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ENTERPRISE RISK MANAGEMENT FROM THE GENERAL INSURANCE ACTUARIAL PERSPECTIVE

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ABSTRACT

The authors have reviewed over 60 texts on the subject of Enterprise Risk Management (ERM). In this paper they set out a summary of ERM based on three of those sources, selected for their relevance and breadth of view. The paper observes that the approaches described vary widely in nature. A separate 'on-line' source is provided, which summarises key readings from the 60 texts. Combining findings from these texts with the authors' own experiences, the paper suggests some best practice checklists, designed to enable organisations to take stock of their current ERM frameworks. It discusses other aspects of ERM for practitioners, including extreme events, opportunity management and the link with corporate strategy. The paper looks at immediate and longer-term implications for actuaries in the United Kingdom, and then poses questions about future professional development and education. It suggests an emerging role for the 'ERM actuary', and, finally, it suggests future work to progress the development of ERM and the actuaries' role.

KEYWORDS

Enterprise Risk Management; Risk Management; General Insurance; Quantification of Risk; Financial Services; Capital Assessment; Capital Management; People, Process and Systems; Regulations and Risk; Stress and Scenario Tests; Risk Cycle; Actuarial Education; Basel II; Solvency II; Professional Development; Institute of Actuaries Strategy; Strategic Planning; Change and Opportunity Management; Risk and Uncertainty; Governance; Control Framework; Information, Indicators and Risk; Chief Risk Officer; Risk Modelling; Risk Appetite; Risk Maps; Risk Exposure; Rating Agencies and Risk

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1. Introduction

1.1 *Background*

1.1.1 Organisations succeed and fail for many reasons, and the management of unexpected or unpredictable events has always attracted interest.

1.1.2 This paper has been written by a group of United Kingdom general insurance actuaries interested in such events, or risk. It is based on work previously undertaken as a GIRO (General Insurance Research Organisation) Working Party. While it comments from a general insurance perspective, the authors believe that the paper may have wider applicability and interest.

1.1.3 Enterprise Risk Management (ERM) is not purely an actuarial preserve; it is important to recognise that it is relevant to all areas of commercial life, and most of the work to date has been carried out by non-actuaries. Our discussion suggests that the opportunities for actuaries to make a meaningful contribution are growing fast, especially given rapidly changing regulatory and capital market conditions.

1.1.4 The Actuarial Profession in the U.K. has as its strap line, 'making financial sense of the future', and, in colloquial terms, the future is uncertain. Following the recent strategic review, its main goal, as stated in its corporate plan, is primarily for its members to be quantitative risk professionals in the financial sector. The recently formed Risk Management Special Interest Group's manifesto, endorsed by the Institute and Faculty Councils, states that all actuaries are risk managers now. It is not extending these statements too far, to suggest that one of its (implicit) goals is to ensure that its members will be well placed to aspire to the position of the chief risk officer (CRO) in financial organisations. Understanding the meaning of risk, how to articulate uncertainty, and the management of unexpected or unpredictable events are some of the central themes in actuarial professional life.

1.1.5 As well as positioning actuaries for the role of CRO, it is timely to suggest that there is now space for the ERM actuary. This role would sit alongside the CRO, and, as well as helping develop transparent, helpful and well understood models, the ERM actuary could ensure that decisions were taken in a well considered manner, reflecting risk profiles in a systematic way. ERM actuaries need to be forward looking, using past experience in a creative way when modelling the effect of anticipated changes in risks written and underlying processes on a company's expected future risk profile. This requires the ability to think in intuitive and perceptive ways, and using traditional analytic skills in a diverse mixture with creative thinking.

1.1.6 ERM has been around for many years, and yet it has had a chequered history, only recently starting to be fully adopted by companies in the U.K. financial service markets and elsewhere around the world. Pioneers included Lam (2003), who is credited with being the first person to use the job title of Chief Risk Officer, Deloach (2000), Miccolis (2000) and Kloman (1999), who also wrote the pioneering article Kloman (1976), entitled 'The Risk Management Revolution'. Interestingly, while their initial work was in the 1980s or a little earlier, their first full texts were generally not published until more recently, in 1999 to 2003.

1.1.7 Continued development of the regulatory environment and the sophistication of analysis techniques have changed companies' approaches. ERM is now commonly accepted as a necessary part of any successful organisation's modus operandi. It is safe to say that ERM is here to stay.

1.2 *The Purpose of this Paper*

1.2.1 This paper has four key purposes:

(1) to provide a quick reference document for those new to ERM in general insurance;
(2) to provide a check list of current best practices for the emerging expert;
(3) to look to the future of ERM, and to provide insights into how the subject may develop; and
(4) to contribute to the discussion about the implications for the U.K. Actuarial Profession, and, in particular, educational requirements.

1.2.2 ERM is a wide subject. As its name implies, it is applicable to enterprises of any type, not restricted to financial services, let alone insurance. That said, there are certain key features of the general insurance market which merit special consideration.

1.2.3 The origins of the paper can be traced to an emerging interest at GIRO; firstly in operational risk, then in the modelling of all risks, and most recently in the full ambit of ERM. A working party was formed in November 2005. Initially it produced a series of essays, but, since November 2006, it has developed a breadth of material which is available via the 'GIRO' link from the Institute of Actuaries' website. This paper extracts the more important elements as a cohesive reference document.

1.2.4 Much actuarial literature focuses on modelling and quantification. This is, indeed, the cornerstone of the actuary's unique contribution, and yet not the only aspect of successful ERM. This paper deliberately seeks to redress the balance by majoring on the non-modelling aspects of ERM. Successful ERM requires numeric analysis and modelling work to be combined with these broader aspects. Any actuary aspiring to be a CRO needs to be well versed in all aspects of risk management.

1.2.5 In the United States of America, both the Society of Actuaries and the Casualty Actuarial Society have formed risk management groups, and, for the last few years, have held regular seminars and annual conferences on the subject of ERM. In Australia, the Institute of Actuaries of Australia has focused on risk management, especially since the failure of HIH in 2001. The International Association of Actuaries (the IAA) is developing an International Accreditation for ERM.

1.2.6 Here, in the U.K., we have recently formed a new Risk Management Special Interest Group, and are in the process of developing a new series of examinations which will include risk management. It is timely

to reflect on the status of ERM in U.K. actuarial thinking. In some senses, this paper fills a gap in U.K. actuarial literature.

1.3 *Structure of the Paper*

1.3.1 Following this introduction, Section 2 considers what ERM is, the scope of ERM, and how it varies from what has previously been discussed under the heading of risk management. It reflects a major review of existing ERM and other risk management literature, referred to in passing, and fully available at Orros (2007a) and Orros (2007b). It summarises key aspects of ERM, based on what the working party regarded as the most important texts. The section is a useful reference to newcomers to ERM.

1.3.2 Section 3 is intended for current risk managers, to assess how up to date their approach is. It lists the topics which a well developed ERM system should encompass. By proposing an ERM framework, populated with examples of best practices, it will enable a consideration of the optimum, or a gap analysis to be undertaken.

1.3.3 Section 4 considers consequences for actuaries now, and also developing trends. It speculates on how ERM could be practised in the longer term. This exercise in imagination is meant to promote discussion, and to help our Profession develop a vision for how its own position might have to evolve. It is deliberately intended to be provocative.

1.3.4 Finally, the threads are pulled together in a short concluding section, which also sets out ideas for future work.

2. Current Best Practice

2.1 *Overview*

2.1.1 We consider that ERM should be positioned firmly in the context of risk and opportunity management (rather than solely of risk control). Furthermore, the strategic agenda for ERM and its ultimate effectiveness will depend on the degree of board sponsorship and understanding, as well as on the levels of enthusiasm with which it is cascaded to lower levels within an organisation.

2.1.2 ERM is a broad holistic subject which covers a wide range of business and enterprise models in all business and community organisation areas. Much can be learned, in the insurance and financial services sectors, from considering the ERM experiences in private sector industries, such as energy, construction, agriculture, pharmaceuticals and healthcare. There are also many public sector applications, and a rich history of documented experiences from national governments and public sector agencies in many countries around the world.

2.1.3 In the public sector, the benefits of systematic risk management have been recognised for many years, and have become embedded in business

process management. Cabinet Office (2002), from the Strategy Unit of the U.K. Cabinet Office, provides a report 'Risk: Improving Government's Capability to Handle Risk and Uncertainty', which describes how handling risk and opportunity is increasingly perceived at the centre of good government. The report stresses that rapid scientific and technological development and globalisation are creating a new agenda for government. This is set against increasing consumerist demand from the public, and increasing scepticism about the trustworthiness of institutions, and a willingness to challenge on specific issues. This advice applies equally to the private financial services sector.

2.1.4 The existence, or otherwise, of robust ERM frameworks will have a direct effect on the amount of capital which a company needs to hold. In particular, companies targeting certain credit ratings will need to monitor the cost associated with the adoption of ERM frameworks against the corresponding reduction in capital required. Each company will find that the optimum balance lies in a slightly different place. Credit rating agencies generally view the quality of ERM as a lead indicator, where a weakening of standards is an indicator of future problems. In particular, they suggest that insurers with good ERM are prepared for soft markets (e.g. credit markets, equity markets, interest markets and insurance markets), and understand the implications for risk limits and risk/reward standards in the face of the softening of each of their relevant risk markets. Typical ERM evaluation criteria, as suggested, e.g. by Standard & Poor's, include risk management culture, risk control, extreme event management, risk models, economic capital and strategic risk management.

2.1.5 One of the GIRO working party's tasks was to review the more important books, papers and published texts on ERM. In total, some 60 were reviewed by Orros (2007a) and Orros (2007b). These are listed in Appendix A, and can be seen via GIRO.ERM Appendix 1A and GIRO.ERM Appendix 1B at http://www.actuaries.org.uk/files/proceedings/giro2007/BHPrize_Tripp_Appendices.zip

2.1.6 The working party felt that three were worth summarising in this paper:

(1) COSO (2004a) and COSO (2004b) provide a thorough commentary, developed by a wide ranging group of U.S. based accountants; COSO gives a good control environment approach to ERM.
(2) Standard & Poor's (2005) provides a checklist assessment, typical of those used by rating agencies.
(3) The textbook by Chapman (2006) is, perhaps, the most all embracing and strategic.

These summaries are set out in Section 2.2.

2.1.7 In addition, we refer to Basel II as indicative of thinking emerging from the banking world.

2.2 *Summary of ERM from COSO, Standard & Poor's, Chapman and Basel II*

2.2.1 *COSO (The Committee of Sponsoring Organisations of the Treadway Commission)*

2.2.1.1 COSO (2004b) has defined ERM as follows:

> "Enterprise risk management is 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 risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives."

2.2.1.2 The COSO Integrated ERM Framework (illustrated in Figure 1), principles and methodologies, can be interpreted as a unifying suite of holistic ERM processes which can be applied to almost any enterprise or organisation. The framework is applicable to both private and public sector organisations (e.g. the Government, regulators). Private sector applications can include insurance and financial services business. The framework combines three dimensions, namely a risk process, a business level view, and intent. In particular, the business level can range from group or entity down to a small subsidiary or strategic business unit. The intent covers strategic compared to operations, and reporting compared to compliance.

2.2.1.3 COSO (2004a) has provided a comprehensive suite of application techniques, which can support insurance and financial services businesses in their quest for an effective ERM framework. These application techniques

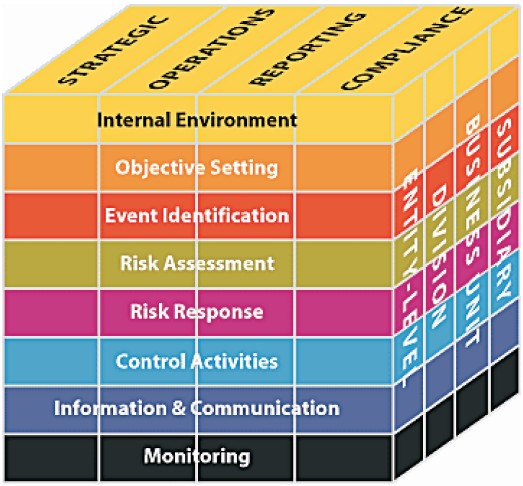

Figure 1. COSO framework

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cover the ERM issues associated with the internal environment, objective setting, event identification, risk assessment, risk response, control activities, information, communication and monitoring. The underlying premise is that every entity exists to provide value and that all activities face uncertainty. The challenge for management is to determine how much uncertainty to accept as it strives to grow stakeholder value.

2.2.1.4 Uncertainty presents both risk and opportunity, with the potential to erode or to enhance value. ERM enables management to deal effectively with uncertainty and associated risk and opportunity, enhancing the capacity to build value.

2.2.1.5 Value is maximised when management sets the strategy and the objectives to strike an optimal balance between growth and return goals and related risks, and efficiently and effectively deploys resources in pursuit of the entity's objectives. ERM encompasses:

(1) aligning risk appetite and strategy, via evaluating strategic alternatives, setting related objectives, and developing mechanisms to manage related risks;
(2) enhancing risk response decisions, via providing rigour in identifying and selecting among alternative risk responses (i.e. risk avoidance, reduction, sharing, acceptance);
(3) reducing operational surprises and losses, via gaining the capability to identify potential events and establish responses, reducing surprises and associated costs or losses;
(4) identifying and managing multiple and cross-enterprise risks, via facilitating effective responses to the interrelated impacts, and integrated responses to multiple risks; and
(5) seizing opportunities, via considering a full range of potential events, and management is positioned to identify and to realise opportunities proactively.

2.2.1.6 ERM capabilities can help management to achieve the entity's performance and profitability targets and prevent a loss of resources. It can help to ensure effective reporting and compliance with laws and regulations, as well as avoiding damage to the entity's reputation and the associated consequences. ERM can help an entity get to where it wants to go, and to avoid pitfalls and surprises along the way. Events can have negative impacts, positive impacts, or both. Events with a negative impact can erode existing value, whereas positive impact events represent opportunities. Management can then channel opportunities back to its strategy or objective-setting processes.

2.2.1.7 One can also illustrate risk appetite in terms of a 'risk map' (see Figure 2). For example, any significant residual risk in the upper right area exceeds the company's risk appetite, calling for management to take action to reduce the likelihood and/or the impact of the risk and to bring it within

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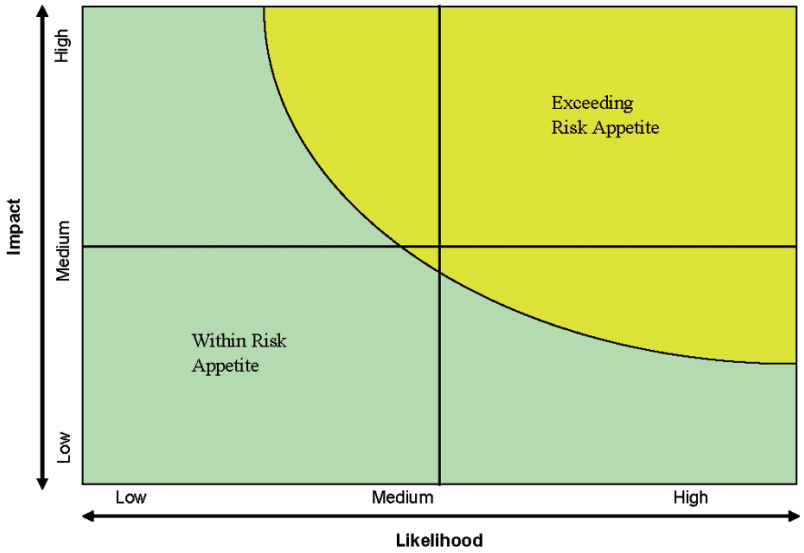

Figure 2. Typical risk map

the company's risk appetite. According to COSO (2004a), the company can then strive to diversify its portfolio to earn a return which lines up along the target profile, rather than lower down, in the interior of the region. A further tool is that of the efficient frontier, showing combinations of return against risk (see Figure 3).

2.2.2 *ERM framework according to Standard & Poor's (2005)*

2.2.2.1 Standard & Poor's (2005) ERM evaluation methodology for insurers consists of seven initial criteria: competitive position, management and corporate strategy, operating performance, capitalisation, liquidity, investments, and financial flexibility (eight if ERM, itself, is included as a heading).

2.2.2.2 ERM involves rationalising risk limits and tolerances across different individual risks, and allowing comparable measures to be applied, so that the risk management process can be performed, both for individual risks and at the level of the total enterprise. Risk capital values can also be linked to risk-taking activities, enabling the insurer to assess the projected and the historical performance of different activities in proportion to the economic capital required to support them. Targets can be set for the return on economic capital of each activity, capital is allocated to optimise the expected return on economic capital, and management efforts to meet targets are assessed (see Figure 3).

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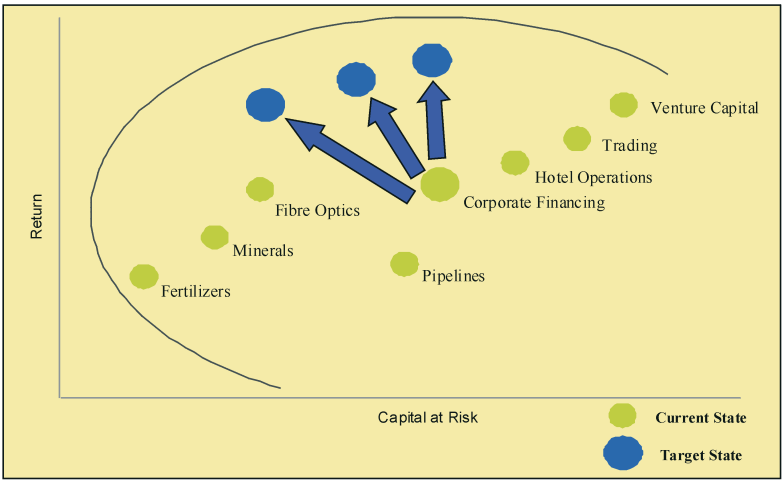

Figure 3. Efficient frontier

2.2.2.3 Standard & Poor's (2005) suggests that ERM, as a rating criterion, has added weight for insurers, because taking risk and risk management are core insurance business activities. Companies are viewed as having excellent, strong, adequate or weak ERM relative to the risks of the company, its ability to absorb risks and the complexity of the risks. ERM classifications relate to sustained capabilities to identify, measure and manage risk exposures and losses within the company's predetermined tolerance guidelines; evidence of the enterprise's practice of optimising risk-adjusted returns; and the extent to which risk and risk management are important considerations in corporate decision making.

2.2.2.4 We have already said that ERM can be viewed as a lead indicator, where a weakening of standards is an indicator of future problems. In particular, excellent ERM insurers need to be mentally prepared for soft markets (e.g. credit markets, equity markets, interest markets and insurance markets), and to understand the implications for risk limits and risk/reward standards in the face of the softening of each of their relevant risk markets.

2.2.2.5 The ERM evaluation criteria proposed by Standard & Poor's (2005) for rating purposes include risk management culture, risk control, extreme event management, risk models and economic capital and strategic risk management (see Figure 4).

2.2.2.6 We have quoted Standard & Poor's as the credit rating example, because it was the first to be published and is widely available. We do not intend to suggest that other agencies' frameworks are not robust nor worth referring to; we do intend to suggest that rating agencies' comments on

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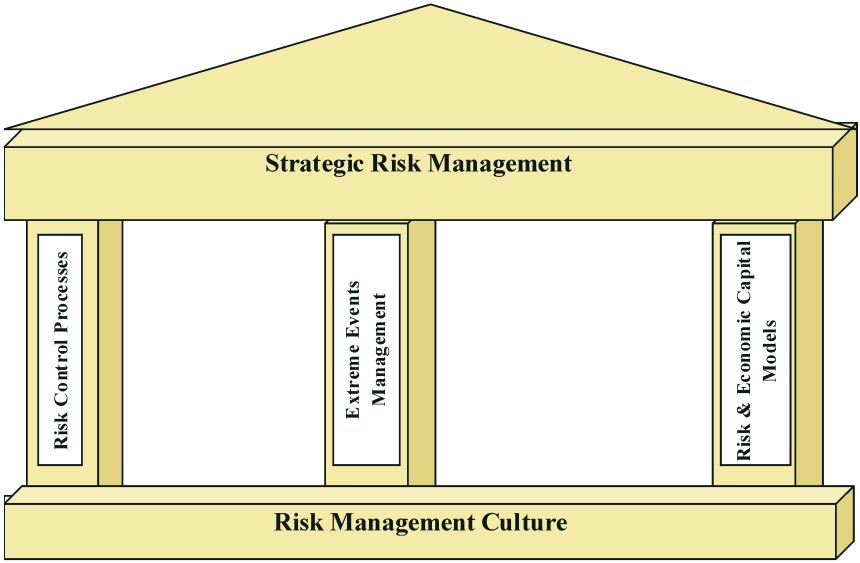

Figure 4. Standard & Poor's ERM evaluation framework

capital (and hence ERM) are important, and that the boards take them very seriously.

2.2.3 *ERM framework according to Chapman (2006)*

2.2.3.1 According to Chapman (2006), the ERM process is defined as:

> "... a systematic process, embedded in a company's system of internal control (spanning all business activity), to satisfy policies effected by its board of directors, aimed at fulfilling its business objectives and safeguarding both the shareholder's investment and the company's assets. The purpose of this process is to manage and effectively control risk appropriately (without stifling entrepreneurial endeavour) within the company's overall risk appetite. The process reflects the nature of risk, which does not respect artificial departmental boundaries and manages the interdependencies between the risks. Additionally, the process is accomplished through regular reviews, which are modified when necessary to reflect the continually evolving business environment."

