

**FINAL REPORT**  
**OF THE ADVISORY COMMITTEE**  
**ON ENTERPRISE RISK MANAGEMENT**



**November 5, 2001**

**Casualty Actuarial Society  
Advisory Committee on Enterprise Risk Management**

**Final Report**

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**Casualty Actuarial Society  
Advisory Committee on Enterprise Risk Management**

**Final Report**

**I. Executive Summary**

The Advisory Committee on Enterprise Risk Management (the Committee) has conducted a thorough and systematic assessment of the research and education needs of the CAS on the subject of Enterprise Risk Management (ERM) – the centerpiece of which was a formal survey of the CAS membership – and has developed a set of specific recommendations to meet those needs. Given the importance of this subject to the future of the CAS, the Committee adopted an aggressive timetable for its work. This report presents our charge, our work process, our results, our recommendations, and our additional thoughts. Our recommendations are highlighted in this Executive Summary.

To guide our work, we developed a working definition of ERM for CAS purposes, and a conceptual “ERM Framework” that specifies the Risk Types covered by ERM and the sequential steps of the Risk Management Process. Central to our definition and Framework is the notion that ERM is not merely a defensive process, but a proactive value creation tool.

In the area of research, we recommend that 12 specific topics within ERM be the subject of focused research. Each of these topics is assigned a priority, which varies according to industry focus. The recommended research methods for each topic are identified. We also recommend that a standing ERM Research Committee be formed to direct and monitor this research, and to take responsibility for related tasks such as maintaining an updated ERM bibliography (an initial bibliography has been drafted by the Committee), providing advice and content to the CAS committees that plan ERM-related seminars and workshops, partnering with other professional organizations as appropriate, developing ERM messages for the CAS to communicate internally and externally, and designating ERM media spokespersons.

In the area of education, we recommend a series of approaches in specific areas to close the gap between current and desired level of knowledge within each element of the ERM Framework. These approaches range from exam syllabus treatment to annual ERM seminars, to tracks/sessions within existing seminars, to self-study guidance, depending on the subject area within the Framework, and reflect the expressed preferences of the CAS membership regarding education methods. These recommendations can be carried out through existing CAS committees, as specified in our recommendations – no new committee or other organizational change is required. To assist these committees, we have drafted a complete set of “Learning Objectives” for each element of the ERM Framework.

We also provide recommendations for enhancing CAS visibility in the ERM arena.

The Committee respectfully requests that our recommendations be promptly approved. There is currently a leadership void among the various professional organizations with interest in ERM, and the CAS is well positioned to assume this leadership role. The ERM approach also presents an opportunity to create a compelling business-relevant whole of the currently unconnected parts of the casualty actuarial discipline, and in the process aid the recruitment of candidates who are asking thoughtful questions about the relevance of the CAS to their careers. Finally, it is evident from our research that the CAS membership is looking for clear and assertive movement in the direction we are recommending.

## **II. Our Charge**

The CAS Executive Council (EC) established the Advisory Committee on Enterprise Risk Management (the Committee) in the summer of 2000 with the following charge:

“The CAS Advisory Committee on Enterprise Risk Management is to identify research and education that the CAS should undertake in the area of enterprise risk management. The Committee is to recommend methods, priorities, and timetables to the EC for implementing that research and education, but is not expected to carry the work out itself. The Committee should learn about and monitor efforts by other CAS committees and recommend any additional efforts it considers appropriate to be undertaken by existing or new committees and task forces. A broad definition of enterprise risk management will be used by the Committee in determining the scope of its work.”

The CAS received a very large number of volunteers for this Committee. The Committee was ultimately staffed by Mike Belfatti, Martin Cauchon, Ed Davenport, Kevin Dickson, Chuck Emma, John Kollar, John Kryczka, Marc-Andre Lefebvre, Larry Marcus, Jerry Miccolis (chair), Chris Nelson, Andrew Rippert, Joe Wallen, Bill Yit, and Ted Zubulake. Mary Frances Miller was assigned to the Committee as EC Liaison.

### **III. Our Work Process and Results**

The Committee met approximately every two months between August 2000 and October 2001. Significant work was performed between full Committee meetings by various short-duration, special-purpose subcommittees.

During the course of its work, the Committee communicated with such other CAS committees as the DFA Committee, the Syllabus Committee, and the Continuing Education Committee. The Committee worked extensively with the Committee on Special Interest Seminars to plan and staff the CAS's April 2001 special interest seminar "Understanding the Enterprise Risk Management Process", and made a presentation on our work in progress at the CAS Annual Meeting in November 2000. The Committee also engaged in some ongoing dialogue with the other CAS Advisory Committees: Securitization/Risk Financing, Valuation of P/C Insurance Companies, and Asset/Liability Management & Investment Policy.

#### *Committee Goals*

The Committee began its work by establishing the interim goals it needed to achieve in order to meet its charge. The goals established were to:

- Define ERM for the purposes of the Committee's work
- Develop a framework within which to identify ERM research and education needs of the CAS
- Outline the ERM knowledge level desired of CAS members
- Determine the current state of the ERM practice/knowledge among CAS members
- Specify learning objectives
- Identify research needs to close the gap between the desired level of knowledge and the current state of knowledge of CAS members
- Identify education needs to close the gap
- Recommend – for both research and education – the methods, priorities, timetable, and industry focus needed to close the gap
- Prepare an initial ERM bibliography
- Identify the implications of ERM on CAS policy and standards, and recommend additional efforts for existing and new CAS committees/task forces to further CAS research and education efforts on ERM and to increase CAS visibility in ERM

#### *ERM Working Definition*

For the purposes of its work, the Committee developed the following definition:

“ERM is the process by which organizations in all industries assess, control, exploit, finance, and monitor risks from all sources for the purpose of increasing the organization's short and long term value to its stakeholders.”

Important elements of this definition include the dual nature of risk (i.e., as both threat to be controlled and opportunity to be exploited), the ultimate objective of value creation, and the relevance of the CAS to industries beyond insurance. These themes are expanded upon in Section V: Concluding Comments.

### *ERM Conceptual Framework*

To guide its discussion of ERM research and education needs, the Committee developed its conceptual framework for ERM. This framework consisted of two dimensions. The first dimension outlined the Risk Types (i.e., sources of risk) encompassed by our view of ERM:

- Hazard Risk
- Financial Risk
- Operational Risk
- Strategic Risk

The second dimension outlined the sequential steps in the Risk Management Process:

- Establishing Context
- Identifying Risks
- Analyzing/Quantifying Risks
- Integrating Risks
- Assessing/Prioritizing Risks
- Treating/Exploiting Risks
- Monitoring And Reviewing

An elaboration on the Risk Types and the Risk Management Process may be found in Appendix A.

### *Gap Analysis*

The key series of steps in the Committee's work was to identify the role of the actuary in the ERM process, and to determine the current level of knowledge, the source of that knowledge, and the desired level of knowledge of the CAS membership as respects ERM. The Committee referred to these steps collectively as the "Gap Analysis."

The Committee undertook several approaches to performing the GAP Analysis, including:

- Review of the CAS Exam Syllabus and the plans of the Syllabus Committee
- Review of CAS continuing education activities and future plans
- Review of other relevant surveys such as the CAS Non-traditional Practice Area Survey, the CAS CEO Survey, and the Tillinghast ERM Benchmarking Survey
- Discussions with other professional organizations such as RIMS, GARP, IAFE, and the SOA
- Discussions among the Committee members

The Committee concluded that these approaches, alone, were insufficient to answer the specific questions relevant to the Gap Analysis.

The Committee decided to conduct a survey of the CAS membership as the primary vehicle to complete the Gap Analysis.

### *CAS Membership Survey*

An eight-page, 21-question, self-administered questionnaire was developed by the Committee and approved by the EC at its March 28, 2001 meeting. (A draft of the survey was circulated to other CAS Advisory Committee chairs to determine if a joint survey covering their collective subject areas would be desirable. It was decided, given the size of the questionnaire and the fact that so much of its content was relevant only to ERM, that the idea of a single multi-subject questionnaire was not feasible.) A total of 3,021 questionnaires were sent, via e-mail, to Fellows, Associates, and Affiliates of the CAS on April 24, 2001. A total of 298 completed questionnaires were returned to the CAS office by May 25, representing a response rate that exceeded our expectations for a survey of this type. A complete Survey Report (including an executive summary of the results, a description of the survey methodology, a profile of the respondents, a detailed presentation of the results, and a copy of the survey questionnaire) may be found in Appendix B.

### *Results of Gap Analysis*

Based on the results of the membership survey and the other avenues that we explored, the Committee completed the Gap Analysis. The Committee developed grids that mapped our ERM Framework in two dimensions, i.e., each of the four Risk Types was mapped on one dimension and each of the seven steps in the Risk Management Process was mapped on the other. For each cell in this grid, the Committee examined the CAS membership's current level of knowledge against their desired level of knowledge. A key result of the Gap Analysis is summarized in the table below. The figures in the table represent the percentage of survey respondents who feel that it is important for all CAS members to know about, or be expert in, the various aspects of ERM – as contained in the ERM framework – by 2005. The figures in bold italics represent areas in which the respondents indicated the greatest relative *gap* between this desired level and their current level of knowledge.

