feedback for the control and assessment of risks; triggers for the activation of specific risk management strategies; and feedback for risk management process improvements.
Control activities

The risk management framework would not be useable, reliable, or effective without an appropriate set of control activities. Some examples of needed control mechanisms:

- **Organization structure.** Effective risk management requires the presence of an enabling corporate structure, typically requiring overall board responsibility for ERM and including a CRO reporting to the CEO or CFO, and executive-level (and business unit-level) risk committees to address asset-liability management, credit, underwriting, and operational risk issues.

- **Objectives.** The insurer’s board should establish overall risk appetite and risk tolerance objectives for the insurer and all its business units. The detailed list of risk measures to be used by the insurer to track progress should also require board approval. The contribution of each key risk should be assessed and changes made to the management of those risks that are outside the agreed-on objectives.

- **Approvals.** The insurer should be expected to establish appropriate approval levels throughout the steps of the risk management framework. Those entrusted with approval authority must have appropriate experience and training to fully appreciate the possible consequences of their decisions (that is, the financial and organizational impacts on their own area as well on the entire company).

- **Limits.** The insurer should be expected to establish appropriate limits on the risk decisions made by its managers to control its exposure to risks. The ability of all key processes to operate within agreed-on limits and authorities must be monitored and exceptions examined for their cause and significance.

- **Training and communication.** The insurer should have in place regular programs for relevant training of staff and for ensuring that all risk management staff have an appropriate level of awareness of risk management practices throughout the insurer. The insurer should ensure that the level of training of its risk management staff (especially those involved with highly complex risks) is commensurate with industry and supervisory standards for those with such responsibilities.

- **Change controls.** Risk management is dependent on the consistent assessment of risks over time. Any changes in source data, experience, models, assumptions, etc. should be subject to appropriate change control procedures so that their impacts do not cloud the true assessment of risk. Such changes can occur through a natural desire to better meet the insurer's performance targets (for example, ROE).

- **Models.** For material or complex risks it is common for insurers to use models to assess and manage these risks. To avoid these models being viewed as a “black box,” insurers should be able to document and describe the key model assumptions, methods, and output. The models should be used regularly within the operations of the insurer. The models should also be subject to validation and
review by knowledgeable internal and external professionals. The models should conform to all relevant industry and supervisory norms and standards.

- **Audit and review.** All key processes of the insurer must be subject to periodic independent review by appropriate experts, and risk management processes are no exception. An insurer’s internal audit function plays a key role in this regard and that department should routinely report directly to the board on these matters. In addition, several key internal processes may involve significant judgment, outsourcing, and expert systems, which will necessitate specialized independent (and perhaps external) reviews of specific aspects of the insurer’s operations.

Control activities should also include a periodic independent review of the effectiveness of all aspects of the framework. This review, organized by the CRO, should encompass all levels of risk management within the insurer and include recommendations for approval by the board.

### Exercises

For each of the following questions, circle the correct response(s); there may be more than one correct response. If you are working with others on this module, develop the answers through discussion and cooperative work methods.

6. Which of the following are considered by ICP 9 to be part of corporate governance?
   - a. Board and senior management accountability for their actions
   - b. Independent risk management function
   - c. Agent licensing
   - d. Timely and accurate disclosure of all material matters affecting the insurer
   - e. Compliance with legal and regulatory requirements
   - f. Senior management incentive compensation

7. Which of the following pairs of risk management statements are appropriately matched?

<table>
<thead>
<tr>
<th>Framework process</th>
<th>Descriptive element</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Assess risks</td>
<td>Coherent risk measures</td>
</tr>
<tr>
<td>b. Identify risks</td>
<td>Probability and severity</td>
</tr>
<tr>
<td>c. Plan strategies</td>
<td>Avoid, retain, reduce, transfer, exploit</td>
</tr>
<tr>
<td>d. Control risks</td>
<td>Risk dashboard</td>
</tr>
<tr>
<td>e. Monitor risks</td>
<td>Reinsure</td>
</tr>
</tbody>
</table>
8. Which of the following are important concepts in the “assess risks” step?
   a. Risk dependencies
   b. Diversification of risks
   c. Volatility risk
   d. Uncertainty risk
   e. Tail risk