2.2.3.2 Chapman describes the process of ERM, which is essentially one of risk and opportunity management, as impinging "on the four main functions of Boards; policy formulation, strategic thinking, supervisory management and accountability and their respective control cycles" (see Figure 5).

2.2.3.3 Another way of looking at the ERM framework, as adapted

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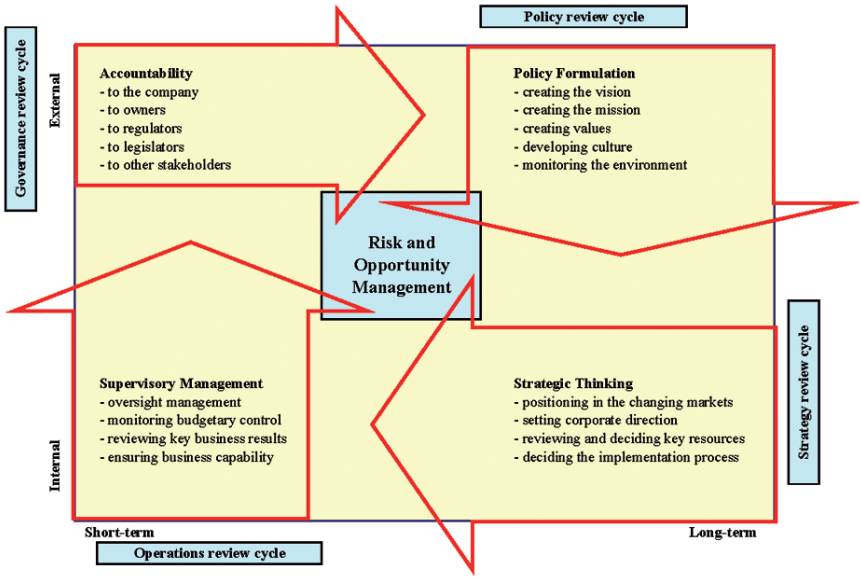

Figure 5. Chapman's ERM overview

from Garratt (2003), and used in Chapman (2006), is as a corporate governance model with five elements:

(1) corporate governance (board oversight);
(2) internal control (sound system of internal control);
(3) implementation (appointment of external support);
(4) risk management process (incremental phases of a six-stage iterative process); and
(5) sources of risk (internal and external).

2.2.3.4 This model is illustrated in Figure 6.

2.2.3.5 According to Chapman, the core ERM process, as shown in Box 4 in Figure 6, can be more clearly seen in the six-stage iterative process shown in Figure 7.

2.2.3.6 In this framework, each of the six risk management processes has its own inputs, outputs, control and mechanisms (see Figure 8). So, for example, the inputs to 'A3 Risk Assessment' would include all the identified risks, their owners, the processes and the objectives which they affected and some listing criteria. The output might include a view on likelihood, potential impact, consequences, dependencies and correlations. The controls might include third party (independent review), and the mechanism might be some form of thought modelling or simulation.

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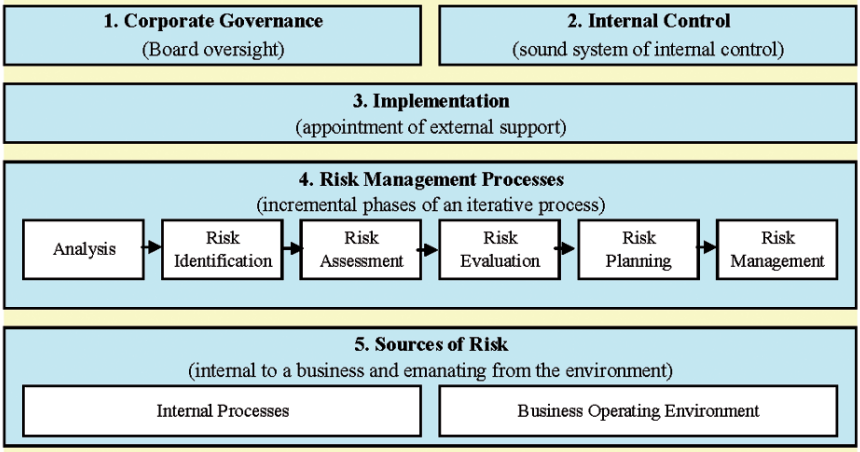

Figure 6. Chapman's ERM framework

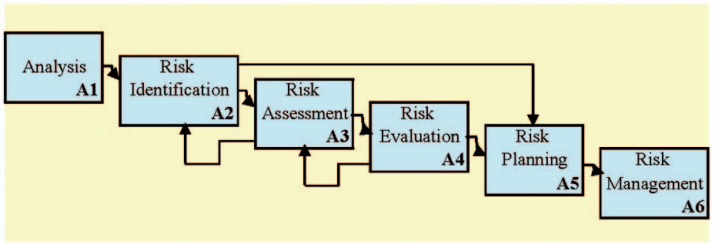

Figure 7. Chapman's core ERM process

2.2.3.7 Risk appetite is defined by Chapman (2006) as:

> "Risk appetite is the degree of risk, on a broad-based level, that a business is willing to accept in pursuit of its objectives. Management considers the business's risk appetite first in evaluating strategic alternatives, then in setting boundaries for downside risk."

2.2.3.8 Chapman categorises micro and macro influences which can be sources of risk/opportunity, and which can shape business performance (i.e. internal and external sources of risk). For these see Figure 9.

2.2.4 *Basel II — The Banking World*

2.2.4.1 Having summarised three texts which together give a good overview of ERM, we next consider how the banks have progressed. In particular, we mention aspects of the Basel banking regulation.

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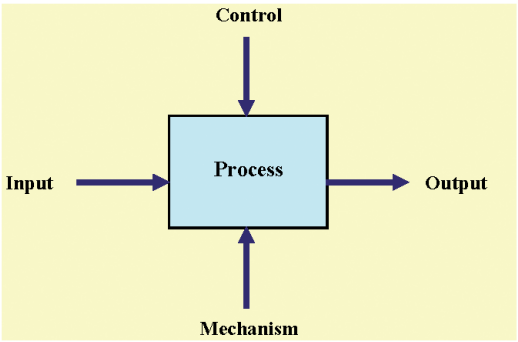

Figure 8. Control cycle of the risk management process

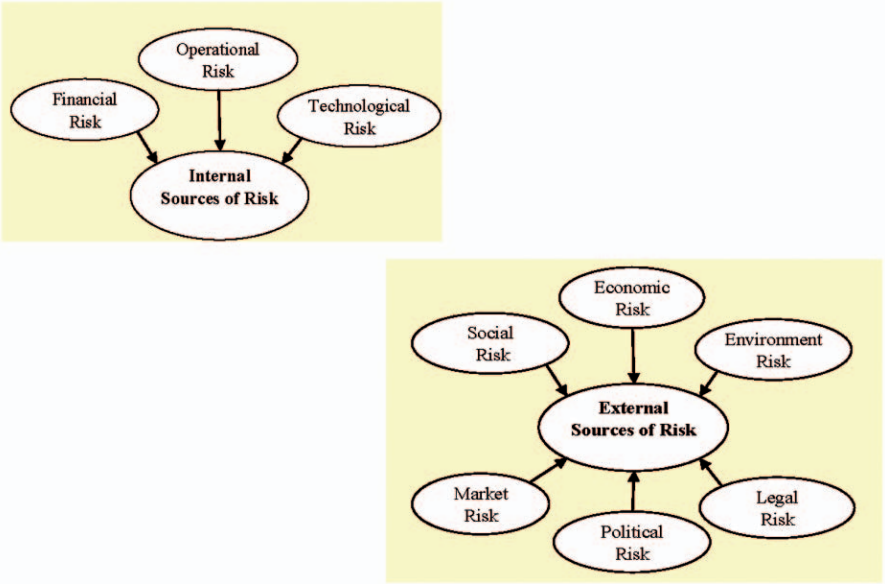

Figure 9. Chapman's macro and micro influences

2.2.4.2 Basel (The Bank of International Settlements) has a well developed risk management framework. Basel II is a revision of the existing framework, which aims to make it more risk sensitive and more representative of modern banks' risk management practices. There are four main components to the new framework:

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(1) It is more sensitive to the risks which firms face: the new framework includes an explicit measure for operational risk; and more risk sensitive risk weightings against credit risk.
(2) It reflects improvements in firms' risk management practices, for example, the internal ratings-based approach (IRB) allows firms to rely, to a certain extent, on their own estimates of credit risk.
(3) It provides incentives for firms to improve their risk management practices, with more risk sensitive risk weights, as firms adopt more sophisticated approaches to risk management.
(4) The new framework aims to leave the overall level of capital held by banks, collectively, broadly unchanged.

2.2.4.3 The new Basel Accord has been implemented in the European Union via the Capital Requirements Directive (CRD). It affects banks and building societies and certain types of investment firms. The new framework consists of three 'pillars'. Pillar 1 of the new standards sets out the minimum capital requirements which firms will be required to meet for credit, market and operational risk. Under Pillar 2, firms and supervisors have to take a view on whether a firm should hold additional capital against risks not covered in Pillar 1, and must take action accordingly. The aim of Pillar 3 is to improve market discipline, by requiring firms to publish certain details of their risks, capital and risk management.

2.2.5 *Pulling the threads together — an optimal approach?*

2.2.5.1 It can be seen from the above that the world of ERM is disparate. The next section of this paper will try to pull some threads together to help practitioners.

2.2.5.2 The subject is still rapidly developing and changing; ERM depends on an organisation's aims and the status of its current framework. The optimal framework will depend on the organisation, its market position, its objectives, its size, its stakeholders, its reputation, its skill and resource base, its current sophistication and its regulatory position.

3. A Best Practice Check List (Maturity Profile) and other Comments for Practitioners

3.1 *Introduction*

3.1.1 The maturity of approach and preparedness for ERM in a general insurance company, or in any enterprise, will evolve over time, as the organisation becomes more familiar with ERM frameworks and more committed to their implementation.

3.1.2 The progression of how ERM is fulfilled in an organisation can be measured on the path to full maturity over time. The optimal position against each dimension will vary from organisation to organisation, and will

depend on many factors, including business strategy and the perceived cost/benefit of adopting a more sophisticated approach.

3.1.3 We set out, in Section 3.2, an ERM maturity matrix, indicating features which, in the current time, might be typical of basic, standard and advanced levels of ERM. This has been prepared to help readers to determine the status of their organisation, and to allow considered thinking of where their optimum position may lie. Following this, we outline some other observations for ERM practitioners, and the link with corporate strategy and strategic planning.

3.2 *ERM Maturity Matrix*

3.2.1 Faced with a choice about what categorisation of headings or framework to use, the authors decided to propose their own, viz:

(1) philosophy to risk and attitudes;
(2) processes;
(3) processes — the risk cycle;
(4) people;
(5) specifics;
(6) planning;
(7) risk management; and
(8) risk modelling.

3.2.2 The underlying indicators have been determined from the sources of reading reviewed, together with the authors' own practical insights. It is understood that they are indicative, and will need continual review and updating as practice develops.

3.2.3 The indicators and relevant key management issues are set out in the form of an ERM maturity matrix, as shown in Tables 1 to 8.

3.2.4 The ERM maturity matrix can help anyone involved in developing the ERM discipline. Typically, the process will be led by a CRO, who will frame the key questions which may need to be asked in order to assess the ERM maturity or preparedness of the organisation. For example, Table 2 (Processes) Section 2.1 (full process mapping and quality management) might require responses to some of the following questions.

3.2.4.1 Which risk processes have been mapped, and how well do we understand the causal links and relationships? How far advanced is our risk mapping and causal modelling capability?

3.2.4.2 Which risk metrics are we using, and what is the rationale for these risk metrics?

3.2.4.3 How well do we understand our physical and virtual value chains, and to what extent have we applied these throughout the organisation?

3.2.4.4 How are our risk management processes aligned with our business mission, our strategic direction, and with our business plans and objectives?

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3.2.4.5 What is the rationale for the assumed linkages between our risk management processes and the group level interactions which we would expect in practice?

3.2.4.6 What are our extreme event management processes, and how are they aligned with business continuity planning procedures?

3.2.4.7 What are the linkages between our corporate governance and our risk control framework, and how are these linkages allowed for in our risk mapping?

3.2.4.8 How are technology plans aligned with our continuous improvement plans and our risk management control cycle?

3.2.4.9 To what extent are our risk management processes independently tested, and are thought to be resilient against unexpected and extreme events?

3.2.4.10 How are our top-down risk maps connected to our bottom-up risk management processes, and to what extent have these connections been independently tested and validated?

3.3 *The ERM Team, and the Focus of the Maturity Matrix*

3.3.1 The structure of the ERM team will have a big impact on the outcome. For example, it is said that one investment bank has dealt with the current credit issues better than others, because its risk management approach used a rotation of people. If staff in an ERM team remain static in their roles, their ideas and attitudes can become fixed, and even blinkered. In this case, the ERM team included bright young people on a rotational basis, leading to a more commercially anchored view on risks. This meant that the risk approach was forward looking and lively.

3.3.2 Good ERM is about ownership: ownership by the board; by the senior management; by risk management experts; by middle management; by everyone in the organisation. A key word is accountability. Are all members of staff truly accountable for risk (and opportunity) management?

3.3.3 In using the maturity matrix, it will be important to consider what is most relevant for a given organisation.

3.4 *The ERM Maturity Profile Matrix*

3.4.1 Table 1 provides a high-level overview of the considerations and the approaches. It can help readers place their organisation's ERM in perspective alongside the more detailed checklists in the tables which follow.

Table 1. Philosophy to risk and attitudes

Basic	Standard	Advanced
1.1 *Philosophy*		
— Un-listening and immature — Not clear — muddled and inconsistent	— Partially developed, but not comprehensive — Strong ideas in some areas, weak or non-existent in others	— Clear, cohesive, holistic, integrated and adult — Comprehensive, yet effective policy statements and procedures — Proportionate (e.g. size, complexity, industry), practical and meaningful — Clarity on performance, measures, expectations, risk adjusted thinking
1.2 *Risk culture*		
— Deny that unexpected things will happen — Closed and inflexible	— Focused on the historical, the tangible — Does consider the known unknowns (Rumsfeld, 2002)	— Expects the unexpected (Taleb, 2007) — Values diversity, eclectic stakeholder views are a positive — Pragmatic and intuitive alongside the analytic
1.3 *Opportunity management*		
— Risk control to minimise downside risk — Awaits reliable market data and intelligence — Follows competitors (who may fail)	— Risk control to minimise downside risk — Acts on market data and intelligence — Generally follows the herd, but prepared to step outside the crowd in some circumstances	— Opportunity management exploits upside risks — 'Blue ocean' strategies to create value innovation — Leadership role to create new market space
1.4 *Attitudes*		
— Does not recognise that the organisation has unique style and values — Sees ERM as an unnecessary cost	— Thinks that every organisation has the same style and values — ERM response related to regulation, real or perceived, in particular rating agency expectations	— Relates organisation style to risk — Integral to governance — ERM business advantage; an offensive weapon; raises certainty and chance of winning

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Table 1. Philosophy to risk and attitudes (continued)

Basic	Standard	Advanced
1.5 *External awareness*		
— Inward looking — borders on the complacent — Highly reactive and not inclined to think ahead in any cohesive manner	— Looks outside, but does not try too hard — Reactive response to external events and their implications	— Hungry to be aware of the outside world — rapid scientific/technological changes affect risk and behaviour, globalisation, consumer demand/awareness, sceptical about institutions — Active event identification (internal/external); seeks meaning and potential opportunities in/from events

Table 2. Processes

Basic	Standard	Advanced
2.1 *Full process mapping and quality management (continuous improvement) — general*		
— Some processes mapped — Limited links between process maps — Generally silo based and limited integrated view — No ongoing updating or metrics — Limited use of modern techniques — Policy framework disjointed, not clearly owned or coherent	— Majority of processes mapped — Some links between process maps — Some key input/throughput/output metrics — Some attempt at coherent policy framework	— All processes mapped and top down view, exists — Links between processes explicit (integrated view) — Policy framework, processes and information flows clear — 6 Sigma used — Causal consequences of failure logged — Full value chain analysis and value drivers understood (McKinsey 7S)

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Table 2. Processes (continued)

Basic	Standard	Advanced
2.2 *Full process mapping and quality management (continuous improvement) — specific/ outsourced*		
— No clear view on key processes — Outsourced processes not fully considered	— Some key processes logged and mapped, often by centralised process team — Outsourced processes considered and key ones mapped	— Strategic processes (e.g. pricing and under-writing; claims and reserving; marketing and sales; cash and investments; service) and support processes (e.g. planning; finance; IT; HR; admin; secretarial) split — Agents (sales), reinsurers, outsourcing and third party management properly considered
2.3 *Full process mapping and quality management (continuous improvement) — technology and future plans*		
— Process development not prioritised — Technology out of date and not aligned (probable legacy systems) — Dealt with at operational rather than at strategic level	— Some attempt to prioritise process development in line with strategic plan — Technology properly considered, but not fully updated/aligned — Mixed views on what capabilities really count	— Clear process development plans — Technology fully aligned to processes, and future developments allowed for — Clear link capability development to strategic plan (e.g. unique selling points (USP) and how to compete)
2.4 *Impact of processes, including that of their failure*		
— Some financial aspects of processes logged — Consequences of failure not fully documented — No explicit understanding of controls — Unexpected events occur regularly (say 1x per week) — No pre-planned responses	— Financial and customer impact of most processes logged — Links between related processes (e.g. claims) in place — Many key performance indicators (KPIs) for some processes measured regularly	— All financial and customer process consequences logged — Causal consequences of one failure understood in group level model — Full assessment of gross/net and controls understood — Risk-based internal audit plan and CRSAs in place — Surprises very rare — pre-identified range of responses clearly set out — Corporate governance system integral part of process view

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Table 2. Processes (continued)

Basic	Standard	Advanced
2.5 *Extreme event management (business continuity planning)*		
— Exists, but not integrated into way business run — Not tested and not regularly updated	— Adequately documented — Independently tested once every two years — Piecemeal testing/walk throughs — Unexpected crises might push adequacy	— Well planned and documented — Independently tested; resilient — Regular walk throughs and lights out testing — Capable of handling unexpected crises
2.6 *Understanding of (group strategic and operational) objectives*		
— Some strategic and operational objectives logged as part of planning process — Some aspects of risk to achieving objectives in place — Basic HML for probability/impact of failure logged	— Most aspects of plans translated into clear objectives — Risks to achieving objectives articulated occasionally — Some quantification of impact in terms of probability and severity	— Strategic and operational goals have well documented objectives — Risks in achieving objectives logged in planning process and regularly updated — Clearly quantified impacts at considerable granularity
2.7 *Control framework*		
— Basic controls exist — Some documented, but generally *ad hoc* — Concerns at regulatory visits — will they be satisfied? — Effort behind controls not proportional to risks (may well increase as profit and loss (P & L) results decline — panic reaction) — Strategic and big management decisions outside framework	— Key controls documented — Some controls not automated, relying on manual work and knowledge of individuals	— Coherent framework — well documented policies — Coherent; inbuilt resilience — Internalised across organisation — Effective regulatory/compliance reporting — Proportionate effort; with clear rationale — Applies to strategic decisions — Clear links to governance, risk management, assurance, (audit)

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Table 2. Processes (continued)

Basic	Standard	Advanced
2.8 *Impact of assumptions failing, and other barriers to achievement*		
— Some key assumptions behind objectives logged — Risk maps consider barriers, but not holistically — Some senior management discussion — Risk management committee	— Most key assumptions logged — Bottom up and top down risk maps exist — Regular senior management and board discussion — Active and well managed risk committee exists	— Rigorous log of all key assumptions — Full risk mapping — Regular senior management/board discussion; external challenge — Risk management committee active and full links audit
2.9 *Risk assessment from processes and objectives*		
— Group level risk assessment from aspects of above — Some top-down risk discussion — Limited challenge and low embeddedness	— Risk assessment derived from process and objectives consideration — Full risk ownership and management protocols — Bottom-up/top-down system — Regular challenge; on-going update — Feedback loop from internal and external audit, and incident reporting	— Risk assessment derived from full process and objectives consideration — Full risk ownership and management protocols vs. clear risk appetite — Regular and active management and board review — Full feedback loops — Systematic, categorised data capture of failures and near misses (operational risk) — Appropriate use of experts/expert groups

3.4.2 *Processes — commentary*

A fundamental requirement is for an alignment between a firm's strategic objectives and the processes forming its physical value chain. A firm must be able to build an information underlay which enables the firm to visualise its value chain from end to end; identifying key processes and critical linkages. ERM provides firms with an opportunity for self-conscious and self-critical scrutiny of their own degree of clarity, concerning strategic objectives and the expression of those objectives in the physical value chain. The practical expression of ERM governing processes flows from this fundamental alignment and understanding.

3.4.3 At a practical, implementation level, this alignment needs to result in a system where there is full executive sponsorship of all ERM processes. The board and the senior management need to be fully involved. All of the firm's key decisions and main processes should be risk assessed. ERM must be embedded in organisation behaviour.

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3.4.4 The risk cycle is, itself, a process with its own inputs, actions/mechanisms, controls and outputs. It is dealt with more fully under a separate table, but key elements are given in Table 3, for completeness. The elements of the cycle are described in many different ways by different sources. The elements given here relate to those suggested by COSO (2004) and Chapman (2006).