Process Step	Risk Type			
	Hazard	Financial	Operational	Strategic
Establish Context	<b>72%</b>			
Identify Risks	89%	<b>79%</b>	53%	54%
Analyze/Quantify Risks	91%	<b>81%</b>	51%	54%
Integrate Risks	<b>69%</b>			
Assess/Prioritize Risks	85%	<b>73%</b>	46%	51%
Treat/Exploit Risks	75%	<b>64%</b>	41%	44%
Monitor & Review	<b>61%</b>			

As is evident from the table, the greatest relative education and research needs are in the area of financial risk.

The full research and education implications of our Gap Analysis are contained in Section IV: Our Recommendations.

### *Bibliography*

The Committee learned that Tillinghast had been engaged by the Institute of Internal Auditors (IIA) to conduct a study of ERM trends and best practices across multiple industries. Tillinghast's work for the IIA included the preparation of a comprehensive bibliography on ERM. The Committee approached the IIA about the possibility of the IIA sharing the bibliography with the CAS. The IIA agreed, with the stipulation that the CAS would share any future updates of the bibliography with the IIA. The IIA ERM bibliography was expanded upon and categorized by the Committee, and is presented in Appendix C. This represents an initial ERM bibliography for CAS purposes, to be maintained and updated per the discussion in Section IV: Our Recommendations.

### *Learning Objectives*

The Committee decided to begin the build-out of the ERM Framework that it had established by specifying the subjects that would need to be mastered by the "ERM expert" within each element of the Framework. The resulting "Learning Objectives" were developed by the Committee and are presented in Appendix D. It is our intent that these Learning Objectives be used by the Syllabus Committee per the discussion in Section IV: Our Recommendations.

#### IV. Our Recommendations

The Committee’s recommendations are presented separately for research and for education, below. Recommendations on increasing CAS visibility on ERM are presented thereafter.

##### *Research*

Based on the results of the Gap Analysis, the Committee developed the following table that depicts our:

- Prioritization of the ERM research needs of the CAS, and
- Recommendations as to the methods by which the identified research needs should be met.

Research Topic	Priority (A=highest) & Industry Focus			Research Method		
	P/C Industry	Other Financial Services	Other	Funded Research (CAS, AERF)	Call Paper Pgms.	Survey Existing (incl. Non- CAS) Research
ERM Overview	A	A	A	✓	✓	✓
Value Creation through ERM	A	B	B	✓	✓	✓
Risk Quantification						
Financial	A	A	A			✓
Operational	A	B	C		✓	✓
Strategic	A	B	C		✓	✓
Risk Correlation	A	B	C	✓		✓
Risk Integration	A	B	C	✓		✓
Establishing Risk Tolerances	B	B	C		✓	✓
Practical Approaches to Optimization & Risk/Reward Metrics & Marginal Portfolio Contributions	B	C	C		✓	✓
Risk Monitoring Tools	C	D	D		✓	✓
Risk Treatments	C	D	D			✓
Pricing, Reserving, Reporting of Integrated Products	C	D	D		✓	✓

The Committee also recommends that the CAS EC and/or Board form a standing ERM Research Committee, with the following charge:

- Direct and monitor research per the table above
  - Expand, update and maintain the ERM bibliography initiated by the Committee (see Appendix C), adding:
    - Books
    - Articles
    - Editorials
    - Web sites
    - Sources of data
    - Sources of models and software
    - Other relevant professional organizations
      - ERM activities
      - Membership requirements
      - Meetings
- } Organize per the ERM Framework “grid”, and annotate
- Work with other ERM-relevant CAS committees to coordinate ERM research activities and provide advice and content for ERM education vehicles; these committees include:
    - Syllabus Committee
    - Program Planning Committee
    - Committee on Special Interest Seminars
    - DFA Committee
    - DFA Seminar Committee<sup>1</sup>
    - Valuation, Finance & Investments Committee
  - Stay abreast of other organizations’ ERM-related activities (e.g., SOA, AAA, IAA, GARP, RIMS, IAFE, NAIC)
    - Build partnerships where appropriate
    - Explore joint committees
  - Develop internal and external CAS communication messages on ERM to be delivered through various media such as the CAS web site
  - Designate ERM “subject matter experts” as media spokespersons

### *Education*

Based on the results of the Gap Analysis, the Committee developed the table below that depicts the Committee’s assessment of the ERM education needs of CAS members by the year 2005. This also reflects the preferences expressed by the CAS membership (through the ERM Survey) regarding the means by which the education is provided. The key to this table is as follows:

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<sup>1</sup> This dialogue has already begun.

<b>Key to Table Below:</b>		
<b>Code</b>	<b>Desired Knowledge Level</b>	<b>Education Implication</b>
<b>1</b>	All CAS members should be expert in this area	On exam syllabus – core subject (similar to ratemaking, reserving)
<b>2</b>	...	On exam syllabus – moderate treatment (similar to accounting)
<b>3</b>	All CAS members need to know about this area	On exam syllabus – light treatment (similar to underwriting)
<b>4</b>	...	On exam syllabus – very light introductory treatment (similar to claims)
<b>5</b>	...	Continuing Ed – annual ERM seminar (similar to CLRS)
<b>6</b>	Some CAS members should know about this area	Continuing Ed – special interest and/or limited attendance seminars (similar to M&A)
<b>7</b>	...	Continuing Ed – Special tracks/sessions within existing CAS (and non-CAS) meetings/seminars
<b>8</b>	...	Self-study/on-line courses/university courses (CAS to maintain bibliography)
<b>9</b>	Outside the scope of CAS	N/A
<b>Note: Any exam syllabus item (codes 1 - 4) also carries continuing education/self-study implications (codes 5 – 8); any continuing education item (codes 5 – 7) also carries self-study implications (code 8)</b>		

<b>Depth of ERM Knowledge Within CAS Desired by 2005:</b>				
ERM Overview		2		
<b>Process Step</b>	<b>Risk Type</b>			
	Hazard	Financial	Operational	Strategic
Establish Context	3			
Identify Risks	5	6	7	7
Analyze/Quantify Risks	1	2	4	4
Integrate Risks	2			
Assess/Prioritize Risks	4	4	5	5
Treat/Exploit Risks	4	4	6	6
Monitor & Review	5			

The Committee also recommends that the CAS:

- Add a paper that presents a thorough introduction to ERM (“ERM Overview”) to the Part 8 (or Part 5) syllabus as soon as it is available (see Research Recommendations above)
- Immediately begin to provide continuing education opportunities per the table above
  - To provide on-going learning for new FCAS’s
  - To provide “catch-up” learning for veteran FCAS’s
- Specifically add the following sessions to CAS meetings and other seminars, as soon as content is available (see Research Recommendations above):
  - “ERM Overview”
  - “Value Creation through ERM”
- Incorporate into the current planning for the 2005 syllabus:
  - The ERM Learning Objectives<sup>2</sup> (see Appendix D)
  - The Committee’s specific exam recommendations per the above table
- Publish the ERM bibliography (see Appendix C) and all updates

The Committee strongly supports the following current educational activities of the CAS:

- The eight-module online course on financial risk management
- The resurrection, in 2002, of the initial 1999 special interest seminar on Financial Risk Management
- The planned reconfiguration (and renaming) of the annual DFA Seminar to cover a broader and more business-relevant range of ERM topics<sup>3</sup>

It is assumed that the ERM Research Committee, once authorized and staffed, will be solicited for advice and content regarding each of the seminars, conferences and workshops cited above.

### *CAS Visibility*

The Committee recommends that the CAS:

- Develop (with assistance from the future ERM Research Committee), and internally and externally publicize, the “CAS position” on ERM
- Publish the Executive Summary and/or some form of this report
- Invite a broad (i.e., including non-CAS) audience to its ERM-related seminars and workshops
- Work through the CAS and AAA Media Committees to proactively promote the actuary’s role in ERM (with subject matter experts to be designated by the future ERM Research Committee)

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<sup>2</sup> Note that the Learning Objectives in Appendix D are expressed in terms of the knowledge required of an *expert* in ERM. For syllabus purposes, the required knowledge level should be calibrated to conform to the “Desired Depth of Knowledge” within the table at the bottom of the preceding page for each element of the ERM Framework.

<sup>3</sup> As noted earlier, this dialogue has already begun.

## V. Concluding Comments

In the preceding sections, we have attempted to present our analyses, findings and recommendations in a crisp and concise manner, to promote prompt review and action by the CAS leadership. In this section we would like to provide some additional context and rationale for our recommendations and, in the process, convey a bit of the passion that the Committee members feel regarding the importance of the CAS's role in ERM.