9. Which of the following are true about the “plan strategies” step?
   a. Using the “reduce” strategy, the insurer may decide to take on a lesser amount of a given risk. This situation might arise when the insurer is confident of its ability to manage the risk in question at a fair price but the amount of risk assumed is approaching the insurer’s appetite for that risk.
   b. Using the “transfer” strategy, reinsurance, hedging of investment risks, and the outsourcing of various administrative functions are used to transfer risk. Risk transfer does not eliminate risk, because residual risk—counterparty risk—is substituted for the original risk.
   c. Using the “retain” strategy, the insurer might embark on a deliberate plan to assume more of a particular risk to lower its overall risk exposure (through risk diversification).
   d. Using the “avoid” strategy, the insurer might avoid underwriting certain products (such as disability insurance), to certain markets (such as to blue collar workers) or through certain distribution channels (such as avoiding “tied” sales agents).
   e. With the “exploit” strategy, there are advantages in assuming large numbers or amounts of similar risk, in that the “law of large numbers” will result in lower aggregate risk measure or diversification of risk, in comparison with a simple summation of the individual risk measures.
C. Summary and conclusions

ICP 18, Risk Assessment and Management, states that “The supervisory authority requires insurers to recognize the range of risks that they face and to assess and manage them effectively.” This module has outlined the importance of risk management, the key sources of insurer risk, and the various stakeholders in insurer risk management. The main elements of the risk management framework for insurers were introduced. Guidance and examples were provided for each step: set objectives, identify risks, assess risks, plan strategies, monitor risks, and control activities.

Risk management is important to all of an insurer’s stakeholders (policyholders, investors, and supervisors), as well as overall system stability. Insurers have long managed their underwriting risks, but the science of managing all their risks of operation (ERM) is still fairly new (although it is rapidly evolving). Although much work is entailed in the effective introduction of a risk management framework, such work may well coincide with other supportive developments related to value-based performance reporting, fair value reporting, economic capital, solvency frameworks, and the like. While insurers will find considerable value in the development of quantitative approaches to risk management, the benefits of qualitative approaches for some types of risk should not be underestimated.

Other useful and related IAIS references include

- ICP 9, Internal Control
- ICP 10, Corporate Governance
- Principle 10, Risk Management in Principles on Capital Adequacy and Solvency.

It is very important that a risk management culture be established throughout an insurer. Ultimate responsibility for risk management rests with its board. Supervisors play a critical role in reviewing the entire risk management process.

Remembering the words of Honorable Justice Owen with respect to governance: it is important to appreciate the difference between an insurer that has an ERM process and one that effectively uses and abides by that process. Insurance supervisors need to detect the difference between a board that says it has an ERM process and a board that periodically assesses its corporate governance practices and ERM process to ensure that they remain well suited to the changing environment in which the insurer operates.
D. References


Posttest

For each of the following questions, circle the correct response(s); there may be more than one correct response.

1. **Which of the following statements about risk management are true?**
   a. Risk management is important in ensuring that the insurer meets its obligations now and in the future.
   b. The business of insurance is fundamentally about the management of risk.
   c. As in other businesses, insurance is subject to operational risk.
   d. Insurance supervisors have identified poor risk management as a leading cause of insolvency.
   e. Risk management is important for overall financial system stability.

2. **Which of the following pairs of insurance stakeholders and perspectives on risk are appropriately matched?**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Perspective on risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insurance supervisor</td>
<td>Seek evidence that insurer is profitable, has good financial strength and good growth prospects</td>
</tr>
<tr>
<td>Insurer personnel</td>
<td>Must view risk management as a key to improving effectiveness</td>
</tr>
<tr>
<td>Customers</td>
<td>Fair treatment and reasonable expectations are met</td>
</tr>
<tr>
<td>Investors</td>
<td>Ensuring insurers are not subject to an undue level of risk, especially systematic risk</td>
</tr>
</tbody>
</table>

3. **Which of the following statements are true for “risk-based” supervision?**
   a. Insurers that are well managed relative to their risks will require less supervision.
   b. Risk-based supervision has implications for the manner in which the supervisory authority performs its duties.
   c. Risk-based supervision has implications for the relationship between the insurer and supervisor.
   d. With risk-based supervision the supervisor adopts ex post (after the fact) reviews or disclosures.