Table 3. Processes — risk cycle

Basic	Standard	Advanced
3.1 *Overview*		
— Exists, with non-complete implementation — Risk manager in place, but low level view	— Fully implemented cycle — CRO (risk director) in place, with individual capital assessment (ICA) links explicit	— Well detailed and fully implemented risk cycle in place — Active and respected CRO influencing business, links ICA and control environment — Appropriate feedback loops, to help learning, take balanced view and ensure calibrated responses
3.2 *Identification*		
— Identification annually — Limited challenge — Limited and controlled access (e.g. only by risk manager)	— Identification fully reviewed annually, with regular updates — External challenge on annual basis	— Continuous identification process (real time) — On going external challenge — Fully accessible
3.3 *Understanding (assessing and evaluating)*		
— Some attempt to quantify — Implicit acknowledgement of controls	— Understanding of risks takes place, and quantification after — Control environment clearly understood	— Clear insight and discussion about consequences of risks documented — Quantification of gross and net takes place once understanding agreed

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Table 3. Processes — risk cycle (continued)

Basic	Standard	Advanced
3.4 *Response planning and managing*		
— Most risks in risk register have owner allocated — Owner sets out bottom up approach to mitigation — No clear executive ownership for ERM	— All risks have clear owners allocated — Owner proposed approach in light of risk appetite (not always mitigation) — Management challenged and agreed by risk committee	— All risks have owners allocated — Full assessment of approach to risk given appetite — Full executive sponsorship for ERM processes — Clear view of control environment and assurance policy
3.5 *Reporting*		
— Annual reporting of full picture (risk register) — Mainly paper based — not open to all	— Exists on regular basis, with non-complete implementation — Risk manager in place, but low level view	— Agreed annual calendar involving right people/ bodies at right time — Lead by highly regarded CRO — Proportionate reporting — coherent information at right level
3.6 *Review of approach*		
— Only occasional review of process — No clear view on what best practice is	— Annual review of process effectiveness — Occasional use of external resource to benchmark	— Fully bench-marked annual review of process — Full participation on risk forum to ensure best practice
3.7 *General approach to risk management*		
— Delegated to risk manager — Some senior management participation in aspects — Risk management committee focus on low level details	— Active involvement of senior management — Risk management committee take overview — Risk management goals in individual's objectives, but not fully embedded	— Board and senior management fully involved — All (key) decisions and main activities risk assessed — Embedded in organisation behaviour
3.8 *Regular reviews*		
— Irregular and partial reviews of policies, strategy, operations and governance, with little board involvement	— Irregular reviews of policies, strategy, operations and governance — with some board involvement	— Regular and thorough reviews of policies, strategy, operations and governance — with full board involvement

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3.4.5 *Risk cycle — commentary*

The inputs, actions/mechanisms, controls and outputs within the risk cycle require a transparent, fully accountable ERM framework. Those firms at the basic level of ERM philosophy and implementation may need to create more open access to information and formal/informal forums to enable debate and challenges. Organisations also need to recognise and to encourage external challenge to inject new ideas, perspectives and, most importantly, debate into the system. The advanced practitioners combine strong executive ERM leadership, clear understanding of objectives embedded in organisational behaviour, specific accountabilities, open and transparent information flows and facilitation for debate and external/internal challenges.

Table 4. People

Basic	Standard	Advanced
4.1 *Overview — general*		
— Risk management seen as frustrating constraint — Risk management, if it exists, 'home-grown'	— Some, limited recognition that people and culture are key elements of risk — Risk management one of a number of supporting management accountabilities — Risk management may include external skills bought in	— Recognition that people and culture are key elements of risk — Risk management is a key part of management — Fully trained and professional risk management resource
4.2 *Overview — wider stakeholder perspective*		
— One group of stakeholders exerts wrong or unbalanced pressure — Limited or no reference to several groups of stakeholders	— Recognition that different stakeholders have different requirements — Some attempt to consider, but differences not reconciled — One or two important stakeholders not fully considered	— Considers view of all stakeholders (regulators, credit rating agents, reinsurers, agents, staff, customers, suppliers, others) — well articulated and balanced response

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Table 4. People (continued)

Basic	Standard	Advanced
4.3 *Roles and responsibilities*		
— Organisation roles/responsibilities not clear or fully articulated — Risk ownership unclear — role of central team, if it exists vs. whole organisation unclear — Responsibility for continual maintenance of risk maps not agreed — Access to risk information severely limited	— Organisation has clarified roles/responsibilities — but not checked if coherent and integrity with strategy — Risk ownership clear — role of central team emerging, but may still be too junior/not respected — Responsibility for continual maintenance of risk maps clear, but piecemeal — Access to risk information open as required to selected few	— Organisation has clear roles/responsibilities — coherent and integrity with strategy — Risk ownership clear — role of central team and management versus whole organisation clear — Responsibility for continual maintenance of risk maps clear — Access to risk information open as required
4.4 *Training and awareness*		
— Risk mentioned occasionally — Risk management team learning on the job — Risk measures limited to specialists — More generally training plans *ad hoc*, and vary by department — No use of intranet or surveys or feedback — Limited understanding of competence or skill requirements for strategy — No access to specialist training	— Risk referred to in general terms in training — Some/*ad hoc* use of web/intranet/one-to-one surveys and feedback — Risk measures being introduced, but not yet widely accepted or understood — Overall training plans (staff and management) reviewed for top-down sense versus strategy, but limited response as consequence — Competence-based training, but not fully directed — Specialist risk training for those who need it	— Risk management fully embedded in all training — Regular use of web/intranet/one-to-one surveys and feedback — Widespread understanding of risk measures — Overall training plans (staff and management) fed from considered capability requirement/current organisational competence analysis — Acknowledge areas of relative competence/incompetence (or expertise) — ensure direction has integrity with the same — not in conflict — Specialist risk training for those who need it

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Table 4. People (continued)

Basic	Standard	Advanced
4.5 *Knowledge sharing*		
— No knowledge sharing — No understanding of required capabilities to compete — Centres of excellence may exist, but to control, not to share	— Knowledge sharing acknowledged as important, but limited action — Capabilities to compete discussed; limited to external benchmarks; not fully acted upon — Centres of excellence may exist and plans in place to develop further; *modus operandi* still under discussion	— Well designed knowledge capture and sharing system — Clearly linked to capability and expertise development programme — Centres of excellence capture and share best practice
4.6 *Performance objectives, assessment and reward*		
— Incentive plan conflicts with risk management goals — Risk objectives not set, or independent of business-line goals — Assessment not independent — biased — Measures make no allowance for risk — No widespread feedback or monitoring of impact of risk management	— Incentive plan generally aligned or mentions risk management goals — Risk objectives set, but not fully integrated with business-line goals — Assessment includes elements of independence — tries to be unbiased and may use 360° assessments — Measures acknowledge need to be adjusted for risk, but not embedded in appraisal system — Some feedback or monitoring of impact of risk management, but *ad hoc*	— Risk an integral part of objectives and objective setting (risk consciousness of people) — Performance assessment (risk and full job) subject to independent feedback — Set and assessed across all key dimensions — Objectives highly co-coordinated with business line objectives — Performance measures — in risk adjusted terms — Reward system reinforces ERM values — Performance feedback (including 360° assessments) includes reference to risk — Better quality of decisions given ERM monitored

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Table 4. People (continued)

Basic	Standard	Advanced
4.7 *Resource planning*		
— No man-power planning — Skills shortages occur as training lead-times not allowed for — Limited use of specialist groups or 'hit-teams'	— Man-power planning considered alongside strategic plans, but only at very high level — Skills planning and training lead-times allowed for in some more forward looking areas of the business — Use of specialist groups (e.g. investment, underwriting, capital management) when major issue needs resolving	— Full man-power planning — Skills planning and training lead times allowed for — Widespread use of specialist groups (e.g. investment, underwriting, capital management)
4.8 *Resource planning — risk management context*		
— Limited specialist resource — Tendency to be hidden and bottom-up — maybe linked with compliance — Use of external resources only in extreme circumstances — Tendency to be home-grown skills lacking true external input	— Acknowledge need for specialists alongside those able to take the overview — *Ad hoc* use of specialist teams and mixed skill teams to resolve risk management issues — *Ad hoc*, but not infrequent use of external resources — Starting to recruit properly trained, experienced risk professionals	— Balance use of specialists with those able to take the overview — Use specialist teams and mixed to resolve risk management issues — Well planned use of external resources — Employ properly trained, experienced risk professionals

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Table 4. People (continued)

Basic	Standard	Advanced
4.9 *CRO and actuary*		
— CRO role may not exist and limited risk policies — Actuary/modeller has ICA in place, but limited if any connection to risk framework — Role of actuary may be narrow and probably seen as black box	— CRO recently appointed with right skills, developing credibility and is starting to be point of co-ordination (not of control) — CRO has initiated draft risk policies — CRO may not yet understand all areas of the business, but generally communicates well — Starting to develop relationship with ERM actuary/modeller — probably not yet in same team — Role of actuary currently narrow modelling one, generally improving communication skills, but still seen as black box; thought leadership an aspiration	— CRO has right skills/credibility and is point of co-ordination (not of control) — CRO sets policy — Understands all areas of the business and communicates well — Needs clear working relationship with ERM actuary/modeller — ideally in same team — Role of ERM actuary may be narrow or wide; exhibits first rate communication skills; not black box; thought leadership
4.10 *Authority levels and discipline*		
— Authority levels, roles and responsibilities not fully established — Appropriate standards of behaviour not the norm — Limited or zero sanction for non-adherence	— Authority levels, roles and responsibilities set out for many parts of organisation, but not coherent with each other or risk appetite and policy — Appropriate standards of behaviour generally endorsed — Suitable sanction for non-adherence generally adopted	— Authority levels, roles and responsibilities clearly set out and coherent with risk appetite and policy — Appropriate standards of behaviour valued and positively rewarded — Suitable sanction for non-adherence

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Table 4. People (continued)

Basic	Standard	Advanced
4.11 *Structures and reporting lines (including checks and balances)*		
— Risk managers low or middle level — Dispersed and incoherent responsibilities — Same people prepare risk monitoring reports as approve/execute risk taking and management — Concept of ERM not discussed — Organisational model not properly thought through — Concept of separate assurance from risk management not understood	— *Ad hoc* checks and balances (probably excluding big/strategic decisions, which may be subject to one-off board decision) — CRO in place; starting to build ERM structure/team with right skills; right size for organisation — Risk management and (internal) audit separate lines — Understood that measures and monitoring should be independent from risk taking and measurement — Organisational model reasonably clear, but not widely articulated or understood — Core risk management team still lacks proper terms of reference and skills; balance practical and theoretical — Use of specialist teams *ad hoc*, but with right mix of skills and behavioural styles	— Appropriate checks and balances (including to big/strategic decisions) — ERM team, under CRO, in place; right skills; right size for organisation — Risk management and (internal) audit separate lines — High level risk manager — Measures and monitoring independent from risk taking and measurement — Organisational model clear, well articulated and widely understood/accepted — Core risk management team — proper terms of reference and skills; balance practical and theoretical — Use of specialist teams, but with right mix of skills and behavioural styles

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Table 4. People (continued)

Basic	Standard	Advanced
4.12 *Leadership style*		
— No clear articulation of style — Varying styles — Blame culture — dominant senior executive — Inflexible and intolerant — Shareholders driving unhelpful/incorrect/inconsistent behaviours	— Leadership in part articulated; linked to organisational values — Consequences of agreed style not discussed widely — Learning and improvement desired key elements of style, but not yet embedded — Executive leadership for ERM initiated — Open/independent assessment of management behaviour *ad hoc*; not 100% welcomed — Decision making generally shared and accepted; can be inconsistent with strategic goals	— Leadership style clearly articulated (e.g. command and control, decentralised, empowered) — Consequences of agreed style fully considered — Learning and improvement key elements of style — Executive leadership for ERM respected — Open/independent assessments of management behaviour regularly undertaken and welcomed — Consistent/transparent decision making
4.13 *The way in which things are done*		
— Risk management purely advisory role — Solely responding to regulatory requirements — Patchy or non-existent — *Ad hoc* board/management access — Delegation of key risk management issues — No clear senior management responsibility	— Values include clear reference to risk management/ERM — Projects/plans and processes normally have some aspect of risk mentioned — Board discuss risk, and, while access clear, not yet regular — Management team understand importance of risk management, but may not 100% agree — Senior management some responsibility for management of key risks — CEO and senior team starting to set the tone — Limited awareness of corporate risk management systems	— Values include clear reference to risk management/ERM — Projects/plans and processes all have ERM mentioned — Risk management has appropriate authority — Board access clear and regular — Management team has clear respect for risk management — Senior management has clear responsibility for management of key risks — CEO and senior team set the tone — High/widespread awareness of corporate risk management systems

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Table 4. People (continued)

Basic	Standard	Advanced
4.14 *Culture and behaviours*		
— Lack integrity — Limited or zero MI framework to track/manage risk — Limited ability to stand up for beliefs in face of strong/demanding management and objectives, but whistle-blowing policy in place — Muddled vision, beliefs and values — no feedback — *Ad hoc* communication — more propaganda, limited mention of risk issues and risk awareness — Relatively unmotivated staff and management	— Terminology still varies across the organisation as silos diminish — Elements of MI framework in support and to track/manage starting to be developed — Intent is for integrity, but not always in practice — In main ability to stand up for beliefs in face of strong/demanding management and objectives — Vision, beliefs and values generally widely articulated — with feedback, but inconsistent application — Regular communication on all matters, including risk issues and risk awareness, but not always as open as ideal — Generally well motivated staff and management	— Common terminology across the organisation — Right MI framework in support and to track/manage — Exhibits full integrity — Ability to stand up for beliefs in face of strong/demanding management and objectives — Shared vision, beliefs and values — with feedback — Clear, regular, open and honest communication on all matters, including risk issues and risk awareness — Well motivated staff and management

3.4.6 *People — commentary*

People and culture will determine a firm's ability to implement meaningful and effective ERM. These two elements shape the probability and impact of risk and the organisation's own ability to manage risk. Basic level ERM practitioners may have evolved a leadership style which is not conducive to embedding ERM in organisational behaviour. This affects the CRO, who needs to be credible, empowered to act as a point of coordination rather than to control. The CRO may be an actuary, but will need to draw on an actuarial function which is not a 'black box', but an integrated, well-connected team of specialists with strong communication skills.

3.4.7 Firms may also need to build a framework to enable constructive dialogue with all stakeholders (external/internal), with the objective of taking a more considered, balanced view across different stakeholder groups, to avoid specific groups exerting wrong or unbalanced pressure. Strategic

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human resource management (SHRM) determines performance objectives, assessment and reward, which need to be aligned with the ERM strategy, e.g. personal objectives aligned with business line objectives, risk-adjusted performance measures, creation of high-performance, multi-disciplinary teams to inform ERM. Ultimately, SHRM has the critical task of promoting risk consciousness across the firm.

Table 5. Specifics

Advanced
The considerations in this section relate to how each of the specific risks is handled in the reader's organisation; while they may imply how to approach aspects of quantification and modelling, they are not intended as detailed descriptions of best practice actuarial techniques. Rather, they are intended to assist the review of the practical identification of each risk, to monitor how it changes, and to provide a view on how to better manage it.
5.1 *Insurance exposure* — Have right degree of granularity (e.g. by business unit, risk type, channel) — Evaluate and monitor risk exposure (including definition, wording, authorities for flexible treatment of rules), reserve/price levels and explore to ultimate — Monitor and test underwriting authorities — both internal and delegated — Regularly report on pricing, claims and exposure movements — independent and disciplined — Be particularly mindful of complex exposures/programmes, reinsurance structures/treaties and blocks/pools — Be mindful of profit commission/share, contingent commission issues and other mechanisms for allocating financials between parties — Explicitly model risks arising from new products, channels, sales and marketing initiatives — Ensure control framework appropriate, including separation of activities (e.g. reserving and underwriting) — Use embedded risk adjusted tools, e.g. economic capital allocation — Have flagging system for risks which are away from core expertise
5.2 *Insurance outcome* — Explicitly recognise market pricing dynamics — Develop pre-planned strategic responses to different competitor actions — Honestly test application of agreed responses at coal face (e.g. underwriting audits) — Have right degree of granularity; e.g. by business line/unit; splitting out pricing, underwriting, claims (working, large and catastrophe), reserving, aggregation and accumulation risks — Incorporate reinsurance with risk of failure consistent with credit risk thinking — Evaluate risk exposure (including definition, wording, authorities for flexible treatment of rules), reserve/price levels and explore to ultimate — Monitor and test underwriting authorities
5.3 *Market risk* — Allow appropriately for economic factors affecting interest rates, profit/dividend levels, market pricing, exchange rate movements, property/real estate and various hedging/derivatives — Monitor cash flows, trades, stock and category allocations — Regularly monitor and actively consider economic, political and other global influences on market — Monitor and consider consequences of competitor investment policies

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Table 5. Specifics (continued)

Advanced
5.4 *Credit risk* — Allow appropriately for bond/loan, reinsurance, agents/broker and other credit risks — Test the unexpected, e.g. reinsurance dispute or breakdown in relationship — Ensure assumptions consistent with those being made for other risk categories
5.5 *Liquidity/asset and liability management (ALM)* — Allow for matching/non-matching risk/reward
5.6 *Operational risk* — Demonstrate explicit knowledge and expertise in this risk; avoid across the board add-ons — Use ORIC/Basel II event type headings with explicit data points — Demonstrate active consideration of the operational risk implicitly contained in other risk categories, and have active plan to improve explicit insight (e.g. better understanding of controls and effect of behaviours)
5.7 *Strategic risk* — Ensure strategic risk externally assessed on regular basis — Demonstrate explicit approach to strategy and risk management — Test and retest intelligence sources, market awareness and management attitude/stretch — Ensure controls around big decisions, new departures, non-organic activity, stand up to scrutiny
5.8 *Group risk* — Demonstrate holistic view to group and intuitively correct overview — Consider and allow for different geographic, regulatory and other cross group pressures
5.9 *Reputation and other* — Carefully define and ensure no gaps when considered with other risk headings — Develop planned responses to issues (e.g. competitor activity affecting own reputation) and ensure well thought through/tested — Allow for legal risk through consultation with counsels
5.10 *Linkages, correlations and combinations* — Explicit recognition that different markets may be linked either causally or in a correlated sense (e.g. credit/interest/insurance price/insurance claims) — Ensure that external risk drivers thought through and implications fully considered
5.11 *General* — Review and ensure methodologies, tools and techniques best practice — Ensure excellence in core specific risk capabilities (e.g. technical pricing, claims handling, investment management) — Maintain suitable data to support risk cycle management and modelling on all specifics — Refresh, external challenge and test to extinction — keep alive and aware of the unexpected

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3.4.8 *Specifics — commentary*

Firms at all stages of development need to adopt and to strive for a dynamic approach, which incorporates regular review and challenges, to ensure that the methodologies, tools and techniques which they utilise remain best practice. Centres of excellence should focus on core specific risk capabilities (e.g. technical pricing, claims handling and investment management), and should ensure that data are identified, harvested, managed and exploited. However, there is no equilibrium, and firms need to review, refresh and seek challenges. Seeking challenges involves external participants and the need to develop meaningful internal structures/openings for challenge and exploration to the ultimate, in order to remain alive, alert and aware of the unexpected. ERM practitioners must understand that they will continually need to develop, test, implement, evolve/discard and replace models in order to maintain and improve their game.