### *ERM as a Value Creation Tool*

Embedded in our definition of ERM and in our ERM Framework is the notion that the objective of ERM is not simply to protect the organization from threats, but to proactively create value. ERM does this by:

- Systematically identifying the material risks (both threats and opportunities) relevant to the organization's business objectives
- Rigorously analyzing the organization's capital requirements to help achieve financial efficiency (for the owners) while protecting solvency (for the customers)
- Evaluating strategies (e.g., capital allocation, asset/liability management, insurance/reinsurance/hedging, operational changes) to find the optimal combination to improve growth and return prospects (i.e., optimization under uncertainty)
- Exploiting the natural hedges, portfolio effects and operational efficiencies of integrated risk management (including opportunities to undertake value-creating ventures that may not have been accepted under less sophisticated risk analysis)
- Enhancing stability (i.e., reducing volatility) of results, which attracts higher ratings, valuations and, for publicly traded companies, stock prices

### *ERM as a Unifying Framework*

ERM has substantial potential as the broad conceptual framework that unifies the many varied parts of the actuarial discipline. Beyond its core sub-disciplines of pricing and reserving, the actuarial discipline spans such subject areas as risk modeling<sup>4</sup>, capital management, asset/liability management, reinsurance, financial performance measurement, accounting, and portfolio management. As should be evident from the preceding discussion on "ERM as a Value Creation Tool", ERM provides a logical structure to link these subject areas together in a compelling way to form an integrated whole. In so doing, ERM addresses critical business issues such as growth, return, consistency and value creation. It expresses risk not just as threat but as opportunity – the reason that business is conducted in the first place. Furthermore, the convergence of financial services industries creates more demand for the type of "cross-silo" risk treatment that ERM represents.

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<sup>4</sup> The CAS's work to develop DFA as the insurance industry's risk modeling template has been admirable, but DFA is losing ground to simpler alternatives from the banking sector that are, in our opinion, dangerously ill-suited to the insurance industry. DFA is in need of a more robust platform that can showcase its superior and multi-faceted business applicability.

Properly unified, these component strengths should make CAS members the primary candidates for Chief Risk Officer, one of the more exciting and rewarding career opportunities to have emerged in recent years. It should accordingly be the case that the actuarial knowledge base is perceived as a very valuable commodity in industries well beyond insurance and financial services.

### *ERM as a Recruitment Tool*

CAS candidates and recent Associates and Fellows are increasingly asking thoughtful and troubling questions about the relevance of CAS membership to their careers. They cite the curricula for the Chartered Financial Analyst (CFA) designation and the Financial Risk Management (FRM) designation, for example, as being more business-relevant in the current environment and offering more growth potential. ERM provides an opportunity to re-engage these young professionals in actuarial science as the most logical path to playing a significant role in a business culture that is clearly embracing ERM as a modern management discipline.

### *Filling the Leadership Void*

There are a number of professional disciplines and organizations that are quite active in ERM. These include the other actuarial bodies (SOA, IAA and LOMA, in particular) as well as the Global Association of Risk Professionals (which grants the FRM designation), the Association of Investment Management and Research (which grants the CFA designation), the Institute of Internal Auditors, and the Association of Certified Public Accountants. Currently, while each of these organizations has targeted ERM as a growth area, none has assumed a clear leadership position in the development or promulgation of ERM as a discipline. This may change shortly, particularly within the financial services industry as that industry converges. The CAS appears to be well positioned to assume that leadership role, as our scope of risks is already quite broader than most of those other organizations, and our structural simulation-based Dynamic Financial Analysis tools and techniques, properly expanded, may be well suited to accommodate the comprehensive risk modeling requirements of ERM. Clearly, in whatever role the CAS plays in the ERM movement, cooperation and partnering with a number of these other organizations is advisable.

The flip side, of course, is that if the CAS does not strongly stake a claim to ERM, the CAS may find itself defined very narrowly in the current business environment, and its status diminished.

### *The Membership Wants to Go There*

The enthusiasm for ERM among the CAS membership is evident from, for example:

- The number of volunteers for this Committee, which was more than twice as many as could be accommodated.

- The number of responses to the ERM Survey, which was 150% of the level typical for membership surveys of this type. And the level of interest expressed through the responses to the survey.
- The high level of attendance at the first CAS-sponsored ERM Seminar in April 2001. And the positive feedback from attendees at the seminar.

It is apparent that a clear and assertive statement by the CAS leadership that the CAS intends to be a major player in the ERM movement would be well received by the membership.

*Do We Really Have a Choice?*

Even those CAS members who do not clearly see ERM as important to the future of the CAS will require ERM research and education as the world evolves around them. Traditional pricing actuaries will increasingly be asked to price integrated products. Traditional reserving actuaries may not otherwise be qualified, for example, to certify the reserves of a captive that provides integrated coverage for property/casualty, financial and employee benefits risks. Traditional corporate actuaries need to know how to respond to rating agencies' use of their own ERM models in their analyses of companies' capital adequacy.

Finally, there are those who believe that the CAS would have "missed its calling" if some other profession or organization becomes the predominant source of Chief Risk Officers of the future – they see it as the obligation of the CAS to properly prepare its membership to thrive in this ERM environment we find ourselves in.

## ERM Framework

The ERM Framework is organized by Risk Type and by sequential steps within the Risk Management Process.

### Risk Types

- *Hazard* risks, such as:
  - Liability suits (e.g., operations, products, environmental)
  - Fire and other property damage
  - Windstorm and other natural perils (including catastrophes)
  - Theft and other crime
  - Personal injury, disease, disability (including work-related injuries and diseases)
  - Business interruption
- *Financial* risks, such as:
  - Price (e.g. asset value, interest rate, foreign exchange, commodity)
  - Liquidity (e.g. cash flow, call risk, opportunity cost)
  - Credit (e.g. default, downgrade).
  - Inflation/purchasing power
  - Hedging/basis risk
- *Operational* risks, such as:
  - Business operations (e.g. customer satisfaction, human resources, product development, capacity, efficiency, product/service failure, trademark/brand erosion)
  - Empowerment (e.g., leadership, change readiness)
  - Information technology (e.g. relevance, availability)
  - Integrity (e.g., management fraud, reputation)
  - Information/business reporting (e.g., budgeting and planning, accounting information, pension fund, investment evaluation, taxation)
- *Strategic* risks, such as:
  - Competition
  - Customer wants
  - Demographic and social/cultural trends
  - Technological innovation
  - Capital availability
  - Regulatory and political trends

### Risk Management Process

- *Establishing Context* – Achieving a full understanding of the present conditions in which the organization operates; this includes understanding the external context (e.g., organization/environment relationship, stakeholder communication policies), the internal context (e.g., business objectives, oversight structure, key performance

indicators), and the risk management context (e.g., units covered, degree of coordination throughout organization).

- *Identifying Risks* – Documenting the conditions and events that represent material threats to the organization’s achievement of its objectives or represent areas to exploit for competitive advantage.
- *Analyzing/Quantifying Risks* – Calibrating and, wherever possible, creating probability distributions of outcomes for each material risk.
- *Integrating Risks* – Aggregating all risk distributions, reflecting correlations and portfolio effects, and expressing results in terms of impact on the organization’s key performance indicators (i.e., the “aggregate risk profile”).
- *Assessing/Prioritizing Risks* – Determining the contribution of each risk to the aggregate risk profile, and prioritizing accordingly.
- *Treating/Exploiting Risks* – Developing strategies for controlling or exploiting the various risks.
- *Monitoring and Reviewing* – Continual gauging of the risk environment and the performance of the risk management strategies.

**The Framework “Grid”**

Some Risk Management Process steps apply to each Risk Type individually, and some, to all Risk Types in the aggregate, according to the following grid, which the Committee used to guide our work and organize our findings.

Process Step	Risk Type			
	Hazard	Financial	Operational	Strategic
Establish Context				
Identify Risks				
Analyze/Quantify Risks				
Integrate Risks				
Assess/Prioritize Risks				
Treat/Exploit Risks				
Monitor & Review				

**SURVEY ON  
ENTERPRISE RISK MANAGEMENT  
REPORT**



**Compiled by CAS Office  
July 26, 2001**

## EXECUTIVE SUMMARY

- The response level was high (298 respondents vs. an expected 200 for surveys of this type).
- The profile of survey respondents may be biased in favor of those more interested in ERM (thus the responses to certain opinion questions may exhibit a bias toward enthusiasm for ERM), but any potential bias is tempered by the fact that the response level was high overall (indicating that such enthusiasm is more representative than would otherwise be implied).
- Respondents from vendors (i.e., brokers, agents, consultants and similar organizations: the “vendor group”) tend to be more familiar with ERM, but respondents from the industry (P/C insurance and reinsurance companies: the “industry group”) tend to spend more of their time on ERM projects.
- ERM knowledge was gained primarily through self-initiative (e.g., on-the-job learning, from others in the same company, self-study of the literature).
  - Sources of ERM learning are mostly CAS-related (and mostly through seminars).
- For those respondents having hands-on involvement with ERM projects:
  - With respect to risk identification, the industry group is much less likely to bridge from property/casualty risks to other hazard risks (e.g., health, safety, HR-related risks) than is the vendor group.
  - All respondent groups are substantially involved in all risk management process steps, across all types of risk, as summarized in the table below (percentages in the table represent the percentage of respondents that indicated that they have been personally involved in the particular aspect of an ERM project).