4. **Which of the following statements about corporate governance are true statements?**
   a. Management is responsible for attending to conflicts of interest.
b. Governance is the manner in which boards and senior management oversee the insurer’s business.

c. Governance is the framework of rules, relationships, systems, and processes within which authority is exercised and controlled.

d. It is the board’s responsibility to understand, test, and endorse the company’s strategy.

e. The board is responsible for the culture of risk management throughout the insurer.

f. The board should be reactive in addressing stakeholder expectations.

5. **Which of the following statements are true?**

a. It is fairly easy to make a clear distinction between the major risk types (for example, underwriting, credit, market, operational).

b. The absence of a culture open to risk disclosure is a key warning signal to insurance supervisors.

c. Risk assessment requires that the underlying root cause or drivers of each risk be clearly understood.

d. Usually a single risk measure can be chosen regardless of its impact on management behavior.

e. Smaller insurers can use standardized approaches for all their risks regardless of the complexity of the risks they assume.

f. There are advantages in assuming large numbers or amounts of similar risks in that the “law of large numbers” will result in a lower aggregate risk measure, compared with a summation of the individual risk measures.

g. Transferring risk through reinsurance will entail some combination of the following consequences: counterparty risk, underwriting risk transfer, change in credit rating, profitability impact.

h. The key data used to monitor the insurer’s risk positions as well as an assessment of the ability of its key processes to operate within given tolerances should be assembled on a routine and timely basis for action at an appropriate level within the insurer.

i. Any change in source data, experience, models, assumptions, and the like should be subject to appropriate change control procedures so that their impact does not cloud the assessment of risk.

j. Insurers will find considerable value in the development of quantitative approaches to risk management. The benefits of qualitative approaches are of lesser importance.

k. Insurance supervisors need to detect the difference between an insurer’s board that says it has an ERM process and an insurer’s board that ensures that the insurer’s corporate governance practices (and ERM) continue to be well suited to the insurer’s changing environment.
Appendix I. ICP 18

ICP 18 Risk assessment and management

The supervisory authority requires insurers to recognize the range of risks that they face and to assess and manage them effectively.

Explanatory note

18.1. An insurer should identify, understand, and manage the significant risks that it faces. Effective and prudent risk management systems appropriate to the complexity, size, and nature of the insurer’s business should identify and measure against risk tolerance limits the risk exposure of the insurer on an ongoing basis to indicate potential risks as early as possible. This may include looking at risks by territory or by line of business.

18.2. Some risks are specific to the insurance sector, such as underwriting risks and risks related to the evaluation of technical provisions. Other risks are similar to those of other financial institutions, for example, market (including interest rate), operational, legal, organizational, and conglomerate risks (including contagion, correlation, and counterparty risks).

18.3. Supervisors play a critical role in the risk management process by reviewing the monitoring and controls exercised by the insurer. The supervisory authority develops prudential regulations and requirements to contain these risks. While the supervisor puts such requirements in place with the intention of ensuring enhanced practices by insurers, the ultimate responsibility for the development of best practices and the proper operation of the insurer must always rest with the board of directors.

Essential criteria

a. The supervisory authority requires and checks that insurers have in place comprehensive risk management policies and systems capable of promptly identifying, measuring, assessing, reporting, and controlling their risks (refer to ICP 10, Essential Criterion d).

b. The risk management policies and risk control systems are appropriate to the complexity, size, and nature of the insurer’s business. The insurer establishes an appropriate tolerance level or risk limit for material sources of risk.

c. The risk management system monitors and controls all material risks.
d. Insurers regularly review the market environment in which they operate, draw appropriate conclusions as to the risks posed, and take appropriate actions to manage adverse impacts of the environment on the insurer’s business.

**Advanced criteria**

e. Larger insurers establish a risk management function and a risk management committee.
Appendix II. Answer key

Pretest

1. a, b, d
2. a, b, e
3. a, c, d
4. a, b, d
5. c
6. a, d, e

Exercises

1. b, e, f
2. a, b
3. a, b
4. a, c
5. a, b, c, f
6. a, b, d, e
7. a, c
8. a, b, c, d, e
9. a, b, d

Posttest

1. a, b, c, d, e
2. b, c
3. a, b, c
4. b, c, d
5. b, c, f, h, i, k