Table 6. Planning

Basic	Standard	Advanced
6.1 *Planning cycle and components*		
— Blurred definition of planning process — No regular updates or review — No flexibility — goals have to be met without exception — Blame culture — no excuses — Back office activity — limited business meaning	— Senior management take responsibility — Strategic/business planning, budgeting and forecasting separate — Time horizons set without practical business insight — Annual review and comparison to ICA/corporate model — Limited realistic discussion of issues — tend to be dealt with by planning department — Some use of techniques such as SWOT, PESTLE and Porter's 5 Forces — Limited consideration of technology/innovation	— Right people and senior management take responsibility — Well defined strategic/business planning, budgeting, forecasting — Time horizons meaningful to business; practical — Regular review and link to ICA/corporate model — Updating of expectations open and honest; generally limited changes based on outward looking assessments — Good use of techniques such as SWOT, PESTLE and Porter's 5 Forces — Forward looking awareness, e.g. new uses of technology/innovation — clear view on leading edge/close follower — trialling ideas in a deliberate manner

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Table 6. Planning (continued)

Basic	Standard	Advanced
6.2 *Objective setting*		
— *Ad hoc*, not cohesive — Mixture top-down, bottom-up — Not clearly set out — No links to performance system — No reference to risk as part of objective set	— Generally cohesive — Main reference to shareholder requirements — Consideration of market share (growth)/profit — Clearly set out, reasonably widely shared — Indirect/emerging links to team and individual performance goals — Acknowledges issues arising from risk appetite and risk tolerance	— Well considered and cohesive — With clear reference to shareholder requirements, competition, external changes, vision, mission and values — Balance market share (growth)/profit struck — Clearly set out, widely shared and understood — Direct links to team and individual performance goals — Includes considered reference to risk appetite and risk tolerance
6.3 *Incorporation of risk issues into planning process*		
— No mention of risk issues — Assumptions not stated — often only implicit — Risk management seen mainly as barrier to getting things done	— Risk referred to in planning process — Occasional links to risk register — Recognition that risk appetite and strategy need to be linked — Risk management generally seen as avoidance of threats — Clear assumptions and risks to these assumptions broadly stated — No real link to business continuity planning (BCP)	— Risk (ERM) an integral part of planning process — Direct links to risk register and sources of risk fully considered — Clear alignment between risk appetite and strategy — well executed prioritisation process — ERM seen as identification of opportunity as well as avoidance of threats — Clear assumptions and risks to these assumptions clearly stated — Consideration of new/emerging risks and links to BCP clear

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Table 6. Planning (continued)

Basic	Standard	Advanced
6.4 *Resource and capital deployment*		
— Economic capital not widely understood nor used — No clear prioritisation process — bottom-up, and he who shouts loudest wins — No recognition of operational risk issues	— Economic capital referred to, but not regularly used — Used in prioritisation and decision taking when remembered — Operational risk and implementation risk considered — Scare resource deployment discussed and done in *ad hoc* fashion	— Clear use of the concept of economic capital — Optimised deployment given objectives and risk insights — use of efficient frontier techniques — Used in prioritisation and decision taking — Allocated to operations/processes as well as projects (help to inform op risk) — Active/dynamic resource deployment (e.g. human resources (HR)/mgt stretch/econ cap/technology)
6.5 *Definition of programmes, projects and change*		
— No clear policy or procedures — Changes *ad hoc* and unplanned	— Programmes, projects and change initiatives articulated, but *ad hoc* — Project management roles generally identified; linkages and dependencies articulated — Risk input for larger projects — Normal to use agreed management disciplines (e.g. Prince 2); may not always be proportionate	— Clear understanding/definition of programmes, projects and change initiatives — Procedures and policy well articulated — Roles identified; linkages and interrelationships clearly set out — Professional (and independent) risk input: de-optimistic — Clear scope definition; agreed management disciplines (e.g. Prince 2); proportionate

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Table 6. Planning (continued)

Basic	Standard	Advanced
6.6 *Treatment of risk*		
— No reference to risk profile — Not updated — only *ad hoc* — Differing decision processes	— Risk profiles and issues reviewed, but not always regularly — Actions generally agreed, but not always completed — Programmes not always distinguished from projects — Risk assessments as part of project by project team	— Regularly reviewed — Action agreed: clear responsibilities and dates — Clear decision processes — Programmes managed systematically with full risk logs — Risk assessments independently tested
6.7 *Monitoring and MIS*		
— Information flows for KPIs (backward looking key performance indicators)) reasonable, but not always reliable — No use of forward looking (lead) indicators and early warnings — KRIs (key risk indicators) not used — Indicators benchmarked occasionally — Monitor actual vs expected deviations	— Information flows generally robust, coherent and timely, but not always complete — Some use of forward looking (lead) indicators and early warnings — KPIs and KRIs — Main indicators benchmarked where possible — Limited use of external indicators used, e.g. reputation feedback, PR summaries — Monitor actual vs. expected deviations and learn lessons	— Information flows robust, coherent and timely — Right information at right time to right decision makers — Good realistic use of forward looking (lead) indicators and early warnings — KPIs, KRIs and KCIs (key control indicators) — Indicators benchmarked where possible — External indicators used, e.g. detailed reputation indices, PR metrics and contact summaries — Monitor actual vs. expected deviations and learn lessons — As far as possible design feeds in automated way, including cleansing, and ensure integrity across many varying feed systems

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3.4.9 *Planning — commentary*

Advanced ERM practitioners demonstrate a well defined strategic/business planning, budgeting and forecasting process. Risk issues are incorporated into the planning process. Such firms perceive ERM as the identification of opportunity as well as the avoidance of threats. These firms are also often characterised by a forward looking awareness, e.g. new uses of technology/innovation, and develop a clear view as a leading edge/close follower in their market which trials ideas in a deliberate manner.

3.4.10 Firms with less mature approaches to ERM may need to address strategic/business planning and associated processes. They may also need to consider whether and how they incorporate risk issues into the planning process. It is also important to consider that objectives are then set with clear reference to shareholder requirements, competition, external changes, vision, mission and values, and also where, in the process of objective setting, careful and considered reference is made to risk appetite and to risk tolerance. Firms at basic and standard levels of development may also not fully understand nor utilise concepts of economic capital, which may lead to sub-optimal deployment of resources and capital and the inability to flex resources and capital to meet other eventualities.

Table 7. Risk management

Basic	Standard	Advanced
7.1 *Roles*		
— Board involved in risk management; possibly fairly passive sign-off — Board has terms of reference, but role not discussed often and different views around table — CEO and executive management take passive view of ERM — ERM leader (CRO) may be fairly junior role, e.g. in finance — Resource allocated directly and indirectly to ERM not clearly agreed — May have large outsourced/ consultancy-based elements	— Board actively involved in risk management, but not driving it — Board recognises role includes policy sign-off; strategy review; Supervisory/regulatory oversight; accountability to stakeholders, but tends to act in response to executive rather than leading — CEO and executive management supportive of risk management processes; still not fully impactful — Risk (may not be defined as ERM) leader (CRO) in place, but may not be on executive, right skills and able to take long-term view — Resource allocated directly and indirectly to ERM still being discussed, and no clear view about right level — An owned/in-house activity	— Board own risk management and set right tone — Board recognises that role includes policy formulation and review; strategy formulation and review; supervisory and operational management oversight; accountability to stakeholders, including reporting and regulatory compliance — Clear lead given by CEO and executive management so that ERM process active and impactful — ERM leader (CRO) in place, executive level, with clear role, right skills and long-term view — Appropriate/ proportionate, known and agreed resource allocated directly and indirectly to ERM — An owned/in-house activity

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.2 *COSO (internal environment) — points not covered fully elsewhere*		
— Risk management philosophy not clearly set out in agreed form — Organisation has generally ethical value set — Organisation says that it is committed to high standards and competence — Reasonably professional human resources (HR) policies and standards, but not best practice — Generally roles/ responsibilities and authority levels clearly set out	— Well articulated risk management philosophy, but not 100% buy-in — Organisation has integrity and ethical value set — Organisation is committed to high standards and competence, but may not have bench-marked what this means — Professional HR policies and standards, but may not be fully agreed by all senior management — Role definitions with accountabilities, responsibilities and authorities set out but not shared across executive team	— Clear and well articulated risk management philosophy — Organisation has integrity and ethical value set — Organisation is committed to high standards and competence — Professional and accepted HR policies and standards — Clear role definitions with accountabilities, responsibilities and authorities fully set out

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.3 *Approach, policy and procedures*		
— Risk management policies and procedures not fully documented — Separate activity; siloed organisation — Objectives not regularly achieved — Strategy a separate or indirectly linked activity — Generally complies with any regulatory requirements — Seen as an expense; not adding value — Risk management policies and procedures established, but not widely known — Mixture of qualitative and quantitative — Ambiguity ignored and outputs therefore muddled — Updated annually — Not fully integrated with the way the organisation functions — Parts of organisation not fully covered	— Important aspect of management meaningful — not just tick-box — Risk management policies and procedures nearing full documentation — Mixture of top-down and bottom-up; but not fully integrated with way organisation works — Starting to give assurance that objectives will be achieved, or indications of higher risk — Is affected by strategy, but not yet influencing it — Fully complies with any regulatory requirements — Some see it as an offensive tool, but not yet used actively to exploit opportunities — Risk management policies and procedures clearly stated, but not yet widely known — Mixture of qualitative and quantitative — Executive understand professional ERM to be important — Able to handle ambiguity, but not explicit — Updated regularly (e.g. four times p.a.) — Not yet fully integrated across whole organisation — Some aspects integrated with the way the organisation functions (but still partly in silos) — Intent is to cover the whole organisation	— Key aspect of management — living and meaningful, not just tick-box — Holistic; top-down; integrated — Gives agreed (reasonable) assurance that objectives will be achieved — Directly affects and is affected by strategy — Fully complies with any regulatory requirements — Adds value: offensive tool: helps identify and exploit opportunities — Risk management policies and procedures clearly stated and widely known — Explicit mixture of qualitative and quantitative — Executive understand professional ERM to be a lead indicator of success — Able to handle ambiguity — Dynamic — updated in real time (not just four times p.a.) — Takes an integrated approach (including responses) across the whole organisation — Is integrated with the way the organisation functions (not siloed) — Covers the whole organisation including e.g. knowledge management, compliance

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.4 *Risk cycle key elements — identification*		
— *Ad hoc* — No ownership — Limited external challenge — Annual exercise with piecemeal categorisation — Interdependencies not logged — Generally bottom-up and focused on down-side events — Risk incidents logged, but not consistent or right level — Risk register exists, but not complete and with limited access	— Combination of board, senior management and bottom-up — Systematic, but not always comprehensive — Generally not externally challenged — Updated, say, four times p.a., but not to reflect incidents as they occur — Risk incidents logged — Categorisation system still being refined — Recognises interdependencies — Includes occasional opportunity identification — Risk register (e.g. event description, likelihood/impact, what aspect of organisation impacted, controls/approach, dependencies, ownership, review)	— Combination of board, senior management and bottom-up — Systematic and comprehensive — Independently challenged — Regularly refreshed and able to reflect incidents as they occur — Risk incidents logged and lessons learned — Suitable categorisation system — Able to stand back and reflect on underlying influencing factors — Recognises interdependencies — Includes opportunity identification — Risk register (e.g. event description, likelihood/impact, what aspect of organisation impacted, controls/approach, dependencies, ownership, review)
7.5 *Risk cycle key elements — understanding (assessment, analysis and evaluation)*		
— Tends to focus on quantification, e.g. assesses likelihood and impact (severity) — Recognises need to consider inherent, control reliability and residual, but tends to focus on residual — Recognises need to allow for event interdependencies and relationships, but may not capture systematically — May well be gaps in thinking	— Understands need to assess real impact of risk as well as quantification — Considers inherent and residual levels of risk, but may not be clear on implied control assessment — Assesses likelihood and impact (severity) — Starting to allow for event interdependencies and relationships — Considers event sources/data — but gaps still exist	— Stands back and understands real impact of risk — Considers inherent and residual levels of risk — Assesses likelihood and impact (severity) — Allows for event interdependencies and relationships — Considers event sources/data — and considers how complete/gaps

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.6 *Risk cycle key elements — response planning*		
— Strategy towards risk only high level, and thus responses established in *ad hoc* manner — Focus tends to be on mitigation — Generally individually compiled responses, without taking holistic view or considering optimal options	— Strategy towards risk being refined and well considered responses for key risks (not yet in systematic prioritised manner) — Generally individual views rather than enterprise value, but recognising that can be more that just mitigation — Recognises interplay of capital, reinsurance and other approaches — Limited evaluation of response option and still not full portfolio view	— Given strategy towards risk, clear and well considered responses established for each risk (in prioritised manner) — Deliberate decisions designed to enhance enterprise value (exploit/accept/control/mitigate/use capital or other financing e.g. reinsurance/transfer/share/reduce/avoid) — Evaluates response options and takes a portfolio view
7.7 *Risk cycle key elements — managing and control activities*		
— Responsibility generally allocated — Bottom up process with limited top-down review — Only major risks have pre-planned contingency responses with agreed decision taking levels — Risk appetite articulated, but not clear how affects agreed management — Only occasionally used to manage the risks taken — No wide understanding of controls, control environment and infrastructure — Some policies, procedures and authority levels — Assurance system (external and internal audit) separate, and not complete or risk based — Limited if any use of control risk self assessments (CRSAs) or risk sign-offs	— Clear allocation of responsibility — Top down/bottom up process and review just completed — Some agreed decision taking (e.g. in response to an event) set out in advance — Risk appetite articulated, but not clear enough to affect all risk management decisions — Fair understanding of controls, control environment and infra-structure, but limited impact on inherent residual risk assessment — Pre-planned contingency responses (e.g. with pre-agreed response teams) for key risks — Appropriate policies, procedures and authority levels — Limited risk-based assurance system (external and internal audit, CRSAs and risk sign-offs)	— Clear allocation of responsibility — Top down/bottom up process and review — Appropriate levels of decision taking (e.g. in response to an event), set out in advance — Clear programmes in place to apply risk appetite — Regularly used to manage the risks taken — Proper understanding of controls, control environment and infrastructure — Pre-planned contingency responses (e.g. with pre-agreed response teams) and with in-built resilience — Appropriate policies, procedures and authority levels — Well understood assurance system (external and internal audit, CRSAs, risk sign-offs)

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.8 *Risk cycle key elements — information and communication*		
— *Ad hoc* reporting — no clear annual calendar — Unclear ownership of who reports what — *Ad hoc* and incomplete indicator (KRI) framework — Unimaginative use of communication tools and therefore imperfect clarity — External stakeholder communication not considered	— Clear ownership of who reports what, but annual calendar not complete and subject to *ad hoc* adjustment — Indicator (limited to some KRIs) framework still under development — Mixed use of communication tools (web, email, heatmaps, diagrams, reports, discussion and review), so clarity not complete for all — External stakeholder communication considered, but not fully planned	— Well considered and clear set of outputs from risk process and communication and reporting plans/ calendar — Clear ownership of who reports what — Suitable Indicator (KRI/KCI — key risk/ control indicator) framework — Appropriate use of communication tools (web, email, heatmaps, diagrams, reports, discussion and review) to aid understanding and ensure clarity — External stakeholder communication clearly considered and planned
7.9 *Independent review and monitoring of agreed risk management approaches and authorities*		
— Irregular review of limits — No consequences if limits exceeded	— Processes in place to check that risk limits are adhered to not complete — Action if limits exceeded clear, predetermined, but may vary by management area — Review and subsequent refinement of ongoing monitoring activities starting — Consideration and review of any reporting deficiencies not regularly discussed	— Processes (both independent and integrated) in place to check that risk limits are adhered to — Action if limits exceeded clear, predetermined and effective — Review and subsequent refinement of ongoing monitoring activities — Consideration and review of any reporting deficiencies

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.10 *ERM development plan — review and strategy*		
— Risk management strategy *ad hoc* — Risk management vision under discussion — still not full ERM and only limited implementation planning — Limited if any external challenge — Risk management process is itself reviewed once every three years (e.g. internal audit)	— Clear and explicit risk management strategy under development — ERM recognised as important, and vision and implementation plan under development — Recognises best practice important, but not clear what this means for own organisation — Some external challenge, but as and when needed, and thus *ad hoc* — Risk management process is itself reviewed (e.g. internal audit)	— Clear and explicit risk management strategy — Clear and agreed ERM vision and implementation plan — Determined to be best practice, or agreed quality suited to organisation strategy and goals — Challenged by/reviewed by external source — continuously improved — Risk management process is itself reviewed (e.g. internal audit)
7.11 *Professionalism — skills, tools and techniques*		
— ERM team/resource too small/low level and not with proper skill set — Limited use of modern ERM techniques and incomplete knowledge of what good looks like — Tendency to argue against intuition and avoid multiple approaches/cross checks	— Recognises need to establish ERM team/resource with proper skill set — Appreciates need to use range of modern techniques, but still learning what these are — Heatmaps used to inform and help decision processes — Questionnaires and feedback from audit seen as useful inputs — Intuition still argued against by the analytics — May use more than one approach, but cross-checks still limited	— Right size ERM team/resource with proper skill set — Causal modelling and chain analysis understood and used — Uses imagineering — able to expect the unexpected — Heatmaps used to inform and help decision processes — Brainstorming, questionnaires, feedback from audit, business studies, scenarios, fault trees, failure mode and effect analyses — Not afraid to use intuition — Uses multiple approaches to give resilience/cross-checks (e.g. bottom-up and top-down)

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.12 *Risk appetite/tolerance — definition and articulation*		
— Unclear risk tolerance — Varies by situation — inconsistent — Risk limits not documented or very broadly set out — Risk tolerance not understood nor widely used	— Risk tolerances starting to be established — Board expectations and involvement with risk appetite still at early stage — Maybe some inconsistencies — Documented limits and standards for risk taking and risk management still embryonic — Limited range of understanding and not yet widely used — Control environment understood, but its reliability not clear	— Clearly articulated risk tolerance consistent with goals and resources — Consistent with board expectations — Clearly documented limits and standards for risk taking and risk management — Widely understood and used — Control environment has known confidence limits
7.13 *Risk management — how decide, who and link back to risk appetite*		
— Risk management procedures are situational or *ad hoc* — Relies on individual judgement (and therefore variable)	— Top down/bottom up process and review — Levels of decision taking not set out in advance and may vary by management area — Programmes to apply risk appetite not the norm — Pre-planned contingency responses	— Top down/bottom up process and review — Appropriate levels of decision taking set out in advance — Clear programmes in place to apply risk appetite — Regularly used to manage the risks taken — Pre-planned contingency responses

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.14 *Gross/inherent, net/residual and control framework*		
— No explicit comment on controls — The norm is to work at residual risk level	— For some risks, a clear control framework exists or is being documented — Gross/net risk levels recognised, but not always clearly articulated — Control framework and policy under development, and thus control failure risk not explicitly articulated — Links and interrelationships between risks not always set out — Control framework understood, but its value not fully accepted	— For each risk, a clear control framework exists and is documented — Clear quantification of gross and net — Well designed, top down control framework and policy — Control failure risk explicitly articulated — Links and interrelationships between risks clearly established — Control framework widely understood and its value accepted
7.15 *Dynamism of system*		
— Put loss events behind as quickly as possible — No review — or only very limited scope of review	— Review/post mortem to learn (e.g. process improvement) occasional and challenges organisation's culture — Recognises need to deal with (one or more events arising from) multiple causes — Flexible, but not always fully adaptive approach	— Review/post mortem to learn (e.g. process improvement) integral part of organisation's culture — Continuous improvement philosophy — Able to deal with (one or more events arising from) multiple causes — Flexible and adaptive approach

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Table 7. Risk management (continued)

Basic	Standard	Advanced
7.16 *Dynamism of system — data feedback loop*		
— Based on 'loss' events only, and these not consistently tracked/ reported — Tracking external and internal events *ad hoc* — KRI framework piecemeal — Data structure not coherent or complete — built *ad hoc* from bottom up	— Incorporates some near misses as well as 'loss' events — Tracking external and internal events — but not against prepared watch lists of early warning indicators — Starting to develop a well considered KRI framework, and recognising control environment — Data structures being considered and starting to recognise lead as well as lag indicators	— Based on near misses as well as 'loss' events — Tracking external and internal events — monitors prepared watch lists of early warning indicators — Horizon/environment scanning (radar) for events and able to react — Well considered KRI (and KCI) framework — Data structure recognises predictive (e.g. modelling), indicative (e.g. trends) and sensitivity (e.g. changes observed) paradigms
7.17 *Business continuity plans or extreme event management*		
— BCP exists, but tends to be owned in one department and not well tested — Focused on specific possibilities — not broad based	— Clear and well tested approach to many imagined events — Has been subject to external scrutiny and regulatory feedback — May refer to unexpected events, but in limited manner	— Clear and well tested approach to extreme events — Recognises need to cope with 'black swans'

3.4.11 *Risk management — commentary*

Firms whose experience corresponds more closely to the standard level may have developed a well articulated risk management philosophy, but not have achieved 100% buy-in across their organisation or established benchmarks to assess standards and competence levels. In such firms, risk management may be affected by strategy, but is not yet influencing it. This compares with a more advanced ERM practitioner firm, where risk management directly affects, and is affected by, strategy.

3.4.12 In practical terms, such firms position risk management as living and meaningful, not just a 'tick-box' exercise. These firms implement a clear allocation of responsibility, appropriate levels of decision taking in response to an event, and clear programmes in place to apply the risk appetite. Firms

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need to strive towards a clearly articulated risk tolerance consistent with their goals and resources, board expectations, and supported by clearly documented limits and standards for risk taking and risk management.