<b>Process Step</b>	<b>Risk Type</b>			
	Hazard	Financial	Operational	Strategic
Identify Risks	80%	74%	51%	51%
Analyze/Quantify Risks	83%	47%	38%	34%
Integrate Risks	59%			
Assess/Prioritize Risks	51%	50%	35%	35%
Treat/Exploit Risks	61%			
Monitor & Review	35%			

- Professionals most often involved in ERM projects are P/C actuaries, accountants, brokers, financial analysts, risk managers and underwriters.
- Relatively few respondents serve as the “integrator” of risks from the various sources.

— Project leadership:

— Respondents among the vendor group are equally likely to be the project manager or the technical analyst; respondents among the industry group are more than twice as likely to be the technical analyst than to be the project manager.

— For projects involving the vendor group, the project leader is often a P/C actuary, a broker or an MBA/management consultant; for projects involving the industry group, the project leader is often a P/C actuary or an underwriter.

— Interestingly, none of the projects in which the respondents were involved were led by internal audit staff – this is at odds with evidence from other sources (e.g., the recent ERM survey by the Institute of Internal Auditors and client experience of the committee members).

■ There is a lack of knowledge of important tools and concepts such as economic capital, Economic Value Added, Expected Policyholder Deficit, Extreme Value Theory, options pricing theory, Risk Adjusted Return on Capital, risk mapping and Value at Risk – even among those respondents who rate themselves as expert in or highly familiar with ERM; Net Present Value and Dynamic Financial Analysis are the only tools/concepts of which respondents have a great deal of knowledge.

■ With respect to their ability to model risks, respondents rated themselves highest with respect to P/C hazard risks (as expected) but lowest with respect to non-P/C hazard risks (lower even than for operational or strategic risks).

■ Respondents believe CAS members should play a significant role in ERM, from project leader to technical analyst to risk integrator.

■ 94% of respondents believe it is important for CAS members to increase their knowledge of ERM; 83% believe it is important to increase their *own* ERM knowledge.

■ Respondents believe CAS members should apply their ERM skills beyond the P/C insurance industry, particularly in the broader financial services industry.

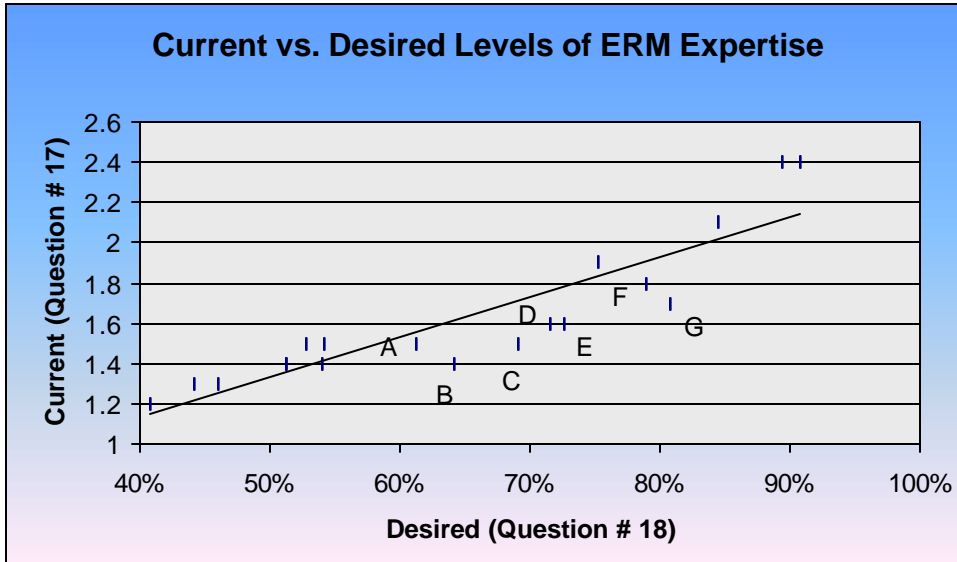
■ There is a very strong desire by respondents to obtain their ERM learning from CAS sources (followed closely by on-the-job learning) rather than from other professional organizations.

— Among the other organizations, the AIMR (Association for Investment Management and Research, grantor of the CFA – Chartered Financial Analyst – designation) ranks highest.

— The preferred CAS learning vehicle is seminars.

— The respondents' view of the gap between desired and current level of knowledge – by risk type and risk management process – is summarized in the graph below. The x-axis of this graph shows the percentage of respondents who felt that it was important for *all* CAS members to know about, or be expert in, the various aspects of ERM as contained in our ERM framework (Question #18). The y-axis shows the average score for the *current* level of ERM expertise

among respondents (Question #17: low=1, high=3). In general, there was rough alignment between desired and current level of knowledge. The seven labeled points below the “line of alignment” indicate areas where the current level of expertise is relatively further behind the desired level (see key to labels below the graph). These areas represent the high-priority areas of focus for future CAS research and education, according to respondents. Note that these areas relate primarily to financial risk.



Key to labels A-G:

Process Step	Risk Type			
	Hazard	Financial	Operational	Strategic
Establish Context			D	
Identify Risks		F		
Analyze/Quantify Risks		G		
Integrate Risks			C	
Assess/Prioritize Risks		E		
Treat/Exploit Risks		B		
Monitor & Review			A	

Finally, it should be noted that the responses to certain questions suggest that:

- some respondents may have equated ERM with DFA, and may not have considered the broader scope that ERM implies; and
- it is likely that, among those that are experienced in ERM, the focus of that experience is within the P/C insurance industry (as opposed to other industries).

# SURVEY METHODOLOGY

## Designing the Questionnaire

An eight-page, 21-item self-administered questionnaire (see Appendix) was developed by the CAS Advisory Committee on Enterprise Risk Management and approved by the CAS Executive Council.

## Conducting the Survey

A total of 3,021 questionnaires were sent as an e-mail attachment to Fellows, Associates, and Affiliates of the CAS on April 24, 2001. In addition, the survey could be completed online through the CAS Web Site. Respondents were asked to complete the survey by May 25, 2001.

## Data Analysis

A total of 298 (9.9%) completed questionnaires were returned to the CAS Office. A total of 258 surveys (87%) were completed electronically through the Web Site. Responses to survey questions were compiled, coded, and entered into a database. The responses were then analyzed using a statistical analysis software package (SPSS).

## Respondent Groups

The data for responses to survey questions includes results for all respondents, as well as 7 separate groups based on key demographic categories. Therefore, for most questions there are 8 columns of respondents. The respondent groups, with the number of respondents for each category included in parentheses, are as follows:

1. **All respondents** (298 total)
2. **Vendor Group**, i.e., employment type of Broker/Agent, Consultant, or Organization Serving Insurance (91)
3. **Industry Group**, i.e., employment type of Property/Liability Insurance Company or Reinsurance Company (192)
4. **Other**, i.e., employment type of Academic, Government, Life, Accident & Health Ins., Retired, or Other (15)
5. **Fellows** (202)
6. **Associates** (87)
7. **Experts**, i.e., Respondents who answered a or b to question 4 (expert in ERM or familiar with ERM) (86)
8. **Non-experts**, i.e., Respondents who answered c, d, or e to question 4 (some understanding of ERM, not very familiar with ERM, or non-interest in ERM). (211)

## RESPONDENT PROFILE

### CAS Membership Status

Response	Frequency	Percent
FCAS	202	67.8
ACAS	87	29.2
Affiliate	6	2.0
Blank	3	1.0
<b>Total</b>	<b>298</b>	<b>100.0</b>

### Year Designation Was Attained

Response	Frequency	Percent
2001	5	1.7
2000	6	2.0
1999	1	0.3
1998	7	2.3
1997	4	1.3
1996	9	3.0
1995	2	0.7
1994	4	1.3
1993	4	1.3
1992	2	0.7
1990	3	1.0
1989	4	1.3
1988	4	1.3
1987	4	1.3
1986	1	0.3
1984	2	1.7
1983	4	1.3
1982	1	0.3
1980	1	0.3
1979	4	1.3
1978	2	0.7
1977	1	0.3
1976	1	0.3
1975	2	0.7
1974	1	0.3
1972	1	0.3
1970	1	0.3
1969	1	0.3
Blank	216	73.5
<b>Total</b>	<b>298</b>	<b>100.0</b>

**Type of Employment:**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
Academic	2	0.7
Broker/Agent	23	7.7
Consultant	62	20.8
Government	5	1.7
Life, Accident, and Health Insurance	1	0.3
Organization Serving Insurance Business	6	2.0
Property/Liability Insurance	149	50.0
Reinsurance	43	14.4
Retired	2	0.7
Other	5	1.7
<b>Total</b>	298	100.0

**Level of knowledge, involvement, and interest in ERM:**

<b>Response</b>	<b>Frequency</b>	<b>Percent</b>
I consider myself somewhat of an expert in ERM and devote a considerable portion of my time to ERM projects.	17	5.7
I am familiar with ERM and have been involved with some ERM projects.	69	23.2
I have some understanding of the ERM concept, but have never been involved with an ERM project.	115	38.6
I am not very familiar with ERM, but am interested to learn about it.	91	30.5
I have no interest in ERM.	5	1.7
Blank	1	0.3
<b>Total</b>	298	100.0

**Level of knowledge, involvement, and interest in ERM by Demographic Profile**

	<b>All Respondents</b>	<b>Vendor Group</b>	<b>Industry Group</b>	<b>Other</b>	<b>Fellows</b>	<b>Associates</b>
Expert in ERM and devote considerable portion of time to ERM	5.7	8.8	4.2	6.7	5.4	6.9
Familiar with ERM and been involved with ERM projects.	23.2	31.9	19.3	20.0	23.8	20.7
Understanding of ERM but have never been involved in ERM project.	38.6	41.8	38.0	26.7	38.1	37.9
Not very familiar with ERM, but interested to learn about it.	30.5	15.4	37.5	33.3	30.7	32.2
Have no interest in ERM	1.7	1.1	1.0	13.3	1.5	2.3
Blank	0.3	1.1	0.0	0.0	0.5	0.0

## RESULTS

### Question 3:

**Which of the following describes how you attained your knowledge of Enterprise Risk Management (ERM)?**

For question 3, respondents were asked to rank the order of importance (1 through 8) of various ways that they attained their knowledge of ERM. The responses were scored in inverse order, with a response of 1 getting a score of 8, a response of 2 getting a score of 7 and so forth, with a response of 8 getting a score of 1. The system used to rank the responses was to sum the scores. The options for how respondents attained their knowledge of ERM are ordered from most important to least important, based on all respondents. The table cells include the rank and the score for each response.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Through on-the-job learning.	1 1088	2 375	1 651	1 62	1 703	1 357	1 589	1 499
From others in my company.	2 951	1 391	2 514	3 46	2 618	2 296	2 427	2 524
Through self-study of the literature.	3 792	3 253	3 490	2 49	3 581	3 180	3 337	3 445
Through seminars or courses.	4 485	4 169	5 307	7 9	4 347	6 122	4 196	6 289
From CAS exam materials.	5 445	6 95	4 326	5 24	5 280	4 154	5 133	5 312
I have no current knowledge of ERM.	6 432	5 104	6 296	4 32	6 272	5 152	8 0	4 424
Other	7 257	8 83	7 157	6 17	7 185	7 63	7 77	7 180
From specific readings/textbooks.	8 232	7 90	8 137	8 5	8 166	8 47	6 113	8 119

Written responses to “Through seminars or courses presented by: (please specify)”

- CAS (21 responses)
- 2001 CAS Special Interest Seminar on ERM (7 responses)
- CAS Spring Meeting (2000 or 2001) (4 responses)
- CANE Meeting (March 2000 or March 2001) (3 responses)
- CAS Ratemaking Seminar (2 responses)
- RIMS (2 responses)
- CAS Annual Meeting (2000)
- CCA
- D&T
- D’Arcy limited attendance seminar on finance
- DFA Seminars
- GARP

- IRRM
- MAF
- MBA degree
- My firm
- Oliver Wyman Co.
- Others outside my company
- Princeton University
- Reinsurance Broker
- Risk Conferences (British group)
- SOA meeting sessions
- TMA and IPCQ
- Various
- Various seminar firms
- VT Captive Association

Written responses to “From specific readings/textbooks. (please specify)”

- CAS Publications (Insurance in the Next Century, Proceedings) (5 responses)
- Various readings, articles (4)
- Business Insurance (3)
- Industry journals and periodicals (3)
- Trade Press (3)
- CFO Magazine (2)
- National Underwriter (2)
- Risk Management (2)
- Any Peter Drucker books
- Arthur Andersen
- Australian RM Best Practices
- Best’s Review
- Business Finance
- Call papers
- CFA Syllabus
- CPCU curriculum
- FRM exam material
- Swiss Re articles
- Tillinghast’s Emphasis Magazine
- Various books on Value at Risk
- Various concerning worker’s comp

Written responses to “Other (please specify)”

- Brokers (reinsurance) (2)
- Committee work (CAS committees, RBC committees) (2)
- This survey (2)
- RiskMail listserv (2)
- Another company’s Risk Management guidelines’ table of contents
- CAS activities
- Clients

- Consultants
- DFA work/analysis
- Discussions with CEO's & RMs
- GARP
- Internet
- Others not in my company
- Own philosophy
- Self study
- Software Development and Modeling Research
- Speakers/lecturers

**Questions 5 – 9**

Note: Questions 5 through 9 were answered only by respondents that indicated that they considered themselves somewhat of an expert in ERM and devoted a considerable portion of their time to ERM projects, or were familiar with ERM and had been involved with some ERM projects. There are five columns of respondents for questions 5 through 9. The respondent groups, with the number of respondents for each category included in parentheses, are as follows:

1. **All respondents** (86 total)
2. **Vendor Group**, i.e., employment type of Broker/Agent, Consultant, or Organization Serving Insurance (37)
3. **Industry Group**, i.e., employment type of Property/Liability Insurance Company or Reinsurance Company (45)
4. **Fellows** (59)
5. **Associates** (24)

**Question 5:**

Approximately what percentage of your time over the past 12 months have you been involved in ERM projects?

	<b>All Respondents</b>	<b>Vendor Group</b>	<b>Industry Group</b>	<b>Fellows</b>	<b>Associates</b>
Over 75%	9.3	10.8	8.9	6.8	16.7
Between 50 and 75%	5.8	8.1	4.4	6.8	4.2
About 50%	5.8	5.4	6.7	6.8	4.2
Between 25 and 50%	17.4	13.5	20.0	10.2	33.3
Less than 25%	41.9	48.6	33.3	42.4	37.5
Blank	19.8	13.5	26.7	27.1	4.2

**Question 6:**

Which of the following aspects of ERM projects have you personally been involved in?

The percentages in the table represent the percentage of respondents that indicated that they have been personally involved in the particular aspect of an ERM project.

**a. Identification of risks on an enterprise-wide scale:**

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Hazard risk – property/casualty	80.2	83.8	77.8	76.3	87.5
Hazard risk – other (e.g., health, safety, HR-related)	20.9	32.4	8.9	16.9	29.2
Financial risk	74.4	70.3	75.6	72.9	75.0
Operational risk	51.2	51.4	51.1	50.8	54.2
Strategic risk	51.2	51.4	48.9	52.5	45.8

**b. Analysis/quantification of hazard risk:**

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Property/casualty hazard risks	82.6	86.5	80.0	79.7	87.5
Other types of hazard risk	14.0	13.5	13.3	10.2	25.0

Written responses to “Other types of hazard risk (please specify)”

- Investment (3 responses)
- Legal (2)
- Weather (2)
- A&H
- Asset
- DCAT/DST
- Financial and technological
- FX, interest rates, commodity prices, credit
- Life/health
- Liquidity
- Political
- Power
- Product contamination
- Tax
- Worker’s safety and related

**c. Analysis/quantification of financial risks:**

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Credit risk	39.5	37.8	37.8	35.6	50.0
Foreign exchange risk	29.1	24.3	33.3	23.7	45.8
Interest rate risk	46.5	45.9	42.2	44.1	50.0
Liquidity risk	26.7	24.3	24.4	27.1	25.0
Other	15.1	16.2	15.6	15.3	8.3

Written responses to “Other (please specify)”

- Commodity price risk (4 responses)
- Equity market risk (2)
- ALM
- Asset risk
- Capital adequacy risk
- Equity valuation risk
- Long-tail line severity
- Medical inflation and stock market yields
- Rate adequacy
- Stocks, corporate bonds, munis
- Underwriting risk

**d. Analysis/quantification of operational risks:**

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Operations	38.4	37.8	40.0	37.3	41.7
Information Technology	18.6	16.2	22.2	22.0	8.3
Integrity	10.5	8.1	13.3	13.6	0.0
Information risk	9.3	5.4	13.3	11.9	0.0
Other	9.3	13.5	6.7	10.2	8.3

Written responses to “Other (please specify)”

- Bad faith allegations
- Claims operations and legislative risks
- Data quality risk/issues
- Income fluctuation risk
- Product recall, inventory
- Product warranty

**e. Analysis/quantification of strategic risk:**

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Competition	33.7	29.7	35.6	28.8	41.7
Customer wants	14.0	13.5	13.3	13.6	16.7
Technological innovation	16.3	16.2	15.6	22.0	0.0
Capital availability	32.6	24.3	37.8	32.2	29.2
Regulatory	33.7	35.1	31.1	33.9	33.3
Political	19.8	24.3	15.6	20.3	16.7
Other	8.1	13.5	4.4	6.8	8.3

Written responses to “Other (please specify)”

- Asset allocation and capital requirements
- Capital investment projects
- Disposable income
- Each of the three on various projects
- Market channel risk
- Obsolescence/senescence risk
- Reputation