Table 8. Risk modelling

Basic	Standard	Advanced
8.1 *General modelling approach — overall*		
— Modellers dive straight into quantification — in isolation from rest of organisation — Modelling scope incomplete — Models lack coherence/integrity — No external scrutiny — No regular updating (e.g. only annual) — Net risks modelled — Company modelled in isolation from real world	— Some general discussion of risk before modelling — Modelling scope complete across main classes of risk — Underlying model logic not directly related to organisation — Different models for component risks, overall coherence not robust — Rigour of quantification work able to stand independent/external scrutiny — Regular updating, but only when needed; allow e.g. for position in underwriting cycle or management change — Gross risk and risk of control failure considered, but may not be directly modelled — (Insurance) market behaviour considered and appropriately modelled (e.g. underwriting cycles)	— Assessment and understanding of risk more important than quantification — Modelling scope complete across all key (well defined) risks — Underlying risk processes imply risk modelling modules — reflect practical inputs and parameters — Different models for component risks, but overall coherence/integrity clear — Rigour of quantification work able to stand — Independent/external scrutiny — Dynamic approach — regular updating; allow e.g. for position in underwriting cycle or management change — Gross risk and risk of control failure explicitly modelled — (Insurance) market behaviour considered and appropriately modelled (e.g. underwriting cycles)

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Table 8. Risk modelling (continued)

Basic	Standard	Advanced
8.2 *General modelling approach — DFA*		
— Use proprietary software in basic form — Only simple dependency structures — Models used regularly without refinement — Models not regularly updated	— AMA (advanced measurement approach) under Basel II — Outputs stand up to practical scrutiny, but based on generally simple logic — Appropriate timelines — Limited use of dependency structures — Simulation outcomes considered and models refined over time — Models updated half-yearly as results/ICA/planning work requires	— More sophisticated than required for AMA under Basel II — Outputs stand up to practical scrutiny — Appropriate timelines — Well considered use of copulas and dependency structures — Simulation outcomes considered and models refined; increasingly realistic and balanced outcomes — Models dynamically updated (e.g. as new results emerge)
8.3 *Range of modelling*		
— Limited number of approaches — Stress and scenario approaches may be the basic approach — Overall modelling may not give balanced outcome	— Range of approaches understood and valued — Stress and scenario approaches give useful insight — Hot spot analyses (e.g. by risk type, risk factor, asset type, geographic region, process type) — Only high level consideration of 'black swans', i.e. what could happen that the model would not cope with — Overall modelling gives acceptable/balanced (not exaggerated) outcome	— Wide range of approaches understood and valued — Stress and scenario approaches give useful insight — Hot spot analyses (e.g. by risk type, risk factor, asset type, geographic region, process type) — Intuitive methods (e.g. brainstorming, Delphi) — Able to deal with 'black swans' — recognition that Gaussian modelling may not capture the extremes that can happen — Modern portfolio theory (CAPM, Black-Scholes) — Use of Bayesian networks — Overall modelling gives balanced (not exaggerated) outcome

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Table 8. Risk modelling (continued)

Basic	Standard	Advanced
8.4 *Coherence, linkages, correlation and diversity*		
— Extremely limited insights into business linkages — Models use simple structures and assumptions — Correlation matrices used, but not fully understood	— Gives some useful insights into relationship between risks — Models have limited ability to handle inconsistent assumptions — Can produce a number of scenarios, but not able to reconcile multiple perspectives — Internal systems dynamics/links/dependencies input as fixed assumptions — Correlation matrices well tested, but real meaning not fully understood — Internal management decisions dealt with by way of refined/fixed assumptions	— Able to give useful insights into relationship between risks and how they arise (e.g. from assets, liabilities and ongoing (underwriting) business — Models able to deal with ambiguity and inconsistent assumptions — Able to explain and reconcile multiple perspectives — Models able to capture business insights, and to recognise internal systems dynamics/links/dependencies — Root causes drive many assumptions; if used, correlation matrices well tested — Internal market dynamics recognised — e.g. prioritisation for scarce resources
8.5 *Clarity of assumption and causal modelling*		
— Assumptions implicit and not widely understood — Scarce data assumed meaningful — Model outputs assumed reliable — no insight into uncertainties	— Assumptions clearly set out — but only really understood by modellers — Approach to dealing with scarce data reasonable — Able to give multiple perspectives	— Assumptions clearly set out — and widely understood — Approach to dealing with scarce data clear — Causal modelling — Able to give multiple perspectives

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Table 8. Risk modelling (continued)

Basic	Standard	Advanced
8.6 *Measures used in modelling*		
— Output limited to simple P & L/balance sheet items — Only basic definition of capital used	— Some risk metrics (e.g. VaR, TVaR, RAROC, RORAC) used — Definition of uncertainty (model, parameter, process error) discussed — Different definitions of capital clearly allowed for, including economic capital — Outputs reflect sub-set of organisation's KPIs, KRIs	— Understanding of risk metrics (VaR, TVaR, RAROC, RORAC) — Definition of uncertainty (model, parameter, process error) clear — Different definitions of capital clearly allowed for, including economic capital — Model logic exposure based — Outputs reflect organisation's KPIs, KRIs and KCIs (key control indicators)
8.7 *Transparency and buy-in to modelling*		
— Effect of internal decisions (e.g. management actions or agreed risk management) not explicitly modelled — Models not used to help determine risk management/mitigation strategy — Models lack credibility and are seen as 'black boxes' — No causal modelling — ICA/ICG links with ARROW issues not catered for in models	— Limited number of key management actions modelled — Models occasionally used to help determine risk management/mitigation strategy, but more usual models changed to reflect expected outcomes from mitigation — Models have some transparency and hence limited credibility — not fully understood — Allows for some external factors — Cause and effect modelling does not stand up to practitioner scepticism — Links ICA/ICG with ARROW issues generally appropriate	— Effect of internal decisions (e.g. management actions or agreed risk management) clearly seen and accepted by non-modellers — Models used to help determine risk management/mitigation strategy — Models have credibility and transparency — Models reflect dynamics of own organisation (now and future planned state) — Models allow for external factors — Cause and effect modelling stands up to practitioner scepticism — Clearly links ICA/ICG with ARROW issues

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3.4.13 *Risk modelling — commentary*

Less mature ERM practitioners may focus on quantification — in isolation from the rest of organisation and from the real world. The danger is that the resulting modelling scope is incomplete and lacks coherence. Firms may often need to step back and focus on the assessment and the understanding of risk. This perspective indicates that models need to reflect the dynamics of the organisation now and in the future, and to allow for wider external factors. The modelling scope should be carefully defined to be complete across all key (well defined) risks, and that, whilst there are different models for component risks, there is a clear overall coherence and integrity. Independent and external scrutiny should be actively sought and explored to support a dynamic approach.

3.4.14 The range of modelling needs to utilise stress and scenario approaches, hot spot analyses and intuitive methods. The approach to modelling also needs to be able to deal with 'black swans'. One way of thinking about modelling is that it helps to think through the consequences of different scenarios; not that it attempts to represent every aspect of the real world, but that it captures the essential features. It is important to emphasise that Gaussian modelling, with its centralisation tendencies, and even non-Gaussian modelling, will fail frequently to capture the extremes which can happen. Put colloquially, the tails of such distributions may not be 'fat' enough. Furthermore, actuaries need to be aware that, while existing practitioners are usually aware of the shortcomings of statistical modelling in capturing the nature of extreme events, not everyone understands or thinks in the same way. Increasingly modellers incorporate shock events — sudden shifts in experience or inclusion of chaotic distributions — to help to assess the consequences of unforeseen events. It may be also that firms need to develop applications of modern portfolio theory and the use of Bayesian networks. The overall objective is to achieve a balanced (not unduly exaggerated or unduly smooth) modelling outcome.

3.4.15 Firms also need to take a critical view of risk metrics. The definition of uncertainty (model, parameter, process error) needs to be clearly established. Acknowledging different definitions of capital may help users, including, for example, economic, regulatory and actual capital. The outputs need to reflect an organisation's KPIs, KRIs and KCIs, and the model logic based on exposure as defined by these measures. Ultimately, models must be seen as credible and transparent and gain buy-in to ensure that they help to determine risk management/mitigation strategy.

3.5 *Other Comments for Practitioners*

3.5.1 There is no black box of quantitative and qualitative ERM techniques which practitioners can use to manage the risks of a general insurance company. Rather, the tools and techniques which do exist need to be used with care, and, in the hands of an experienced practitioner, can

facilitate the embedding of ERM principles throughout the whole organisation and the prudential management of the organisation.

3.5.2 Firstly, consider the case of the ERM challenges (and opportunities) faced by the public sector, as represented by the example of the U.K. Government. The Cabinet Office (2002) report illustrates the ERM issues arising from the public sector's need to do more to anticipate risks, so that there are fewer unnecessary and costly crises (citing BSE and failed IT contracts as examples); to ensure that risk management is part of the delivery plans; to get the right balance between innovation and change on the one hand, and avoidance of shocks and crises on the other; and, finally, to improve the management of risk and its communication.

3.5.3 Handling risk, both opportunity and threat, is perceived as increasingly central to the business of government. The accelerating pace of change in science and technology, and the greater connectedness of the world, are creating new responsibilities and demands. Rising public expectations for government to manage risk are set against a backdrop of declining trust in institutions, declining deference and increased activism around specific risk issues, with messages amplified by the news media.

3.5.4 Governments constantly need to keep under review where responsibility for managing risk should sit best. In the U.K., risk management has been found wanting in a number of recent policy failures and crises. Successful risk handling rests on good judgement, supported by sound processes and systems.

3.5.5 Secondly, consider the case of the lessons learned from successful ERM implementations in the U.S.A. In order to illustrate the complexities involved and the practical experience required in ERM implementations, COSO (2004b) outlines some of the risk management steps which might be taken during the ERM implementation process:

3.5.5.1 *Implementation commonalities*

An entity's size, complexity, industry, culture, management style, and other attributes will affect how ERM can be imbedded. Experience shows, however, that certain commonalities exist, as outlined below.

3.5.5.2 *Core team preparedness*

Establishing a core team, with representation from business units and key support functions, including strategic planning, is an important first step. This team becomes intimately familiar with the framework's components, concepts, and principles. This familiarity provides a common understanding and language, and a foundational basis needed to design and implement an ERM process which addresses the entity's unique needs effectively.

3.5.5.3 *Executive sponsorship*

While the timing and the form of executive sponsorship vary by organisation,

it is important that executive sponsorship be initiated early, and be solidified as implementation progresses. Executive leadership articulates the benefits of ERM, and establishes and communicates the business case for the related investment of resources. CEO support, and usually, at least, initial direct and visible involvement, drives success.

3.5.5.4 *Implementation plan development*

An initial plan is created for the next steps, setting out key project phases, including defined work streams, milestones, resources, and timing. Responsibilities are identified, and a project management system put in place. The plan serves as a means to communicate and to coordinate consistently with the team leadership, and as a basis for communicating and confirming expectations of various units and personnel, and discussing organisation-wide changes anticipated from adopting ERM.

3.5.5.5 *Current state assessment*

This includes an assessment of how ERM components, concepts, and principles are being applied currently across the organisation. This usually involves ascertaining whatever risk management philosophy has evolved within the organisation, and determining whether there is uniform understanding of the organisational risk appetite. The core team also identifies formal and informal policies, processes, practices, and techniques currently in place, as well as existing capabilities in the organisation for applying the framework's principles and concepts.

3.5.5.6 *ERM vision*

The core team develops a vision which sets out how ERM will be used going forward, and how it will be integrated within the organisation to achieve its objectives — including how the organisation focuses ERM efforts on aligning risk appetite and strategy, enhancing risk response decisions, identifying and managing cross-enterprise risks, seizing opportunities, and improving the deployment of capital.

3.5.5.7 *Capability development*

The current state assessment and the ERM vision provide insights needed to determine the people, technology, and process capabilities already in place and functioning, as well as new capabilities, which need to be developed. These include defining roles and responsibilities, and modifications to the organisational model, policies, processes, methodologies, tools, techniques, information flows, and technologies.

3.5.5.8 *Implementation plan*

The initial plan is updated and enhanced, adding depth and breadth to cover further assessment, design, and deployment. Additional responsibilities

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are defined, and the project management system refined as needed. The plan typically embraces general project management disciplines, which are a part of any implementation process.

3.5.5.9 *Change management development and deployment*

Actions are developed, as needed, to implement and sustain the ERM vision and desired capabilities — including deployment plans, training sessions, reward reinforcement mechanisms, and monitoring the remainder of the implementation process.

3.5.5.10 *Monitoring*

Management will continually review and strengthen risk management capabilities as part of its ongoing management process.

3.5.6 ERM is essentially about the practical application of common sense and good corporate governance to the profitable management of a business of uncertainty. It recognises that we live in a world of uncertainty, without sustainable equilibrium, and that this uncertainty creates the need for both risk control and opportunity management. Although there are both upside and downside risks, the ERM practitioner needs to steer a prudential course and to take calculated risks if the organisation is to survive and prosper.

3.5.7 Many readers will be familiar with the report 'Prudential Supervision of Insurance Undertakings: Report of the London Working Group on Solvency II'. It provides a series of case-study analyses which identify a chain of multiple causes involved in insurance company 'near misses' and failures.

3.5.8 The general insurance industry has come to recognise that the prudential management of insurance risks involves qualitative risk management issues as well as the quantitative financial effects. The London Working Group report provided evidence that the causal chain was generally traced back to underlying internal causes (problems with management, shareholders or other external controllers). Problems included incompetence, working outside areas of expertise, a lack of integrity, conflicting objectives or weakness in the face of inappropriate corporate parent decisions.

3.6 *ERM — Opportunity Management and the Link with Corporate Strategy*

3.6.1 Finally, what is the link between corporate strategy and ERM? The discussion can become one of business semantics; what do the words planning, strategy and risk management really mean? Some people will see them as different aspects of the same concept; others will see them as different concepts. On the one hand, a prerequisite for strategic direction is a sound understanding of the value drivers and the value destroyers, which implies a comprehension of which risks to take and which risks are best

avoided. On the other hand, ERM-based business strategic vision and business planning without a true entrepreneurial streak does not automatically lead to an effective corporate strategy. Texts such as Collins (2001) refer to the need for 'getting the right people on the bus' (i.e. recruiting and employing staff with the right skills, experience and attitudes), giving them the right direction, and driving in a single minded manner for continuous improvement.

3.6.2 Practical ERM, for any business, is about 'risk and opportunity management'. The upside risks could be argued as being the more important, since being unprepared for good news can lead to unrealistic stakeholder expectations. Focussing on the upside and being opportunity led may be most relevant for sales and marketing functions, or a company in a new market. That said, ERM means thinking things through properly. The audit and risk management function has to include risk mitigation and control, no matter what the objective, albeit in balance with the upside opportunity, given the business's risk appetite and tolerance.

3.6.3 The strength of the link between ERM and the corporate strategy will depend on the interaction of the company's strategic direction, the corporate mission, the business objectives, the risk appetite and communication to the key stakeholders, which may include the shareholders, the rating agencies, the investment analysts, the management and the employees, and, of course, the regulatory authorities.

3.6.4 Risk averse companies will have a small risk appetite, and may want to follow the market leaders, taking as few risks as possible. They are likely to use risk quantification measures focussing on a risk mitigation, erring on the side of caution. On the other hand, entrepreneurial market leaders, with new marketspace ambitions, will have a large risk appetite, and may focus on using ERM for opportunity management.

3.6.5 Whatever the risk appetite, the CRO needs to implement and to manage a practical ERM framework, which is aligned to the agreed corporate strategy and the associated business plans. This will require the effective management of risk and reward in a business of uncertainty, dealing with the upside risks as well as the downside risks.

3.6.6 A strategic management perspective of risk appetite within an ERM framework is likely to involve risk decisions and choices between requests for limited capital and resources. The board and the CRO may, in effect, have an innovation portfolio of potential investments, and they will need to balance the balance the risks and rewards inherent in this innovation portfolio. A risk matrix model, with probability bands indicating the probability of failure, may be helpful. Day (2007) has proposed such a model, and has provided template checklists of some challenging management questions along the lines of: "Is it real?" "Can we win?" and "Is it worth doing?"

3.6.7 ERM requires practitioners to think across the organisation in a

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way which has hitherto been the preserve of the board. This paper should clarify that people skills are every bit as important as technical analytic skills. A good ERM system will require pointing out 'unacceptable' facts from time to time; the way in which this is done and the skill with which messages are imparted will determine, ultimately, the success or otherwise of the ERM function.

3.7 *General Comments*

3.7.1 ERM, in the context of innovation screening, needs to be positioned as part of a continuous improvement and learning process. Sometimes business decisions are seen as black and white, or binary; as a go/no-go decision. In reality businesses tend to be more pragmatic, and the development of strategy is a series of steps towards a goal. Team members who perceive ERM as a red/green traffic light may perceive the various tools, systems and dialogue as obstacles to circumvent, rather than as opportunities to make a realistic evaluation, prior to taking a decision.

3.7.2 We believe that ERM should be positioned as helping to develop the (insurance) company's capability to move from risk control to opportunity management. For an insurance enterprise with an innovation portfolio, the screening tools outlined above, which can be aligned to a robust and strategic ERM framework, can help the CRO to move firmly into the opportunity management arena.

3.7.3 Communication and the proper use of management information remain ERM challenges. Gathering appropriate information relies heavily on the ERM actuary, working in co-operation with all the various operating areas of the business, and then being able to communicate findings in a persuasive and relevant manner.

4. The Future — Implications for Actuaries Now and in the Longer Term

4.1 *Section Introduction*

In this section we start by considering aspects of what is changing today, and then imagine the world in 2025. Based on these observations, we then postulate the immediate implications for our profession. Next, we set out views for discussion on how our education might evolve. Finally, we offer thoughts and reflections on whether we are moving ahead fast and boldly enough.

4.2 *The World Around us is Changing Today*

4.2.1 Whichever way we look, change is endemic. Life is more instant, with communications being global and access to information at our fingertips 24 hours a day. Traditional boundaries are being challenged as businesses

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constantly seek to redefine themselves, whether just to survive or to exploit new opportunities.

4.2.2 In a narrower sense financial service industries are converging. This trend is driven, in part, by the demands of customers, who are more aware and better educated, demanding improved customer oriented responses. It is also driven by shareholders and supply side thinking; looking by the demand to increase shareholder value through growth and by the seeking of economies of scale and scope.

4.2.3 This convergence forces different professions, skills, semantics and experiences into close proximity. For example, starting from different places, banking world quantification techniques are coming together with those emerging in the general insurance world. General insurance actuaries and practitioners can both share and learn, enriching their toolset and improving their contribution.

4.2.4 New firms and conglomerates face new challenges at the same time as the environment in which they operate is altering faster than ever before. The need for business management to consider different approaches, to adapt proven tools and to be flexible (even inventive) is greater than ever.

4.2.5 At the same time, the regulatory world is both being driven by these changes and driving them. For example, in the U.K. and in Australia, the FSA and APRA, respectively, have been given a remit covering all financial services industries, be they banking, asset management, investment banking or insurance. A different stance is taken in the U.S.A., keeping banks and insurers separate, possibly still influenced by the anti-trust laws of previous generations. It is too early to say which approach will prove more robust, or, indeed, whether such convergence and subsequent divergence is as much part of society's need for change as a human being needs to breathe in and breathe out.

4.2.6 The basis of regulation is constantly being reviewed. The thirst for rules and the apparent certainty of being able to fulfil regulatory requirements is juxtaposed with the desire to work by principles. At the present time, in sophisticated markets the move to a more principles-based approach seems to be finding favour. This philosophy has the strength that it can be more easily adapted to rapidly changing circumstances, even though it opens the door to judgement and room for different approaches aimed at the same ends.

4.2.7 In the U.S.A., Sarbanes Oxley (SOX) placed increased demands on businesses to describe their processes in precise detail, together with how these processes were controlled. The intent was so that boards and senior managers could rest easy with the robustness of the information which they provide to stakeholders. The focus was on controls rather than on outcomes; on a formulaic approach to risk rather than on a self assessed insight.

4.2.8 In Europe, financial regulations include Basel II for banks and the new Solvency II Directive for insurers. While banks and insurers are subject to different regulations, many of the principles are similar. For instance, both sets of regulation allow, and even encourage, the use of internal models for assessing regulatory capital. Notwithstanding this, the regulations still allow companies a choice between using a simple rules-based approach and their own internal (advanced measurement) models.

4.2.9 The internal model approach is designed to build on an insurer's own risk management framework. The International Association of Insurance Supervisors (IAIS) refers to models as a "system developed by an insurer to analyse the overall risk position, to quantify risks and to determine the economic capital required to meet those risks." An internal model may also be used to determine the insurer's regulatory capital requirements, on the basis of the insurer's specific risk profile and the defined level of safety of the solvency regime.

4.2.10 Then there are ongoing changes in the way in which companies are managed. Organisations need to move faster and be more adaptive; they need to allow for the consequences of empowerment and involvement, as they seek to increase their capacity for change. They need to make sure that old barriers and silo thinking do not get in the way of holistic and forward looking approaches. They need to make sure that quantitative and qualitative approaches are made to work together. They need to make sure that all risks are considered, that there is no longer room to hide or to pretend that a risk does not exist. Alongside this, in the U.K. at least, models and risk-based thinking need to be, and to be seen to be, embedded in the way in which an organisation works. In Europe Solvency II mirrors this with the concept of own risk self assessments (ORSAs).

4.2.11 This means that the ERM framework and the control environment have to be in constant flux — not an inhibitor, but a facilitator to continuous improvement.

4.2.12 Actuarial reports will be required under Solvency II, perhaps being a development of the U.K.'s ICA, which is based often on actuarial work, at least in respect of the quantification aspects.

4.3 *The 2025 Scenario*

4.3.1 Having considered today's changes, we now want to stretch the readers' imagination by presenting a scenario of what ERM might look like in over 15 years' time. This is only one scenario, and is not intended to be a definitive suggestion about what will happen; it is intended to help raise the sights and stir a wider discussion.

4.3.2 In developing this scenario, it is suggested that there are a number of underlying assumptions and trends:

(1) computing power, data storage and global communications continue to develop exponentially;

(2) there is a desire for ever more accurate detailed models — models which reflect reality with ever more granular modelling techniques;
(3) enterprise wide models become the norm (i.e. modelling every facet of an organisation in a realistic manner is commonplace);
(4) monitoring of activity (through tools such as dashboards or balanced business scorecards) takes place real-time (as per global manufacturing industry);
(5) risk warning indicators (key risk indicators) are replaced by real-time risk predictive metrics;
(6) globalisation continues;
(7) automated language translation and speech recognition eliminate verbal understanding barriers; and
(8) regulators move to a transparency of view, managing at a global level.

4.3.3 Insurance companies, banks, investment houses and other financial services organisations have fully integrated ERM monitoring and control systems. Management can monitor changing risk profiles in real time, as different types of new business are underwritten.