**f. Integrated risk analysis including the following categories:**

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Integration of various types of P/C hazard risks faced by an entity (e.g., property catastrophe risk with automobile liability).	59.3	70.3	48.9	55.9	66.7
Integration of P/C hazard risks with other types of hazard risk faced by an entity (e.g., workers compensation with health risk).	26.7	29.7	20.0	18.6	45.8
Integration of hazard risk, financial risk, operational risk, and/or strategic risk.	59.3	67.6	48.9	57.6	58.3

**g. Assessment or prioritization of risks faced by an entity.**

	<b>All Respondents</b>	<b>Vendor Group</b>	<b>Industry Group</b>	<b>Fellows</b>	<b>Associates</b>
Hazard	51.2	64.9	44.4	50.8	50.0
Financial	50.0	62.2	42.2	47.5	54.2
Operational	34.9	45.9	26.7	30.5	45.8
Strategic	34.9	45.9	26.7	32.2	37.5

**h.**

	<b>All Respondents</b>	<b>Vendor Group</b>	<b>Industry Group</b>	<b>Fellows</b>	<b>Associates</b>
Recommending ways to treat or exploit risks that have been identified, quantified, and assessed.	60.5	73.0	51.1	59.3	66.7

**i.**

	<b>All Respondents</b>	<b>Vendor Group</b>	<b>Industry Group</b>	<b>Fellows</b>	<b>Associates</b>
Monitoring of changes in the risk environment and performance of the risk management processes.	34.9	37.8	33.3	35.6	33.3

**Question 7:****What other types of practitioners have you worked with in an ERM project?**

The percentages in the table represent the percentage of respondents that indicated that they have worked with the type of practitioner in an ERM project.

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Academics	19.8	18.9	17.8	15.3	29.2
Accountants	55.8	56.8	53.3	52.5	58.3
Actuaries - life/health	18.6	18.9	13.3	13.6	33.3
Actuaries - pension	8.1	10.8	4.4	6.8	12.5
Actuaries – P/C	70.9	70.3	71.1	71.2	70.8
Brokers	46.5	59.5	37.8	44.1	54.2
Economists	27.9	32.4	22.2	22.0	41.7
Financial analysts	48.8	37.8	55.6	42.4	62.5
HR professionals	14.0	18.9	11.1	11.9	16.7
Internal auditors	20.9	16.2	20.0	22.0	16.7
IT professionals	20.9	21.6	20.0	23.7	12.5
Lawyers	17.4	18.9	13.3	16.9	16.7
Marketing professionals	17.4	18.9	13.3	18.6	12.5
MBA/Mgmt consultant	25.6	32.4	15.6	23.7	33.3
Operations experts	15.1	16.2	15.6	18.6	4.2
Risk managers	39.5	51.4	31.1	30.5	58.3
Risk specialists	19.8	24.3	15.6	13.6	37.5
Strategy/org. experts	16.3	16.2	15.6	16.9	12.5
Underwriters	47.7	35.1	60.0	45.8	50.0
Others	10.5	13.5	8.9	6.8	16.7

## Written responses to “Other (please specify)”

- Investment Managers, Professionals, Chief Investment Officer (3 responses)
- Cat Modelers
- Claims Experts
- Earth Sciences, Engineers
- ERM Consultants
- Executives: CEO, CFO
- Geologists / Chemists
- Meteorologists
- Project Managers
- Statisticians

**Question 9:**

**For those ERM projects in which you were one of several practitioners involved with the ERM process, in general which practitioner served as the project leader?**

The percentages in the table represent the percentage of respondents that indicated that the type of practitioner served as the project leader in an ERM project.

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Academics	0.0	0.0	0.0	0.0	0.0
Accountants	4.7	2.7	4.4	3.4	8.3
Actuaries – life/health	1.2	2.7	0.0	0.0	4.2
Actuaries – pension	0.0	0.0	0.0	0.0	0.0
Actuaries – P/C	15.1	10.8	17.8	16.9	8.3
Brokers	5.8	10.8	2.2	5.1	4.2
Economists	1.2	2.7	0.0	1.7	0.0
Financial analysts	4.7	0.0	8.9	3.4	8.3
HR professionals	0.0	0.0	0.0	0.0	0.0
Internal auditors	0.0	0.0	0.0	0.0	0.0
IT professionals	1.2	0.0	2.2	1.7	0.0
Lawyers	0.0	0.0	0.0	0.0	0.0
Marketing professionals	0.0	0.0	0.0	0.0	0.0
MBA/Mgmt consultant	5.8	10.8	2.2	5.1	8.3
Operations experts	0.0	0.0	0.0	0.0	0.0
Risk managers	2.3	2.7	2.2	1.7	4.2
Risk specialists	0.0	0.0	0.0	0.0	0.0
Strategy/org. experts	2.3	0.0	4.4	3.4	0.0
Underwriters	9.3	0.0	15.6	10.2	8.3
Others	9.3	5.4	13.3	10.2	4.2
Blank	37.1	51.3	26.7	37.3	41.7

Written responses to “Other (please specify)”

- CFO (3)
- Actuaries and/or accountants
- Chief Investment Officer
- Product managers
- Project Managers/Deal Structurers
- Various
- Various personnel at clients

**Question 8:**

Which of the following best describes your primary role in the ERM projects that you have been involved with?

	All Respondents	Vendor Group	Industry Group	Fellows	Associates
Project leader	25.6	32.4	20.0	25.4	25.0
Primary technical analyst for all risks	12.8	13.5	13.3	11.9	16.7
Primary technical analyst for hazard risk, but a secondary role in other risks	29.1	18.9	37.8	23.7	37.5
“Integrator” of all risks.	9.3	5.4	11.1	10.2	8.3
Other	14.0	16.2	11.1	18.6	4.2
Blank	9.3	13.5	6.7	10.2	8.3

Written responses to “Other (please specify)”

- Changed over time. Now mostly internal consultant
- Committee participant
- Consultant
- General team member
- Group member in identifying risks – no analysis
- Involved with partial ERM projects only
- Management role overseeing results
- Manager of primary tech analyst for hazard risk
- Manager of project leader
- Manager/decision authority over technical actuarial analysts
- Participant in data collection
- Peer Reviewer
- Secondary analyst
- Subject matter expert for information risk
- Team member for general identification of risk
- Various

Note: Questions 10 through 20 were answered by all respondents. Therefore, there are ten columns of respondents for questions 10 through 20.

**Question 10:**

**Please indicate your level of understanding of the following, using the scale**

**1 = no or low understanding, 2 = medium understanding, 3 = high understanding.**

The data in the table cells represents the average response for each category. A response of 1 was inserted for those items left blank.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Basel Capital Accord	1.11	1.12	1.08	1.08	1.10	1.14	1.26	1.05
Causal modeling	1.27	1.35	1.28	1.28	1.29	1.23	1.47	1.19
Credit Risk Models (e.g., Credit metrics.)	1.40	1.45	1.38	1.34	1.41	1.37	1.57	1.34
Dynamic Financial Analysis (DFA)	2.07	2.27	2.12	1.78	2.07	2.03	2.40	1.93
Economic capital	1.59	1.70	1.64	1.72	1.64	1.45	1.87	1.48
Economic Cost of Ruin or Expected Policyholder Deficit	1.77	1.87	1.87	1.48	1.81	1.66	1.97	1.68
Economic Value Added (EVA)	1.50	1.71	1.58	1.54	1.55	1.34	1.74	1.40
Extreme Value Theory (EVT)	1.25	1.30	1.31	1.22	1.23	1.24	1.43	1.18
Fuzzy logic	1.17	1.23	1.20	1.08	1.18	1.15	1.23	1.15
Generalized Autoregressive Heteroskedastic models	1.13	1.24	1.10	1.10	1.12	1.16	1.16	1.12
Net Present Value (NPV)	2.61	2.78	2.69	2.48	2.65	2.48	2.74	2.55
Options Pricing Theory (e.g., Black-Scholes model)	1.78	2.01	1.84	1.92	1.72	1.85	2.03	1.67
Real Options	1.34	1.55	1.31	1.46	1.33	1.33	1.52	1.26
Return on Risk Adjusted Capital–RORAC	1.52	1.43	1.64	1.82	1.56	1.39	1.78	1.41
Risk Adjusted Return on Capital–RAROC	1.60	1.65	1.72	1.90	1.66	1.44	1.95	1.45
Risk Mapping	1.21	1.50	1.16	1.04	1.20	1.18	1.47	1.11
Strengths, Weaknesses, Opportunities, Threats (SWOT) Analysis	1.46	1.81	1.53	1.30	1.50	1.33	1.66	1.36
System Dynamics models	1.08	1.18	1.03	1.00	1.05	1.08	1.14	1.05
Value at Risk (VAR)	1.54	1.84	1.56	1.38	1.51	1.55	1.95	1.37
Tail VAR	1.27	1.48	1.23	1.30	1.25	1.26	1.57	1.14
Other ERM-relevant metrics, models, concepts	1.09	1.09	1.08	1.08	1.09	1.10	1.19	1.05

Written responses to “Other ERM-relevant metrics, models and concepts (please specify)”

- CAPT
- Catastrophe models
- Correlation/Copulas
- Hedging via futures and options
- Marginal analysis
- Probability of ruin
- Statistical modeling
- Utility based return measures

**Question 11:**

**Please indicate your level of ability to quantify/model the following types of risk, using the scale 1 = no or low ability, 2 = medium ability, 3 = high ability.**

The data in the table cells below represent the average response for each category. A response of 1 was inserted for those items left blank.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
hazard – property/casualty	2.46	2.41	2.47	2.26	2.46	2.46	2.47	2.45
hazard – non p/c (e.g., health, safety, HR-related)	1.30	1.45	1.25	1.44	1.26	1.37	1.40	1.26
financial	1.69	1.63	1.70	1.76	1.70	1.68	1.94	1.59
operational	1.34	1.43	1.32	1.36	1.33	1.37	1.42	1.30
strategic	1.38	1.40	1.36	1.50	1.39	1.36	1.51	1.33

**Question 12:**

**In the future, which of the following best describes the role you believe CAS members should play in the ERM process?**

The percentages in the table represent the percentage of respondents that indicated that CAS members should play the particular role in the ERM process.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
As the project leader	50.0	50.5	49.5	53.3	51.0	49.4	66.3	43.1
As a project team member with primary responsibility for all risk quantification work	60.4	63.7	58.3	66.7	58.9	64.4	69.8	56.4
As a project team member with primary responsibility for all hazard risk quantification work	46.0	51.6	41.7	66.7	48.0	42.5	50.0	44.1
As a project team member with primary responsibility for all property/casualty risk quantification work	53.7	50.5	53.1	80.0	55.4	50.6	51.2	54.5
As a risk “integrator”	43.3	48.4	40.1	53.3	46.5	37.9	61.6	35.5
Other	5.7	8.8	3.6	13.3	5.9	4.6	9.3	4.3
None	2.0	1.1	1.6	13.3	1.5	3.4	3.5	1.4

Written responses to “Other (please specify)”

- Any of the above for which qualified.
- As the writer of responses to requests for proposals to perform ERM work, encompassing all aspects of the proposed analysis (although other team members would be equally qualified to do this).
- Client
- None, if they’re smart.
- Risk Consultant
- Subject matter expert based on job experience.

**Question 13:****How would you rate the relative importance of increasing your knowledge of ERM?**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Low importance	16.8	15.4	17.2	20.0	16.8	16.1	10.5	19.4
Medium importance	47.3	37.4	52.1	46.7	51.0	37.9	40.7	50.2
High importance	33.6	45.1	28.1	33.3	29.7	43.7	44.2	28.9
Blank	2.3	2.2	2.6	0.0	2.5	2.3	4.7	1.4

**Question 14:****How important is it for CAS members to become better trained in ERM?**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Low importance	6.4	8.8	5.2	6.7	7.4	4.6	8.1	5.7
Medium importance	51.7	44.0	55.2	53.3	52.5	49.4	37.2	57.8
High importance	39.9	45.1	37.5	40.0	37.1	46.0	50.0	35.5
Blank	2.0	2.2	2.1	0.0	3.0	0.0	4.7	0.9

**Question 15:****Please indicate how involved actuaries should be with respect to ERM in the following industry groups, using the scale 1 = no or low involvement, 2 = medium involvement, 3 = high involvement.**

The data in the table cells below represent the average response for each category. A response of 1 was inserted for those items left blank.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Property/casualty insurance industry only	2.72	2.52	2.77	2.92	2.68	2.86	2.74	2.72
All financial services	2.04	2.04	2.02	2.34	1.98	2.20	2.13	2.00
Any industry	1.76	1.83	1.62	1.64	1.74	1.77	1.83	1.72

**Question 16:**

Please rank the relative importance of the following potential sources of ERM education for current CAS members, using a scale 1 = no or low importance, 2 = medium importance, 3 = high importance.

The data in the table cells below represent the average response for each category. A response of 1 was inserted for those items left blank.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
CAS Special Interest Seminars	2.43	2.29	2.42	2.58	2.45	2.45	2.34	2.46
CAS Examination Syllabus	1.87	1.73	1.89	1.48	1.89	1.84	1.83	1.88
Other professional organizations' seminars/syllabi	1.34	1.62	1.26	1.28	1.33	1.38	1.48	1.29
Business school	1.54	1.70	1.54	1.66	1.52	1.57	1.57	1.52
Self-study	2.07	2.25	1.97	2.14	2.08	2.06	2.28	1.98
On-the-job learning	2.23	2.45	2.18	2.12	2.13	2.45	2.42	2.15
Other	1.15	1.18	1.11	1.12	1.16	1.13	1.09	1.18

Written responses to “Other professional organizations’ seminars/syllabi (please specify)”

- CFA (13 responses)
- GARP (5)
- CPCU (4)
- RIMS (2)
- AAA
- Any related
- Association of Financial Professionals
- CAS Part 8
- CCA
- Financial institutions / economists
- Institute of Actuaries
- Risk Conferences
- SOA
- Specialties as needed
- Topics at CAS conventions
- University courses

Written responses to “Other (please specify)”

- Sessions at May & November meetings (3 responses)
- All CAS meetings and seminars – not just special interest seminars
- Call Papers / Forum
- Can CAS compile a bibliography?
- Continuing education
- Coordinating with other people doing similar work
- Online Course
- Post fellowship certification program
- Sessions at DFA seminar

**Question 17:**

**On the risk type / process grid below, please indicate the level of expertise you currently possess, using the scale 1 = no or low level of expertise, 2 = medium level of expertise, and 3 = high level of expertise.**

A total of 25 respondents did not provide an answer for question 17. These respondents are not included in the data analysis below. The demographic breakdown for these respondents follows:

Employment type of Broker/Agent, Consultant, or Organization Serving Insurance	6
Employment type of Property/Liability Insurance Company or Reinsurance Company	19
Employment type of Academic, Government, Life, Accident & Health Ins., Retired, or Other	0
Fellows	20
Associates	5
Respondents who answered a of b to question 4	9
Respondents who answered c, d, or e to question 4	16

The data in the table cells below represent the average response for each category. A response of 1 was inserted for those items left blank.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Establish Context (all risk types)	1.64	1.94	1.57	1.44	1.60	1.66	2.05	1.48
Identify Risks – Hazard	2.41	2.69	2.30	2.10	2.40	2.39	2.66	2.31
Identify Risks – Financial	1.81	1.95	1.77	1.56	1.86	1.67	2.08	1.70
Identify Risks – Operational	1.50	1.82	1.46	1.40	1.54	1.38	1.66	1.43
Identify Risks – Strategic	1.52	1.76	1.48	1.52	1.56	1.39	1.83	1.39
Analyze/Quantify Risks - Hazard	2.41	2.68	2.28	2.02	2.41	2.39	2.55	2.36
Analyze/Quantify Risks – Financial	1.68	1.87	1.64	1.44	1.69	1.62	1.99	1.55
Analyze/Quantify Risks – Operational	1.36	1.52	1.34	1.04	1.38	1.34	1.45	1.32
Analyze/Quantify Risks – Strategic	1.38	1.52	1.34	1.40	1.39	1.37	1.56	1.30
Integrate Risks (all risk types)	1.48	1.84	1.36	1.20	1.46	1.52	1.91	1.31
Assess/Prioritize Risks - Hazard	2.13	2.53	2.01	1.56	2.15	2.07	2.38	2.03
Assess/Prioritize Risks – Financial	1.56	1.76	1.53	1.38	1.61	1.41	1.86	1.44
Assess/Prioritize Risks – Operational	1.32	1.54	1.29	1.40	1.35	1.24	1.45	1.27
Assess/Prioritize Risks – Strategic	1.37	1.68	1.33	1.20	1.40	1.30	1.61	1.27
Treat/Exploit Risks - Hazard	1.92	2.33	1.77	1.46	1.88	1.98	2.19	1.81
Treat/Exploit Risks - Financial	1.41	1.59	1.35	1.30	1.41	1.38	1.69	1.30
Treat/Exploit Risks - Operational	1.22	1.37	1.20	1.08	1.24	1.20	1.35	1.17
Treat/Exploit Risks - Strategic	1.27	1.40	1.24	1.20	1.29	1.24	1.47	1.19
Monitor & Review (all risk types)	1.48	1.58	1.43	1.20	1.49	1.46	1.70	1.39

**Question 18:**

**On the risk type/ process grid below, please indicate the level of knowledge you believe is necessary for CAS members to have by the year 2005. Use the scale below:**

- 1 = All CAS members should be expert in this area.
- 2 = All CAS members need to know about this area and some should be expert.
- 3 = Some CAS members should know about this area.
- 4 = Outside the scope of CAS and should remain so.