4.3.4 The emphasis has moved from quantification, embedding capital models into organisational thinking and creating a culture of risk awareness, towards risk management as a forward looking process, eliminating risks before they occur. The latest models allow for the detailed simulation of risk return profiles of potential strategies. The use of reinsurance, financial instruments and capital arbitrage to transform risk outcomes is common. Any residual risks left on the balance sheet are those which either the company wishes to take or those which are more effectively capitalised than mitigated in other ways.

4.3.5 Assumptions are continually refined as divergences with actuals emerge over time, and models are typically updated on a daily basis. The speed of updating models to respond to the latest trends, and hence reflect reality better, is a competitive advantage.

4.3.6 Artificial intelligence (AI) based systems are the norm. Every risk is assessed at both the pre and post control level, and management decisions are monitored as they are taken. Where risks are judged as beyond the agreed risk appetite, they are subject to manual consideration. An organisation's overall capacity to manage and to handle change is continually monitored. Algorithms with superior predictive powers are as important as management actions in driving outstanding performance!

4.3.7 At the operational level, the use of engineering techniques to monitor processes has become the norm. Organisations have realised that working on the elimination of variation (for example as in 6 Sigma) was only one dimension of process improvement and management. Process inputs, process consumption, process output and the complex causal links between processes at both the pre and post control level have produced dramatic

automation of operational change. The ability both to reduce variation and to understand the links between processes means that operational risk now only exists to the extent that new risks emerge which are not fully anticipated nor are quantified by the models.

4.3.8 Jumps in assumption values and the subsequent impact on volatilities are still best caught by capital buffers. A company's capital regularly shifts between reserves and shareholder funds, as the risk profile is updated. Business plans are adjusted regularly in recognition of these forces. There are now a number of contingent capital facilities for raising capital in a 'just in time' (JIT) fashion; however, this extra liquidity tends to come at a cost. Capital raising is still easiest in buoyant markets, and with growth strategies in mind. Most companies implement long-run strategies, considering their likely capital needs over a five to ten year time horizon.

4.3.9 Running an insurance company in 2025 has some parallels with banking in the late nineties. Although companies have a natural tendency to operate in specific parts of the risk spectrum, they do take views on future overall spreads, and vary their short-term strategies accordingly. A capital rich company, for example, may decide to speculate in BBB risks, if it believes that the risk adjusted returns here are higher than normal. In this way, most potential arbitrages are taken out quite quickly over time.

4.3.10 The residual risks emerging in this environment have also changed. One key common risk emerging has been assessing resource requirements accurately, and at appropriate levels. Poor workload projections mean shortfalls in resources and/or in the appropriate skills. Pools of expertise are available at short notice, but normally have significant cost attached, and they are seldom useful immediately.

4.3.11 The CRO role is occupied by a wide range of people. Engineers, game theorists, accountants, financial experts, risk management specialists, actuaries, bankers, internal auditors, social scientists all bid to provide new perspectives and to win competitive advantage. Companies with similar risk appetites may actually end up taking on quite different risk profiles, dependent on where their skill sets lie.

4.3.12 Regulation in this environment is dynamic. There is now one global regulator who receives updates in real time, supplemented with credit agency interpretations. Centrally captured information is used for constructive purposes only. Global data are now captured and are available for regulatory assessment, although not publicly. Detailed performance metrics for individual organisations are compared against global models, and any unexpected deviances noted. Data mining techniques indicate correlations of parameter values which, when exhibited together, form 'danger signals'. Problems are identified before they have an opportunity to develop in an uncontrollable fashion, although underlying relationships still break down most frequently when there are substantial changes in competitive/economic conditions.

4.3.13 Competitive pressures are also expected to change further the way in which companies are run. Many companies are already outsourcing significant parts of the value chain. It is expected that this trend will expand further, with a generation of companies emerging which are primarily underwriting engines, with suppliers competing to service different parts of their value chain. More sophisticated or wholesale buyers may well prefer to shop around for specific segments of the value chain, particularly if they obtain a favourable price for so doing.

4.4 *Synthesis of Immediate Implications for Actuaries*

4.4.1 Regulators may accept a one in 200 risk of company insolvency, but consumers regard failure of financial institutions as 100% unacceptable. Shareholders look to firms to deliver steadily increasing profits — fluctuations are dealt with harshly in the share price.

4.4.2 In reality, we live in a world which is increasingly uncertain. Random events will always happen, and, as the world becomes more globalised and more connected, these events will affect more people and more companies. In general, people do not understand randomness and uncertainty. They have different views on what it means: is it like tossing a coin where the outcome, in some sense, is symmetrical; is it about having some variation around an expected or mean result; is it about the unexpected or tail events?

4.4.3 As actuaries, we are used to dealing with uncertainty and risk. Indeed, we have special skills and experience in these, and are as well placed as any profession to play a significant role in understanding and in describing (or interpreting) issues associated with risk management.

4.4.4 In the U.K., our Profession is nearing the end of the process of re-structuring, following the independent Morris Review. Our regulation will rest with a separate body, the Board for Actuarial Standards (BAS), under the auspices of the Financial Reporting Council. As a result, we will have more space to adapt. From the spring of 2008 our specialist subject boards will be replaced by practice committees. In particular, a new Enterprise Risk Management Practice Committee will seek to harness the Profession's potential across all practice areas.

4.4.5 The BAS, in its recent consultation paper, 'Towards a Conceptual Framework', draws a distinction between planning and valuation — in particular, between approaches in pensions, where calculations have the objective to help trustees and others plan future contribution rates, and in insurance, where the emphasis is on likely liability values and degrees of uncertainty. It is the combination of these skills and the ability to deal with uncertainty which stand us in good stead for playing a key role in ERM, so long as we develop our skills and education.

4.4.6 Both qualified and student actuaries require a broad education into all aspects of ERM. This paper has given a flavour for the breadth of the

subject beyond traditional modelling aspects. A different thought process from the typical analytic approach is needed. The need to understand how internal models should be assembled is one thing; the ability to explain how they fit into a full ERM framework is another. In principle, our education needs to be holistic and forward looking; not just rules based or purely quantitative.

4.4.7 Clearly, we need a wider set of techniques and tools. We have become used to capital market modelling, but there is more to do in improving our insights into different definitions of capital, risk and risk adjusted measures.

4.4.8 To this we might want to add illustrations of different quantitative approaches, such as those used by banks across Europe.

4.4.9 Then there are further statistical and computational methods, including neural networks, causal models, aspects of Bayesian thinking, the Delphi method, data mining, numeric analysis and optimisation routines from operations research.

4.4.10 The framework within which internal models are used is as important as constructing the models themselves. How often do models fail, because non-actuaries cannot understand them or feel that they are unrealistic? If an ERM system incorporates systems of control, as the control environment changes, so should the model outcomes. An actuary should be able to explain the link between the real world and the model; ideally demonstrating transparent links. We should be able to interpret models, give insights, and help managers think through implications for risk, risk appetite and risk management.

4.4.11 Early warning indicators, including KRIs, are another aspect where actuaries' analytic and quantitative skills could be developed.

4.4.12 We fully support the ongoing work in extending our examination syllabuses, which will be especially helpful for students.

4.4.13 Risk identification, quantification, communication and management has been always been at the heart of our core reading — but it seldom extended to more than a single unit within any syllabus, and it has been hidden away within the many other practice area topics relating to pricing and reserving. For example, the current ST3 (formerly 303) syllabus has in its unit 6: "Describe the major areas of risk and uncertainty in general insurance business, in particular those that might threaten profitability or solvency.''

4.4.14 The Profession's Qualifications Executive Committee has sought to improve the commitment to risk management and to explore the potential and the appetite for risk management as a separate specialism stream. It was agreed to start by extending the actuary's basic toolkit, the CT or 100-series subjects. CA1 was introduced in 2005 to give all actuaries, whatever their eventual specialism, grounding in the principles of assets and liabilities across the practice divisions.

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4.4.15 Subject CA1 Core Applications Concepts became Core Applications Actuarial Risk Management, and its first examination is expected in Spring 2009. The proposed syllabus is attached as Appendix B.

4.4.16 Two further developments are planned in the short to medium term. Firstly, the Profession is in the process of developing the equivalent of the specialist technical (300 series) paper, ST9-ERM. It then has plans for a specialist application (400 series) syllabus to offer to the actuarial student an alternative path of qualification as a risk management expert. The necessary educational objectives have been drafted, and the creation of appropriate material is in hand, so that the first ST9 examinations will be sat in 2009 or 2010.

4.4.17 Secondly, the U.K. Profession is working in tandem with the Society of Actuaries and the Casualty Actuarial Society to develop a risk management credential. Embracing the CT/100-series subjects, CA1, as described above, and additional material which may include (aspects of) the newly created ST9 paper in ERM, it will probably be launched in 2010. The proposed syllabus is attached as Appendix C.

4.4.18 For the qualified population, a study and examination-based approach will be inappropriate, due to individual time constraints and differing levels of ERM expertise. It is suggested that the Profession should consider adding a requirement to CPD to make sure that all actuaries spend at least 30% of their CPD time, both formal and informal, on ERM.

4.4.19 Qualified actuaries must learn about ERM. We consider that every member of the profession should take it upon themselves to read, understand and start applying the ERM concepts and terminology. An excellent place to start is a review of the available literature, including our recommended reads — see Orros (2007a) and Orros (2007b).

4.4.20 This paper pulls together a number of good sources, based on extensive research into available materials. However, real life examples are less easy to find, and a list of things which one might do to implement an ERM system is sadly lacking. This could be a source of further work. The case studies developed as a pre-cursor to this paper are a useful starting point, and are easy to read. They can be seen via GIRO_ERM Appendix 4A and GIRO_ERM Appendix 4B at http://www.actuaries.org.uk/files/proceedings/giro2007/BHPrize_Tripp_Appendices.zip

4.4.21 Our own profession has established an Enterprise Risk Management Practice Committee (http://www.actuaries.org.uk/Display_Page.cgi?url=/finance_invest/erm.html), and one of its aims is to educate actuaries on risk management.

4.4.22 Actuaries need to think about the practical ways in which they can add value. A useful starting point might be to think how ERM principles apply to their own companies, and how they can improve the capital model developed for ICA. They might consider how they can work with the risk managers to enhance existing risk management into fully developed ERM;

and how they can embed traditional actuarial work into the ERM framework.

4.4.23 Finally, for already qualified actuaries, we suggest developing a diploma in ERM, based on either remote or residential development with a combination of examination and dissertation-based assessment. This could be developed jointly with other bodies, including the Institute of Risk Managers, the Internal Auditing Institute, the Institute of Operational Risk or the Institute of Chartered Accountants.

4.5 *Longer-Term Implications for Actuaries*

4.5.1 Looking to the longer term, a fundamental question for our Profession concerns the desired scope of our work. We currently have a reasonably well defined role. The recent fundamental Morris Review stated that: "Actuaries are trained to apply mathematics, economics and finance to the management ... and ... measurement of assets and liabilities in life assurance, pensions and general insurance.'' Our unique selling points are clearly around analysis, quantification, statistics, financial insight, economics and the specific knowledge of general insurance, life assurance, investments and pensions. This is what currently differentiates us from other professions, and what generates the values which we add and the rewards which we receive.

4.5.2 Is this right for the longer term? At the outset of this paper we talked about some of the Profession's published statements. If we are serious about the 'quantitative risk professional' vision, what do we need to do in order to earn ourselves the opportunity to be seen as key contenders for the role of CRO?

4.5.3 We are not suggesting that an actuary can, or in the future should, be able to do everything. An actuary should be part of a multi-disciplinary ERM team, bringing the unique skills suggested in ¶4.5.1. To be a respected member of this team, the actuary needs to understand the semantics and the special contributions of other professions and experts — to be able to work with a diverse set of technical specialists in a cohesive team, and, if required, to architect the vision and the design of a practical ERM process.

4.5.4 We are hoping to promote a discussion about how far we see our Profession developing, and whether we could aspire to the wide ranging ambit of a CRO, and how this relates to the Actuarial Profession's training and education.

4.5.5 The wider we see our potential future role, the more important a whole series of wide ranging topics become to our education and training needs. A full analysis of the required education would mean articulating a desired future state, comparing it with our present position, and completing a gap analysis.

4.5.6 Whatever the vision, we need a framework. One way of looking at ERM is to see it as embracing the risk aspects of everything within a general insurance organisation. The prudential supervision regime will be aligned

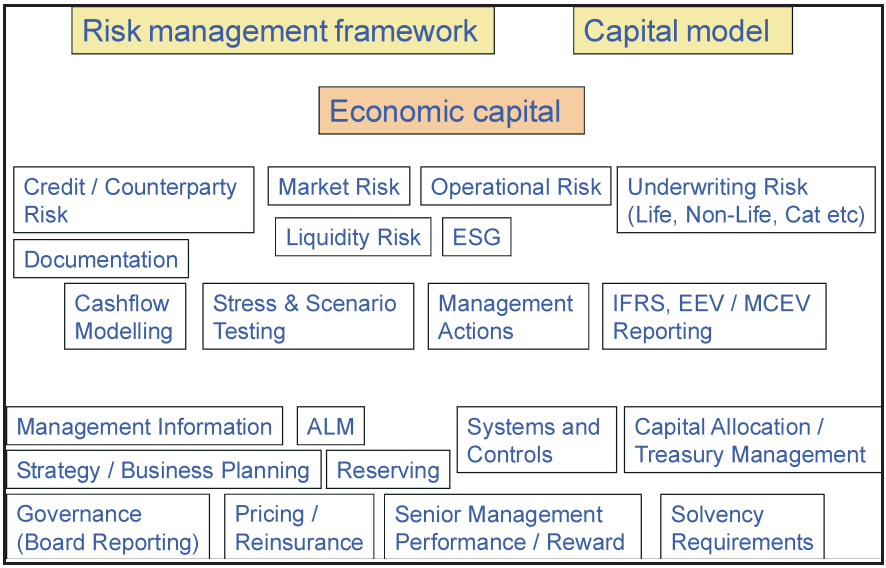

Figure 10. An illustrative ERM framework

with how a well-run firm operates, and ERM will be the foundation and the cement. One framework could be that set out in Figure 10.

4.5.7 ERM effectively brings together internal models and the risk management framework. The proposed new European regime will require models to be approved before they can be used, and this means that firms will have to live and breathe ERM to achieve this. They will need a 'new-look' or ERM actuary to achieve this.

4.5.8 To be well placed, it is possible to argue that we would need to be conversant in (that is to have a general understading of) a number of disciplines, starting, perhaps, with emotional intelligence and behavioural analysis. The list might be very long, and could continue to include artificial intelligence; engineering insights into systems and processes; process (re)engineering; total quality management and 6 Sigma; causal models, Bayesian (and neural) networks; game theory; subjective methods, such as the strategic analyses 'five forces' and PESTLE (political, economic, social, technological, legal and environmental analyses); use of scenarios and stress tests; the Delphi method; extreme event management; and business continuity planning.

4.5.9 Alongside such a framework, our Profession also needs to continue its determined communication shift. We have expertise in understanding uncertainty and risk, and this is something upon which we can build.

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4.5.10 The ERM actuary understands 'fat tails', skewness and correlation of tail events. Experts have developed models which are based on past experience to try to understand it. The ways in which the world experiences randomness change quickly, so inductive logic can be fundamentally flawed — see Taleb (2007). At the very least, they need careful explanation and interpretation.

4.5.11 The Actuarial Profession can describe uncertainty and risk; ERM gives a framework for this. The focus on the risks underlying a business, the culture of openness which is required to implement ERM successfully, and the holistic view taken of a business give an ideal platform for actuaries to use their analytical strengths to become a key part of ERM teams.

4.5.12 In the recent past, the General Insurance Board of the Profession has sponsored research into general insurance reserving by actuaries; see Jones *et al.* (2005), Jones *et al.* (2006) and Jones *et al.* (2007). A key conclusion of the report is that actuaries need to communicate uncertainty in reserve estimates better, and to highlight the main areas of uncertainty. The Profession is currently researching ways of doing this, and encouraging actuaries to do this via guidance — see Institute of Actuaries (2006). We can extend this work to help improve ERM frameworks.

4.5.13 This work led to the formation of GRIT (The General Insurance Reserving Issues Task Force) and subsequently to the GI ROC (General Insurance Reserving Oversight Committee). Subsequently in the premium rating world GRIP (General Insurance Premium Rating Issues Working Party) was formed. Arguably we now need an equivalent in ERM — GIERM (General Insurance ERM Working Party).

4.5.14 As well as discussion about subject matter, content and communication, there should also be discussion about thinking styles and personality traits. Our profession draws on the mathematically minded — the analytic. Yet, in the ERM space, the perceptive and the intuitive are as important. It might be considered a step too far for our Profession to develop routes to fellowship for the arts graduates, and yet some of the best and brightest brains study politics, philosophy and economics. Are we right to deny ourselves the enrichment which they could bring?

4.5.15 If we remain firm to our traditional mathematical base, then, at the very least, we should ensure that we are open to other thinking styles. Our education could be extended to incorporate insights into perceptive or intuitive thinking; we could teach about different levels of thinking (chunking up, or chunking down — helicopter and big picture, rather than worm's eye and detailed) — not to distract us from what makes us what we are, but to ensure that we can relate well to others.

4.5.16 In some sense, it is as though there is a new profession forming from a convergence of accounting, internal auditing, regulation, actuarial, insurance, 'traditional' risk management, and more advanced financial risk management, in banking, insurance, securities, and industries such as energy

and pharmaceuticals. If we continue to develop and to work hard to convince others, we may be judged worthy to play a leading role in establishing this new profession.

4.5.17 Medium-term syllabus ideas and implications need further consideration. Obvious questions include how far the language of banks should become part of our training. Also, before banking, what about ART, insurance broking, insurance purchasing, reinsurance broking, and so on? How far and how fast do we want our Profession to develop, and how global should our aspirations be?

4.5.18 The Society of Actuaries and the Casualty Actuarial Society in the U.S.A. have been at the forefront of this development, and have added a paper on ERM to their syllabuses. It is envisaged that other professional bodies around the world will do likewise. Should we start to collaborate more closely, and, rather than re-invent materials which exist elsewhere, use our energies to extend the global reach of actuaries?

4.5.19 The question is where to draw the line. What defines our profession and what makes it unique? Where does our special training end and commercial insights into how to run businesses begin? In the past, there have been discussions about the boundaries between strategic planning or the use of computers and technology, and actuarial science. Now the debate may be whether risk management or resource planning and management are different skills. Would encroaching upon them dilute what we really have to offer?

4.5.20 Other experts in statistics have vital contributions. Can we open up more active discussions to explore options?

4.5.21 While we feel convinced that there will still be a place for the technical actuary, we are not convinced that this is enough. We do not consider that the Profession should leave behind its strength in mathematics. We do believe, however, that this needs to be harnessed in conjunction with good communication and an understanding of the key issues.

4.5.22 So, a strong, technically skilled and business focussed actuary is needed to be the ERM actuary of the future.

5. Summary and Conclusions

5.1 We hope that we have given readers food for thought — something to help the newcomer to ERM, something to help the current relative expert practitioner and something to fuel debate about our future as a profession in the world of ERM. We hope that we have opened the door for the ERM actuary, and what may be required for the CRO.

5.2 At present, there is no complete and widely accepted definition of ERM. There is no one answer or framework to what ERM best practice is. It requires judgement and awareness of any given business's current position

to make a sensible suggestion about the steps required to develop a suitably tailored solution. This is the job for a well experienced CRO to evaluate, ideally assisted by the newly defined ERM actuary.

5.3 ERM has to incorporate both top down and bottom up approaches or methods, to ensure a solid risk management process. All key areas and units need to work together, across arbitrary departmental boundaries and continuously, to achieve the strategic outcome. Similarly, short-term and long-term strategies need to be set, with input from individual business units and areas, so that the risk is understood and the commitment can be achieved. We need to develop a series of principles against which practitioners can determine what they need to do next in developing their best practice.

5.4 This will include reference to whether the business strategy is proactive and opportunity seeking, or defensive and desiring to minimise the downside of risk.

5.5 Increasingly, ERM is seen as a way of adding value to an enterprise (about identifying *viable* opportunities, as much as or more than mitigating the downside of risks). The full engagement of the board is therefore essential, and the ERM process has to provide real world insights to assist in this involvement.

5.6 Planning and analytics, the traditional actuarial ground, are by no means the full answer to ERM — considered thinking, whilst essential, takes you only so far, and the unexpected will still happen. ERM is far more than modelling, and is not inhibited by inductive logic.

5.7 As well as understanding and modelling risk, we need to consider how control frameworks mitigate risk. It also highlights how deliberate decisions to live with risk affect inter-linkages and dependencies, and how cause and effect analyses might give greater insights. In general, we need to understand how to relate to other risk experts in an open and understandable manner.

5.8 Currently actuaries focus on modelling, the use of analytic techniques to inform risk management and, in particular, focus on the tail of the distribution of outcomes. They can be seen as specialists operating 'black boxes'. To progress as a Profession, we feel strongly that we should develop our core skills to include a wider understanding of the market. We also need to be more convincing in our flexibility and in our speed to react to change, and in our ability in decision making and leadership skills. ERM requires interpretation of the full range of outcomes — not just the extreme 'right hand tail'.

5.9 Further work includes:

(1) setting up an ERM Wiki and discussion forum;
(2) enhancing and the maintaining the best practice maturity profile;
(3) developing practical case studies;
(4) adding resource and support to the new ERM Practice Committee and the Risk Management Special Interest Group;

(5) taking part in both local and global initiatives in order to develop thinking, influence and presence, and to enhance educational opportunities;
(6) establishing and contributing to broadly-based discussion forums and think tanks;
(7) possibly developing a paper, or educational text, about how to implement an ERM framework (drawing on this paper and the GIRO case studies); and
(8) continuing to develop new modelling techniques.

5.10 With a sound ERM framework, a business can take more risks with more certainty; by behaving more confidently, it can be more successful. The upside in value creation far and away exceeds any costs of implementing and maintaining a full ERM framework. There is much for us to do if we want our Profession to develop into this space and to gain the leading reputation which we would want in such an important field.

6. Acknowledgements

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References

Cabinet Office (2002). *Risk improving Government's capability to handle risk and uncertainty*. Strategy Unit, Cabinet Office, HM Government, London, U.K.

Chapman, R.J. (2006). *Simple tools and techniques for enterprise risk management*. John Wiley & Sons, Inc., New Jersey, U.S.A.

Collins, J. (2001). *Good to great: why some companies make the leap ... and others don't*. HarperBusiness, New York, U.S.A.

COSO (2004a). Enterprise risk management — integrated framework, application techniques. COSO (The Committee of Sponsoring Organisations of the Treadway Commission), September 2004.

COSO (2004b). Enterprise risk management — integrated framework, executive summary. COSO (The Committee of Sponsoring Organisations of the Treadway Commission), September 2004. http://www.coso.org/Publications/ERM/COSO_ERM_ExecutiveSummary.pdf

Day, G.S. (2007). Is it real? Can we win? Is it worth doing?: managing risk and reward in an Innovation Portfolio. *Harvard Business Review*, December 2007.

DeLoach, J. (2000). *Enterprise-wide risk management*. Financial Times/Prentice Hall, England.

Garratt, R. (2003). *The fish rots from the head: the crisis in our boardrooms — developing the crucial skills of the competent director*. Profile Books Ltd., London, England.

Institute of Actuaries (2006). GN12: general insurance business: actuarial reports. Institute of Actuaries, London, http://www.actuaries.org.uk/files/pdf/map/GN12V4-0.pdf

Jones, A.R. *et al.* (2005). GRIT consultation paper. Institute of Actuaries. http://www.actuaries.org.uk/files/pdf/general_insurance/grit_consultation.pdf

Jones, A.R. *et al.* (2006). A change agenda for reserving. *British Actuarial Journal*, **12**, 435-619.

Jones, A.R. *et al.* (2007). Quantification and reporting of uncertainty for GI reserving. GI ROC (General Insurance Reserving Oversight Committee), Institute of Actuaries. http://www.actuaries.org.uk/files/pdf/general_insurance/giroc_reservingpaper_0807.pdf

Lam, J. (2003). *Enterprise risk management: from incentives to controls.* Wiley Finance.

Kloman, H.F. (1976). The risk management revolution. *Fortune.*

Kloman, H.F. (1999). Milestones: 1900 to 1999. *Risk Management Reports*, **26**(12).

McNamee, D. (2004). Risk reflections: based on his extensive experience. *Internal Auditor*, October 2004 (report of an interview).

Miccolis, J. (2000). Enterprise risk management in the financial services industry: from concept to management process. International Risk Management Institute. www.irmi.com/expert/articles/miccolis003.asp

Moyer, D. (2006). Blindsided. *Harvard Business Review.*

Orros, G. (2007a). ERM literature review. GIRO 2007 Convention, Institute and Faculty of Actuaries. http://www.actuaries.org.uk/files/proceedings/giro2007/BHPrize_Tripp_Appendices.zip and via http://www.actuaries.asn.au/NR/rdonlyres/1C5D0157-1B4E-4059-B75E-32F751723D99/2811/ERM_LitRev_Main_180807.pdf

Orros, G. (2007b). ERM bibliography and literature review. GIRO 2007 Convention, Institute and Faculty of Actuaries. http://www.actuaries.org.uk/files/proceedings/giro2007/BHPrize_Tripp_Appendices.zip and via http://www.actuaries.asn.au/NR/rdonlyres/1C5D0157-1B4E-4059-B75E-32F751723D99/2812/ERM_LitRev_Annex_180807.pdf

Roberto, M.A. *et al.* (2006). Facing ambiguous threats. *Harvard Business Review.*

Rumsfeld, D. (2002). Department of defense news briefing. February 12, 2002. http://www.quotationspage.com/quote/30526.html

Standard & Poor's (2005). *Insurance criteria: evaluating the enterprise risk management practices of insurance companies*. Standard & Poor's, McGraw Hill, U.S.A.

Taleb, N.N. (2004). *Fooled by randomness: the hidden role of chance in life and in the markets* (2nd edition). The Random House Publishing Group 2005, published in Penguin Books 2007, London, England.

Taleb, N.N. (2007). *The black swan: the impact of the highly improbable*. Allen Lane, an imprint of Penguin Books, London, England.

APPENDIX A

ERM BIBLIOGRAPHY

The following is the list of the more important books, papers and published texts on ERM, which is referred to in ¶2.1.5.

ACHARYYA, M. (2007). The fundamentals of designing an integrated model of financial risk and operational risk within an enterprise risk management framework: findings of an empirical study. 2007 CAS ERM Symposium. http://www.ermsymposium.org/2007/pdf/papers/Acharyya.pdf

BEASLEY, M. *et al.* (2007). Information conveyed in hiring announcements of senior executives overseeing enterprise-wide risk management processes. 2007 CAS ERM Symposium. http://www.ermsymposium.org/2007/pdf/papers/Pagach.pdf

BODOFF, N.M. (2007). Capital allocation by percentile layer. 2007 CAS ERM Symposium. http://www.ermsymposium.org/2007/pdf/papers/Bodoff.pdf

BOHN, C. & KEMP, B. (2006). *Enterprise risk management quantification — an opportunity*. Casualty Actuarial Society, U.S.A.

BRAZ, R. *et al.* (2006). *Enterprise risk management monograph*. American Society for Healthcare Risk Management, U.S.A.

BREHM, P. *et al.* (2007). *Enterprise risk analysis for property & liability insurance companies: a practical guide to standard models and emerging solutions*. Guy Carpenter & Company LLC, New York, U.S.A.

CABINET OFFICE (2002). *Risk improving Government's capability to handle risk and uncertainty.* Strategy Unit, Cabinet Office, HM Government, London, U.K.

CAREY, M. (2003). *COSO enterprise risk management framework comments.* DelCreo Inc., Utah, U.S.A.

CHAPMAN, R.J. (2006). *Simple tools and techniques for enterprise risk management*. John Wiley & Sons, Inc., New Jersey, U.S.A.

COLLINS, J. (2001). *Good to great: why some companies make the leap ... and others don't*. HarperBusiness, New York, U.S.A.

COSO (2004a). *Enterprise risk management — integrated framework, application techniques.* COSO (The Committee of Sponsoring Organisations of the Treadway Commission), September 2004.

COSO (2004b). *Enterprise risk management — integrated framework, executive summary.* COSO (The Committee of Sponsoring Organisations of the Treadway Commission), September 2004. http://www.coso.org/Publications/ERM/COSO_ERM_ExecutiveSummary.pdf

CROUHY, M. *et al.* (2006). *The essentials of risk management*. McGraw-Hill, U.S.A.

DAY, G.S. (2007). Is it real? Can we win? Is it worth doing?: managing risk and reward in an innovation portfolio. *Harvard Business Review.* December 2007.

DEFRA (2002). *Risk management strategy*. Department for Environment, Food and Rural Affairs, London, U.K.

DELOACH, J. (2000). *Enterprise-wide risk management.* Financial Times/Prentice Hall, England.

DELOITTE DEVELOPMENT LLC (2006). *The risk intelligent enterprise.* Deloitte Development LLC, U.K.

ERNST & YOUNG (2006). *Managing risk: stakeholder perspectives.* Ernst and Young Global Limited, U.S.A.

FINANCIAL SERVICES AUTHORITY (2006). Insurance sector briefing: risk management in insurers. http://www.fsa.gov.uk/pubs/other/isb_risk.pdf

FREESTONE, T. *et al.* (2006). Enterprise risk model for P&C companies. 2006 CAS ERM Symposium. http://www.ermsymposium.org/2006/pdf/papers/Freestone%20paper%204-7-06.pdf

Garratt, R. (2003). *The fish rots from the head: the crisis in our boardrooms — developing the crucial skills of the competent director.* Profile Books Ltd., London, England.
Gates, S. (2006). Incorporating strategic risk into enterprise risk management. XVème Conférence Internationale de Management Stratégique, Annecy/Genève 2006. http://www.strategie-aims.com/aims06/www.irege.univ-savoie.fr/aims/Programme/pdf/SP26%20GATES.pdf
Gorvett, R. & Nambiar, V. (2006). Setting up the enterprise risk management office. 2007 CAS ERM Symposium. http://www.ermsymposium.org/2006/pdf/papers/Gorvett%20and%20Nambiar%20paper.pdf
HM Treasury (2003). *Appraisal and evaluation in central Government (The green book) revised.* The Stationery Office, on behalf of HM Treasury, London, U.K.
HM Treasury (2004). *Management of risk — principles and concepts (The orange book) revised.* The Stationery Office, on behalf of HM Treasury, London, U.K.
Hoyt, R.E. & Liebenberg A.P. (2006). *Enterprise risk Mmnagement: evidence from the U.S. insurance industry.* University of Georgia, U.S.A.
Institute of Actuaries (2006). GN12: general insurance business: actuarial reports. Institute of Actuaries, London. http://www.actuaries.org.uk/files/pdf/map/GN12V4-0.pdf
Institute of Chartered Accountants (1999). Implementing Turnbull — a boardroom briefing. The Institute of Chartered Accountants in England and Wales. www.icaew.co.uk/viewer/index.cfm?AUB=TB2I_26539&tb5=1
Institute of Internal Auditors (2004). *The role of internal audit in enterprise-wide risk management.* The Institute of Internal Auditors, Florida, U.S.A.
Institute of Risk Management *et al.* (2002). *A risk management standard.* The Institute of Risk Management (IRM), The Association of Insurance and Risk Managers (AIRMIC) and ALARM, The National Forum for Risk Management in the Public Sector, U.K.
Jones, A.R. *et al.* (2005). GRIT consultation paper. Institute of Actuaries. http://www.actuaries.org.uk/files/pdf/general_insurance/grit_consultation.pdf
Jones, A.R. *et al.* (2006). A change agenda for reserving. Institute of Actuaries. *British Actuarial Journal*, **12**, 435-619.
Jones, A.R. *et al.* (2007). Quantification and reporting of uncertainty for GI reserving. GI ROC (General Insurance Reserving Oversight Committee), Institute of Actuaries. http://www.actuaries.org.uk/files/pdf/general_insurance/giroc_reservingpaper_0807.pdf
Kaufman, C. (2006). A strategy for incorporating risk assessment in the compliance and ethics agenda. http://www.aon.com/us/busi/risk_management/risk_consulting/ent_risk_mgmt/ERM_Compliance_WP.pdf
Kloman, H.F. (1976). The risk management revolution. *Fortune.*
Kloman, H.F. (1999). Milestones: 1900 to 1999. *Risk Management Reports*, **26**(12).
KPMG (2001). *Enterprise risk management: an emerging model for building shareholder value*. KPMG International, Switzerland.
KPMG (2006). *Risk and capital management for insurers*. KPMG International, Switzerland.
Lam, J. (2003). *Enterprise risk management — from incentives to controls*. John Wiley & Sons, Inc., New Jersey, U.S.A.
McConnell, P. (2004). A 'standards based' approach to operational risk management under Basel II. http://www.m-bryonic.co.uk/library/ORStandards.pdf
McDonald, J.R. & Rivera, J. (2006). *Enterprise risk management and improved shareholder value.* St Edward's University.
McDonnell, W. (2002). Managing risk: practical lessons from recent "failures" of E.U. insurers. Occasional Paper 20, Financial Services Authority, London, U.K.
McNamee, D. (2004). Risk reflections: based on his extensive experience. *Internal Auditor*, October 2004 (report of an interview).
Miccolis, J. (2000a). Enterprise risk management in the financial services industry: from concept to management process. International Risk Management Institute. www.irmi.com/expert/articles/miccolis003.asp

Miccolis, J. (2000b). Enterprise risk management in the financial services industry: still a long way to go. IRMI (International Risk Management Institute). http://www.irmi.com/Expert/Articles/2000/Miccolis08.aspx

Mosher, M.C. (2006). *A.M. Best comments on enterprise risk management and capital models*. A.M. Best Company Inc., NJ, U.S.A.

Moyer, D. (2006). Blindsided. *Harvard Business Review*, December 2006.

National Audit Office (2000). *Supporting innovation: managing risk in Government Departments.* The Stationery Office, London, U.K.

National Audit Office (2004). *Managing risks to improve public services.* The Stationery Office, London, U.K.

Nikonov, R. (2007). Efficient project portfolio as a tool for enterprise risk management. 2007 CAS ERM Symposium. http://www.ermsymposium.org/2007/pdf/papers/Nikonov.pdf

Orros, G. (2007a). ERM literature review. GIRO 2007 Convention, Institute and Faculty of Actuaries. http://www.actuaries.org.uk/files/proceedings/giro2007/BHPrize_Tripp_Appendices.zip and via http://www.actuaries.asn.au/NR/rdonlyres/1C5D0157-1B4E-4059-B75E-32F751723D99/2811/ERM_LitRev_Main_180807.pdf

Orros, G. (2007b). ERM bibliography and literature review. GIRO 2007 Convention, Institute and Faculty of Actuaries. http://www.actuaries.org.uk/files/proceedings/giro2007/BHPrize_Tripp_Appendices.zip and via http://www.actuaries.asn.au/NR/rdonlyres/1C5D0157-1B4E-4059-B75E-32F751723D99/2812/ERM_LitRev_Annex_180807.pdf

PriceWaterhouseCoopers (2003). *Developing a strategy to manage enterprisewide risk in higher education.* NACUBO and PriceWaterhouseCoopers, U.S.A.

PriceWaterhouseCoopers (2004a). *7th annual CEO survey — managing risk: an assessment of CEO preparedness.* PriceWaterhouseCoopers, U.S.A.

PriceWaterhouseCoopers (2004b). *Enterprise-wide risk management for the insurance industry: global study.* PriceWaterhouseCoopers, U.S.A.

PriceWaterhouseCoopers (2006). *Enterprise risk management (ERM) benchmarking survey 2006.* PriceWaterhouseCoopers, Finland.

Protiviti (2006). *Guide to enterprise risk management: frequently asked questions.* Protiviti Inc., U.S.A.

Rech, J.E. (2005). Enterprise risk management for insurers: theory in practice. Contingencies. http://www.contingencies.org/novdec05/enterprise_1105.asp

Roberto, M.A. *et al.* (2006). Facing ambiguous threats. *Harvard Business Review*, November 2006.

Ross, A. (2005). *The evolving role of the CRO, sponsored by ACE, Cisco Systems, Deutsche Bank and IBM.* The Economist Intelligence Unit.

Ross, C.F. & Rasmussen, M. (2005). *The Forrester wave TM: enterprise risk management consultants, Q4 2005.* Forrester Research Inc., Cambridge, MA, U.S.A. Also http://www.deloitte.com/dtt/cda/doc/content/dtt_ers_The%20Forrester%20Wave_Enterprise%20Risk%

Rumsfeld, D. (2002). Department of Defense news briefing, February 12, 2002. http://www.quotationspage.com/quote/30526.html

Sharma, P. *et al.* (2002). Prudential supervision of insurance undertakings: report of the London working group on Solvency II. Conference of the Insurance Supervisory Services of the Member States of the European Union, Paris, France.

Schmidt Bies, S. (2006). A bank supervisor's perspective on enterprise risk management. *BIS Review* 34/2006.

Slywotsky, A.J. & Drzik, J. (2005). Countering the biggest risk of all. *Harvard Business Review*, April 2005.

Society of Actuaries (2006). *Enterprise risk management specialty guide.* Society of Actuaries, U.S.A.

Standard & Poor's (2005). *Insurance criteria: evaluating the enterprise risk management practices of insurance companies*. Standard & Poor's, McGraw Hill, U.S.A.

Taleb, N.N. (2004). *Fooled by randomness: the hidden role of chance in life and in the markets* (2nd edition). The Random House Publishing Group 2005, published in Penguin Books 2007, London, England.

Taleb, N.N. (2007). *The black swan: the impact of the highly improbable*. Allen Lane, an imprint of Penguin Books, London, England.

Towers Perrin Tillinghast (2000a). *Enterprise risk management: an analytic approach.* Towers Perrin Tillinghast, U.S.A.

Towers Perrin Tillinghast (2000b). *Enterprise risk management in the insurance industry: 2000 benchmarking survey report*. Towers Perrin Tillinghast, U.S.A.

Towers Perrin Tillinghast (2002). *Enterprise risk management in the insurance industry: 2002 benchmarking survey report*. Towers Perrin Tillinghast, U.S.A.

Towers Perrin Tillinghast (2006). *Risk management risk opportunity. The 2006 Tillinghast ERM survey*. Towers Perrin Tillinghast, U.S.A.

Vance, B. & Makomaski, J. (2007). *Enterprise risk management for dummies.* RIMS, Wiley Publishing, U.S.A.

Wang, S. & Faber, R. (2006). *Enterprise risk management for property-casualty insurance companies*. Jointly sponsored by CAS, ERM Institute International Ltd and joint CAS/SOA Risk Management Section, U.S.A.

Zhang, Y. (2007). Why should an insurance firm charge for frictional costs? 2007 CAS ERM Symposium. http://www.ermsymposium.org/2007/pdf/papers/Zhang.pdf

APPENDIX B

DRAFT: CA1 CORE APPLICATIONS: ACTUARIAL RISK MANAGEMENT SYLLABUS FOR THE 2009 EXAMINATIONS — 1 JUNE 2008

THE FACULTY OF ACTUARIES AND INSTITUTE OF ACTUARIES

Aim

The aim of the Core Applications — Actuarial Risk Management subject is that upon successful completion, the candidate should understand generic issues in the management of the business activities of financial institutions and programmes, including the processes for management of the various types of risk faced, and be able to analyse the issues and formulate, justify and present plausible and appropriate solutions to business problems.

Links to other subjects

Each of Subjects CT1–CT8 provides principles and tools that are built upon in Core Applications — Actuarial Risk Management.

The Specialist Technical Subjects ST1–ST6 and the Specialist Applications Subjects SA1–SA6 use the principles developed in this subject to solve complex problems, to produce coherent advice and to make recommendations in specific practice areas.

Objectives

On the successful completion of this subject the candidate will be able to:

B.1 How to do a professional job

- Describe how actuaries can contribute to meeting the business needs of their clients and other stakeholders.
- Describe the statutory roles that may be required of actuaries in pensions and insurance, both in the public and private sectors.
- Outline the professionalism framework of the Actuarial Profession and the difference between ethical or conduct standards and technical or practice standards.
- Describe the factors and issues to be taken into account when doing a professional job.
- Describe the Actuarial Control Cycle and explain the purpose of each of its components.

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— Demonstrate how the Actuarial Control Cycle can be applied in a variety of practical commercial situations, including its use as a Risk Management Control Cycle.

B.2 Stakeholders and their needs

— Identify the clients that actuaries advise in both the public and private sectors and the stakeholders affected by that advice.
— Describe how stakeholders other than the client might be affected by any actuarial advice given.
— Describe the functions of the clients and potential clients that actuaries advise and the types of advice that actuaries might give to their clients.
— Explain why and how certain factual information about the client should be sought in order to be able to give advice.
— Explain why subjective attitudes of clients and other stakeholders — especially towards risk — are relevant to giving advice.
— Distinguish between the responsibility for giving advice and the responsibility for taking decisions.
— Describe the main providers of benefits on contingent events.
— Describe how products, schemes, contracts and other arrangements can provide benefits on contingent events.
— Describe the ways of bringing together stakeholder needs and the benefits on contingent events provided by financial and other products, schemes, contracts and other arrangements.

B.3 General environment

— Risk environment
  — Describe the risk management process for a business that can aid in the design of products, schemes, contracts and other arrangements to provide benefits on contingent events.
  — Describe how risk classification can aid in the design of products, schemes, contracts and other arrangements that provide benefits on contingent events.
  — Discuss the difference between systemic and diversifiable risk.
  — Discuss risk appetite and the attainment of risk efficiency.
  — Describe credit risk and the use of credit ratings.
  — Describe liquidity risk.
  — Describe market risk.
  — Describe operational risk.
  — Describe business risk.
  — Describe attitudes to and methods of risk acceptance, rejection, transfer and management for stakeholders.

- — ***Discuss the portfolio approach to the overall management of risk, including the use of diversification and avoidance of risk concentrations.***
- — Discuss the circumstances in which risk can be seen as an opportunity rather than a constraint.
- — Describe the principle of pooling risks.
- — Describe the role of insurance and reinsurance for transferring risks.
- — Describe how integrated risk management at the enterprise level can add value to the management of a business.
- — Describe the risks and uncertainties affecting:
  - — The level and incidence of benefits payable on contingent events
  - — The overall security of benefits payable on contingent events
- — Regulatory environment
- — Describe the principles and aims of prudential and market conduct regulatory regimes.
- — Explain the concept of information asymmetry.
- — Explain how certain features of financial contracts might be identified as unfair.
- — Discuss the implications of a requirement to treat the customer fairly.

— External environment
- — Describe the implications for the main providers of benefits on contingent events of:
- — legislation — regulations
- — state benefits
- — tax
- — accounting standards
- — capital adequacy and solvency
- — corporate governance
- — risk management requirements
- — competitive advantage
- — commercial requirements
- — changing social trends
- — environmental issues
- — lifestyle considerations
- — international practice
- — technological changes

— Investment environment
- — Discuss the cashflows of simple financial arrangements and the need to invest appropriately to provide for financial benefits on contingent events.
- — Demonstrate a knowledge and understanding of the charac-

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teristics of the principal investment assets and of the markets in such assets.
- Explain the principal economic influences on investment markets.
- Describe the main features of the behaviour of market price levels and total returns and discuss their relationships to each other.
- Discuss the theoretical and historical relationships between the total returns and the components of total returns, on equities, bonds and cash, and price and earnings inflation.

— Capital requirements
- Discuss why the main providers of benefits on future financial events need capital.
- Describe how the main providers of benefits on contingent events can meet, manage and match their capital requirements.
- Discuss the implications of the regulatory environment in which the business is written for provisioning and capital requirements.
- Discuss different measures of capital needs.
- Discuss the relative merits of looking at an economic balance sheet in order to consider the capital requirements of a provider of benefits on contingent events.
- Discuss the use of internal models for assessment of economic and regulatory capital requirements.

B.4 Specifying the problem

— Contract design
- Discuss the factors to be considered in determining a suitable design for financial structures e.g. products, schemes, contracts or other arrangements that will provide benefits on contingent events in relation to:
  - the characteristics of the parties involved
  - the risk appetite or risk aversion of the parties involved
  - the level and form of benefits to be provided
  - any options or guarantees that may be included
  - the benefits payable on discontinuance or transfer of rights
  - the method of financing the benefits to be provided
  - the choice of assets when benefits are funded
  - the charges that will be levied
  - the capital requirements
- Describe how the design of products, schemes, contracts and other arrangements can be used to help develop corporate human resource strategy.

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- Project planning and management
  - Describe the process of project management.
  - Show how actuarial techniques can be used in the assessment of capital investment projects and cost-benefit analyses.
  - Discuss how the risks of the project are taken into account in project management.

B.5 Data

- Discuss the data requirements for determining values for assets, future benefits and future funding requirements.
- Describe the checks that can and should be made on data.
- Describe the circumstances under which the ideal data required might not be available and discuss ways in which this problem may be overcome.
- Describe how to determine the appropriate grouping of data to achieve the optimal level of homogeneity.

B.6 Risk management

- ***Discuss the issues surrounding the management of risk.***
- Describe the tools that can be used to aid the management of risk. Discuss the methods of measuring risk that can be used by the main providers of benefits on contingent events.
- Discuss the importance of risks with low likelihood but high impact and how they might be managed.
- Discuss the use of scenario analysis, stress testing and stochastic modelling in the evaluation of risk.

B.7 Producing the solution

- Modelling
  - Describe the approaches available to produce the solutions.
  - Describe the use of actuarial models to support the methodology used in terms of:
    - the objectives of and requirements for building a model the basic features of a model required to project future cash and revenue flows
    - the use of these models for:
      - pricing or setting future financing strategies
      - risk management
      - assessing the capital requirements and the return on capital or the funding levels required
      - assessing the provisions needed for existing commitments to provide benefits on future financial events

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  - pricing and valuing options and guarantees
  - how sensitivity analysis of the results of the models can be used to help decision making.
- Assumption setting
  Describe the principles behind the determination of assumptions as input to a model relevant to producing a specific solution having regard to:
  - the types of information that may be available to help in determining the assumptions to be used the extent to which each type of information may be useful, and the other considerations that may be taken into account, in deciding the assumptions
  - the level of prudence in the assumptions required to meet the objectives of the client
- Expenses
  - Describe the types of expenses that the providers of benefits on future financial events must meet.
    Describe how expenses might be allocated when pricing products, schemes, contracts or other arrangements.
- Developing the cost and the price
  - Discuss how to determine the cost of providing benefits on contingent events.
  - Discuss the factors to take into account when determining the appropriate level and incidence of contributions to provide benefits on contingent events.
  - Discuss the factors to take into account when determining the price or the contributions to charge for benefits on contingent events.
  - Discuss the influence of provisioning or reserving requirements on pricing or setting financing strategies.
- Investment management
  - Discuss the principles and objectives of investment management and analyse the investment needs of an investor, taking into account liabilities, liquidity requirements and the risk appetite of the investor.
  - Discuss the different methods for the valuation of individual investments and demonstrate an understanding of their appropriateness in different situations.
  - Discuss the different methods for the valuation of portfolios of investments and demonstrate an understanding of their appropriateness in different situations.
  - Show how actuarial techniques and asset/liability modelling may be used to develop an appropriate investment strategy.
  - Discuss methods of quantifying the risk of investing in different classes and sub-classes of investment.

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- — Describe the use of a risk budget for controlling risks in a portfolio.
- — Provisioning
  - — Discuss the different purposes for the valuation of the benefits from financial and other products, schemes, contracts and other arrangements and the impact on the choice of methodology and assumptions.
  - — Discuss how to determine values for provisions in terms of:
    - — the need for placing values on provisions and the extent to which values should reflect risk management strategy the principles of 'fair valuation' of assets and liabilities and other 'market consistent' methods of valuing the liabilities. the reasons why the assumptions used may differ in different circumstances.
    - — the reasons why the assumptions and methods used to place a value on guarantees and options may differ from those used for calculating the accounting provisions needed
    - — the use of replicating portfolios for valuing liabilities
    - — the use of stochastic deflators and other stochastic discount methods.
    - — how sensitivity analysis can be used to check the appropriateness of the values and be able to perform calculations to demonstrate an understanding of the valuation methods.
  - — Describe different methods of allowing for risk in cash-flows.
  - — Discuss different methods of allowing for uncertainty in present values of liabilities.
  - — Discuss the purpose of and uses for equalisation reserves.
  - — Describe the influence of comparisons with market values.
- — Relationship between assets and liabilities
  - — Describe the principles of investment and the asset/liability matching requirements of the main providers of benefits on future financial events.
  - — Discuss the use of portfolio theory to take account of an investor's liabilities.
  - — Discuss the need to monitor investment performance and to review investment strategy.

B.8 Living with the solution

- — Maintaining profitability
  Describe how the main providers of benefits on contingent events can control and manage the cost of:
  - — payments arising on contingent events
  - — expenses associated with the payment of benefits on contingent events

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- Determining the expected results
  - Describe how a provider's expected results can be projected.
  - Discuss the possible sources of surplus/profit and the levers that can control the amount of surplus/profit.
- Reporting actual results
  - Describe the reports and systems which may be set up to control the progress of the financial condition of the main providers of benefits on contingent events.
  - Describe the reports and systems which may be set up to monitor and manage risk at the enterprise level.
  - Discuss the issues surrounding reporting on risk facing the main providers of benefits on contingent events.
- Asset management
  Describe the principles of asset management and allocation.
- Capital management
  Describe the principles of capital management.
- Surplus management
  - Describe why a provider will carry out an analysis of the changes in its surplus/profit.
  - Describe how any surplus/profit arising may be distributed.
  - Discuss the issues surrounding the amount of surplus/profit that may be distributed at any time and the rationale for retention of surplus/profit.
- Insolvency and closure
  Discuss the issues that need to be taken into account on the insolvency or closure of a provider of benefits on contingent events.
- Options and guarantees
  Discuss the issues surrounding the management of options and guarantees.

B.9 Monitoring

- Describe how the actual experience can be monitored and assessed, in terms of:
  - the reasons for monitoring experience
  - the data required
  - the process of analysis of the various factors affecting the experience
  - the use of the results to revise models and assumptions
- Describe how the results of the monitoring process in the Actuarial Control Cycle or the Risk Management Control Cycle are used to update the financial planning in a subsequent period.

B.10 Have an understanding of the principal terms used in financial services and risk management.

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APPENDIX C

DRAFT ST9: ENTERPRISE RISK MANAGEMENT SPECIALIST TECHNICAL SYLLABUS FOR THE 2010 EXAMINATIONS

THE FACULTY OF ACTUARIES AND INSTITUTE OF ACTUARIES

Note

The syllabus below is intended to give an overview of the topics that the student should be able to master in order to be able to gain the UK Profession's proposed new ERM credential. This is currently being worked on with the Society of Actuaries and Casualty Actuarial Society in the USA (via Harry Panjer) to ensure international equivalence. Thus the syllabus itself contains more material than would be required for study for any examination; there is much overlap with CA1 for example. The syllabus will be refined in length and content before it constitutes a standalone exam.

It is perhaps noteworthy also that the Profession's proposed ERM credential is likely to be introduced at a level above associateship. This arises from the fact that all of the current subjects (CTs and CAs) are currently deemed necessary for the appellations "associate'' and "actuary''.

Aim

The aim of the Enterprise Risk Management Specialist Technical subject is to instil in successful candidates the ability to apply, in simple situations, the principles of enterprise risk management within functions of actuarial planning and control on sound financial lines.

Links to other subjects

Subject CA1 — Core Applications: Actuarial Risk Management will provide a grounding for this subject.

Subjects ST1 — ST8 — All other Specialist Technical subjects will contain elements of the material covered in ST9.

The Specialist Applications Subjects SA1–SA6 use the principles developed in this subject to solve complex problems, to produce coherent advice and to make recommendations in specific practice areas.

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Objectives

On completion of this subject the candidate will be able to:

C.1 Understand the principal terms in Enterprise Risk Management (ERM)

C.2 Discuss what is meant by risk and uncertainty.

- Show an awareness that there is no one accepted definition of risk.
- Discuss different definitions and concepts of risk including:
  - Variability in possible future outcomes
  - Quantifiable probabilities associated with different outcomes
  - The unquantifiable possibility of losses associated with different future events
  - The possibility of adverse outcomes
  - The negative impact of an adverse event
  - Other definitions given in textbooks or used by professional bodies
- Discuss how risk and uncertainty can be subdivided according to:
  - Whether or not the risk depends on future uncertain events or on past events that have yet to be assessed or past events that have already been assessed
  - Whether the risk has been identified or not

C.3 Full risk taxonomy:

- Demonstrate an understanding of the following types of risk:
  - Market risk (including interest rate risk, inflation risk and asset-specific risks such as equities, property, credit spreads)
  - Default risk
  - Insurance risks (including longevity, mortality and persistency)
  - Underwriting risk (including model and parameter risk)
  - Operational risk (including extreme weather, computer systems, fraud)
  - Concentration
  - Legal and regulatory risk
  - Liquidity risk
- Demonstrate an awareness of how individual risks might be categorised in different ways (e.g. credit risk incorporates default risk, re-rating risk and credit-spread risk).
- Discuss the extent to which each of the above risks can be amenable to quantitative analysis.
- Discuss the role of model and parameter risk in each of the above risks.

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C.4 Why is it necessary or desirable to manage risk?

- Discuss the relevance of risk measurement and management to the following stakeholders:
  - Policyholders and customers
  - Regulators
  - Government
  - Company directors
  - Professional advisers
  - Shareholders or equivalent
  - The general public
- Show an understanding of the role of contagion and how it affects different stakeholders.
- Discuss important past examples of risk failures (including Barings Bank, Orange County, Drexel, Long Term Capital Management, Equitable Life, Northern Rock) and discuss how better risk management might have prevented these failures.
- Analyse hypothetical examples *ex ante* and discuss how the situations described could benefit from risk management.

C.5 Basel II and Solvency II and analysis of their underlying principles.

- Demonstrate an understanding of the objectives of Basel II and Solvency II.
- Describe the three pillar approach under each of Basel II and Solvency II.
- Under Basel II, describe the different calculation methods that can be used to assess credit risk.
- Discuss the latest developments under Solvency II.
- Under Solvency II, describe the approach to risk measurement using the Standard Formulae and using an Advanced Approach.
- Discuss the commercial implications resulting from the introduction of Basel II and Solvency II.

C.6 Describe the role of credit-rating agencies.

- Describe the criteria used by ratings agencies for grading an organisation's risk management processes.
- Demonstrate an understanding of why these criteria are relevant.

C.7 Analyse quantitative financial and insurance data using modern statistical methods (including asset prices, credit spreads and defaults, interest rates and insurance losses).

- Analyse univariate financial time series data
  - Describe the different types of distribution for financial returns including fat tailed distributions and discuss how to choose which distribution is most suitable.

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- Discuss the role of hypothesis tests, diagnostic tests and model selection criteria in choosing the most appropriate distribution or model.
- Demonstrate an awareness of why it is important to model accurately the tails of the returns distribution.
- Demonstrate an awareness of how extreme value theory can be used to help model risks that have a low probability.
- Describe how to verify the assumptions underpinning extreme value theory.
- Describe and apply formal and diagnostic tests for the independence of a sequence of random variables.
- Discuss the evidence for non-constant volatility in financial returns data.
- Demonstrate an awareness of the different models for stochastic volatility including GARCH models.

— Discuss the different statistical methods that can be used to analyse multivariate financial time series data.
- Describe the common multivariate distributions (including the multivariate normal, t, non-central-t, and normal mixture distributions.
- Show how to develop factor models for multivariate risks.
- Show how dimension reduction methods and principal components analysis can be used to improve the reliability of models for multivariate risks.
- Describe the following measures of correlation and discuss the relative merits of each: Pearson correlation; Rank correlation; Spearman's rho.
- Define what is meant by a copula and describe the basic properties of a copula.
- Describe the following copulas: Gaussian, t, Gumbel, Clayton, Archimedean.
- Show how copulas can be used as part of the process of modelling multivariate risks.
- Define what is meant by tail correlation.
- Demonstrate an awareness of how tail correlation can differ from the conventional definition of correlation.
- Discuss the importance of tail correlation in measuring and managing multivariate risks.

— Discuss the extent to which multivariate operational risks can be subjected to statistical analysis.

C.8 Show an awareness of how to assess and manage operational risk.

— Discuss the importance of operational risk: distinguishing it from other more "quantitative" risks and emphasising increasing emphasis from both the regulatory and commercial perspectives.

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- Describe the different ways of quantifying operational risk under Basel II.
- Discuss the data requirements that must be satisfied to permit the use of an advanced measurement approach to the assessment of operational risk under Basel II.
- Describe the key challenges and how to carry out a scenario analysis for determining operational risk capital as an alternative to the advanced approach.
- Describe how to use scenario analysis to synthesize data for modelling, including main distributions, distribution fitting and Monte-Carlo analysis.
- Discuss the advantages and disadvantages of scenario analysis for operational risk.
- Discuss issues surrounding quantification of operational risk for capital purposes including how to combine information from different sources: internal data; external data; and scenario analysis.
- Discuss the role of an operational risk committee.
- Discuss how to develop a crisis management strategy.

C.9 The determination of capital adequacy using risk measures.

- Discuss the advantages and disadvantages of Value-at-Risk (VaR) as a measure of risk.
  - Define VaR.
  - Discuss how, for example, the 95% VaR ignores extreme risks.
- Demonstrate an understanding of how different parts of an organisation and different parts of a portfolio will be subject to different capital adequacy standards, and discuss how these vary according to the type of organisation.
- Define what is meant by a coherent measure of risk.
- Define expected shortfall as a measure of risk and show that it is a coherent measure of risk.
- Define the probability of ruin as a measure of risk.
- Discuss what acceptable levels might be for the probability of ruin for different organisations and time horizons including examples of the consequences of using different probability levels.
- Demonstrate an understanding of how to allocate capital across an organisation including: risk versus return; and the Euler method.

C.10 The risk measurement and management process

- Show an awareness of how different time horizons are suitable for different risks including: bank trading; and pension funds.

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- Discuss how to choose a suitable risk discount rate for difficult-to-quantify risks.
- Discuss how the risk discount rate might depend on the stakeholder seeking to measure and manage risk.
- Demonstrate an awareness of the difference between risk evaluation and risk management including examples of how risk can be measured and ways that they can be managed.
- Discuss, through the use of case studies, how different organisations measure and manage risk including:
  - A bank owning an insurance company
  - An insurance company owning a bank
  - Why insurance companies are happy to buy and hold risks over a long period of time
  - How retail banks follow an originate-and-distribute strategy where risk is backed out into the market, reflecting a low appetite for long-term risk.
- Discuss the tensions involved when, for example, a bank is owned by an insurance company.

C.11 Discuss how to work beyond the confines of a single stochastic model and a single calibration of that model.

- Describe the use of scenario analysis and stress testing in the risk measurement process.
  - Describe the difference between scenario analysis and stress testing.
  - Discuss how to choose a good set of scenarios.
  - Demonstrate an understanding of the advantages and limitations of scenario analysis including what the scenarios can reveal and what they do not explain.
  - Discuss the advantages and disadvantages of stress testing.
- Discuss how to take account of model and parameter risk.
  - Demonstrate an awareness of the importance of using a number of different models and what this might reveal.
  - Discuss the advantages and disadvantages of using different models.
  - Describe techniques that can be used for assessing parameter risk.
- Discuss how the decision-making process builds on of the results of stochastic modelling, scenario analysis, stress testing and analysis of model and parameter risk including: how senior executives satisfy themselves that the information they receive is correct.
- Demonstrate an awareness of the fact that decisions have to be made on the basis of incomplete information (e.g. mergers and acquisitions).

C.12 Risk optimisation and responses to risk

- Show an awareness that risk presents opportunities (upside) as well as dangers (downside).
- Discuss how to optimise an objective, possibly subject to constraints (including a review of portfolio theory efficient frontiers and indifference curves).
- Discuss how to maintain risk efficiency.
- Discuss risk optimisation and responses to risk through illustrative examples including hedge funds, porous car parks, hip replacements, leveraging, secondary risks.

C.13 Credit risk

- Discuss the different sources of credit risk to which a financial or other enterprise might be exposed.
- Discuss the financial instruments that explicitly provide exposure to credit risk such as credit derivatives.
- Discuss what is meant by a credit spread.
- Demonstrate an understanding of the sources of credit risk: correlations, contagion, loss given default etc.
- Demonstrate an understanding how these and other sources (e.g. liquidity, term to maturity) translate into credit spreads etc.
- Show how to use credit derivatives (e.g. CDO's) to mitigate credit risk.
- Discuss the role of credit insurance in the financial markets.
- Discuss the different theoretical and commercial approaches to modelling credit risk including:
  - Structural versus reduced form models
  - The KMV approach
  - The CreditMetrics approach
  - Modelling of a basket of risks: factor models, mixture models, copulas
  - Calculating the loss distribution
  - Calibration and estimation

C.14 Discuss the risk management control cycle.

- Describe the different approaches to the control cycle.
- Discuss how to determine a company's risk appetite.
- Discuss how to identify risks.
- Describe how to regularly analyse, measure and assess risks.
- Discuss the practical application of the available methodologies for managing the full range of risks to which an enterprise might be exposed, including strategic, project and operational risks.

- Define what is meant by "enterprise risk management" (ERM).
- Describe the different people who might be involved in the ERM process.
- Describe the role of the following concepts in ERM
  - The holistic approach
  - Remedial action
  - Downside and upside risks
  - Unquantifiable risks
- Describe the following tools in the ERM toolkit (not listed elsewhere):
  - Brainstorming
  - Social benefit analysis
  - Concept mapping
  - Horizon scanning
  - Pattern recognition
  - Influence diagrams
  - Decision criteria for projects
- Describe how to share risk through financial and legal structures including risk securitisation.
- Describe approaches that can be used to manage an organisation's overall risk profile.
  - Describe how risks can be bundled to manage risk for specific stakeholders. (For example, with profits fund from shareholder perspective. Candidates should understand that risks are often bundled for the needs of customers eg equity fund with a guarantee of no capital loss.)
  - Describe how complex risks can be unbundled (with reference to specific examples) to allow specific risks to be securitised, hedged or insured against, including: with-profits funds; pension funds.
  - Demonstrate an understanding of how to identify the risks that remain after unbundling, securitisation, hedging and insurance and how to identify any new risks that might emerge as a result of this process.
  - Describe (with reference to specific examples) the role of risk capital in mitigating against risks that cannot be unbundled, insured against or hedged.
  - Demonstrate an understanding of how an organisation's capacity to manage risk is affected by regulatory constraints, the external demand for risks being transferred, and the maximum price the organisation is prepared to pay for risk mitigation.
  - Demonstrate an understanding that removing downside risks might also remove the potential for upside gains.

- Discuss how the risk-reward trade-off can lead to the retention of specific risks.
- Discuss the portfolio approach to overall risk.
  - Show how to identify the common risks and causes of risk.
  - Describe the role of factor analysis.
  - Describe other approaches to modelling dependence including copulas. (See McNeil, Frey and Embrechts.)
- Discuss the cultural aspects of risk assessment and management, including the problems of bias.
- Discuss an organisation of risk management and control within an appropriate culture.
- Discuss the lessons from real-life case studies: good and bad practice; what can we learn from disasters.
  - Examples from: life, non-life, health; banking; two others in non-actuarial situations
- Discuss how to adopt best practice in ERM in compliance and corporate governance.
- Discuss methods of communicating results to board, consumers, regulators and shareholders.
- Demonstrate an awareness of practical issues, such as:
  - methods of dealing with bias
  - managing relationships with third parties and the public
  - limitations on the extent to which risks can be transferred
  - getting risk leadership from busy boards
  - the treatment of tax
  - conversion of experts' views into probability distributions
  - dealing with uncertainties such as political, social and environmental risks
  - risks arising from short-term pressures

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