A total of 41 respondents did not provide an answer for question 18. These respondents are not included in the data analysis below. The demographic breakdown for these respondents follows:

Employment type of Broker/Agent, Consultant, or Organization Serving Insurance	11
Employment type of Property/Liability Insurance Company or Reinsurance Company	27
Employment type of Academic, Government, Life, Accident & Health Ins., Retired, or Other	3
Fellows	26
Associates	14
Respondents who became members within the last five years	2
Respondents who became members more than five years ago	6
Respondents who answered a of b to question 4	14
Respondents who answered c, d, or e to question 4	27

**Establish Context (all risk types)**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	9.7	10.0	9.1	16.7	7.4	9.6	16.7	7.1
All CAS members need to know about this area and some should be expert.	58.8	52.5	63.0	41.7	58.5	61.6	59.7	58.2
Some CAS members should know about this area.	26.1	30.0	23.0	41.7	27.8	24.7	18.1	29.3
Outside the scope of CAS and should remain so.	1.2	2.5	0.6	0.0	1.1	1.4	1.4	1.1
Blank	4.3	5.0	4.2	0.0	5.1	2.7	4.2	4.3

### Identify Risks – Hazard

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	41.6	48.8	38.2	41.7	39.2	46.6	54.2	37.0
All CAS members need to know about this area and some should be expert.	46.3	40.0	49.7	41.7	48.9	39.7	38.9	48.9
Some CAS members should know about this area.	8.9	8.8	8.5	16.7	9.7	8.2	5.6	10.3
Outside the scope of CAS and should remain so.	1.6	1.3	1.8	0.0	1.1	2.7	1.4	1.6
Blank	1.6	1.3	1.8	0.0	1.2	2.7	0.0	2.1

### Identify Risks – Financial

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	10.5	13.8	9.7	0.0	8.5	15.1	13.9	9.2
All CAS members need to know about this area and some should be expert.	67.3	62.5	69.1	75.0	71.0	57.5	70.8	65.8
Some CAS members should know about this area.	19.1	20.0	18.2	25.0	17.6	23.3	13.9	21.2
Outside the scope of CAS and should remain so.	1.6	2.5	1.2	0.0	1.7	1.4	1.4	1.6
Blank	1.6	1.3	1.8	0.0	1.2	2.7	0.0	2.1

### Identify Risks – Operational

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	3.9	6.3	3.0	0.0	2.8	6.8	5.6	3.3
All CAS members need to know about this area and some should be expert.	47.9	45.0	49.1	50.0	46.0	52.1	45.8	48.4
Some CAS members should know about this area.	42.0	40.0	42.4	50.0	44.9	37.0	43.1	41.8
Outside the scope of CAS and should remain so.	4.3	6.3	3.6	0.0	5.1	1.4	4.2	4.3
Blank	2.0	2.6	1.8	0.0	1.2	2.7	1.4	2.1

### Identify Risks – Strategic

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	4.3	6.3	3.6	0.0	4.0	5.5	5.6	3.8
All CAS members need to know about this area and some should be expert.	48.6	50.0	49.1	33.3	46.6	53.4	50.0	47.8
Some CAS members should know about this area.	41.2	37.5	41.2	66.7	43.8	35.6	40.3	41.8
Outside the scope of CAS and should remain so.	3.5	3.8	3.6	0.0	4.0	2.7	2.8	3.8
Blank	2.3	2.6	2.4	0.0	1.7	2.7	1.4	2.7

### Analyze/Quantify Risks – Hazard

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	51.0	61.3	46.7	41.7	48.3	56.2	61.1	46.7
All CAS members need to know about this area and some should be expert.	37.0	26.3	42.4	33.3	39.8	32.9	31.9	39.1
Some CAS members should know about this area.	7.8	10.0	6.1	16.7	8.5	5.5	5.6	8.7
Outside the scope of CAS and should remain so.	1.2	0.0	1.8	0.0	1.1	1.4	0.0	1.6
Blank	3.1	2.6	3.0	8.3	2.3	4.1	1.4	3.8

### Analyze/Quantify Risks – Financial

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	13.2	16.3	12.7	0.0	11.9	15.1	15.3	12.0
All CAS members need to know about this area and some should be expert.	65.4	65.0	66.1	58.3	67.6	61.6	66.7	65.2
Some CAS members should know about this area.	17.5	16.3	17.0	33.3	16.5	19.2	18.1	17.4
Outside the scope of CAS and should remain so.	1.2	1.3	1.2	0.0	1.7	0.0	0.0	1.6
Blank	2.7	1.3	3.0	8.3	2.3	4.1	0.0	3.8

### Analyze/Quantify Risks – Operational

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	5.4	3.8	6.7	0.0	3.4	11.0	4.2	6.0
All CAS members need to know about this area and some should be expert.	44.0	48.8	43.6	16.7	43.2	46.6	43.1	44.0
Some CAS members should know about this area.	43.2	40.0	42.4	75.0	45.5	38.4	47.2	41.8
Outside the scope of CAS and should remain so.	3.9	5.0	3.6	0.0	5.1	0.0	4.2	3.8
Blank	3.5	2.6	3.6	8.3	2.9	4.1	1.4	4.3

### Analyze/Quantify Risks – Strategic

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	5.1	3.8	6.1	0.0	4.0	8.2	5.6	4.9
All CAS members need to know about this area and some should be expert.	47.5	53.8	46.7	16.7	46.6	50.7	48.6	46.7
Some CAS members should know about this area.	41.6	37.5	41.2	75.0	43.2	37.0	43.1	41.3
Outside the scope of CAS and should remain so.	3.1	2.5	3.6	0.0	4.0	1.4	1.4	3.8
Blank	2.7	2.6	2.4	8.3	2.3	2.7	1.4	3.2

### **Integrate Risks (all risk types)**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	7.0	6.3	7.9	0.0	4.0	12.3	6.9	7.1
All CAS members need to know about this area and some should be expert.	57.2	52.5	60.0	50.0	59.1	53.4	56.9	57.1
Some CAS members should know about this area.	27.6	28.8	25.5	50.0	27.3	28.8	29.2	27.2
Outside the scope of CAS and should remain so.	1.2	2.5	0.6	0.0	1.7	0.0	1.4	1.1
Blank	7.0	10.1	6.1	0.0	8.0	5.5	5.6	7.6

### **Assess/Prioritize Risks – Hazard**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	28.8	37.5	24.8	25.0	25.0	27.0	40.3	23.9
All CAS members need to know about this area and some should be expert.	54.1	46.3	58.2	50.0	60.8	41.1	38.9	60.3
Some CAS members should know about this area.	13.6	12.5	13.3	25.0	10.8	19.2	18.1	12.0
Outside the scope of CAS and should remain so.	1.6	1.3	1.8	0.0	1.7	1.4	0.0	2.2
Blank	2.0	2.6	1.8	0.0	1.7	1.4	2.8	1.6

**Assess/Prioritize Risks – Financial**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	8.9	12.5	7.9	0.0	7.4	12.3	11.1	7.6
All CAS members need to know about this area and some should be expert.	62.6	57.5	64.8	66.7	66.5	56.2	61.1	63.6
Some CAS members should know about this area.	25.7	27.5	24.2	33.3	22.7	30.1	26.4	25.5
Outside the scope of CAS and should remain so.	1.2	1.3	1.2	0.0	1.7	0.0	0.0	1.6
Blank	1.6	1.3	1.8	0.0	1.7	1.4	1.4	1.6

**Assess/Prioritize Risks – Operational**

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	1.9	3.8	1.2	0.0	0.6	5.5	4.2	1.1
All CAS members need to know about this area and some should be expert.	43.2	43.8	43.0	41.7	42.6	46.6	38.9	44.6
Some CAS members should know about this area.	47.5	43.8	49.1	50.0	48.3	45.2	48.6	47.3
Outside the scope of CAS and should remain so.	5.4	6.3	4.8	8.3	6.8	1.4	5.6	5.4
Blank	2.0	2.6	1.8	0.0	1.7	1.4	2.8	1.6

### Assess/Prioritize Risks – Strategic

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	2.7	3.8	1.8	8.3	2.3	4.1	6.9	1.1
All CAS members need to know about this area and some should be expert.	47.5	47.5	47.9	41.7	47.7	49.3	44.4	48.4
Some CAS members should know about this area.	42.4	42.5	42.4	41.7	41.5	42.5	41.7	42.9
Outside the scope of CAS and should remain so.	5.4	3.8	6.1	8.3	6.8	2.7	4.2	6.0
Blank	2.0	2.6	1.8	0.0	1.7	1.4	2.8	1.6

### Treat/Exploit Risks – Hazard

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	23.3	27.5	21.8	16.7	18.8	32.9	29.2	20.7
All CAS members need to know about this area and some should be expert.	49.8	48.8	50.9	41.7	56.3	38.4	40.3	53.8
Some CAS members should know about this area.	21.8	16.3	23.0	41.7	19.9	24.7	23.6	21.2
Outside the scope of CAS and should remain so.	2.3	3.8	1.8	0.0	2.3	2.7	1.4	2.7
Blank	2.7	3.8	2.4	0.0	2.9	1.4	5.6	1.6

### Treat/Exploit Risks – Financial

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	5.4	7.5	4.8	0.0	2.8	11.0	8.3	3.8
All CAS members need to know about this area and some should be expert.	57.2	53.8	60.0	41.7	60.8	52.1	51.4	59.8
Some CAS members should know about this area.	32.7	32.5	30.9	58.3	31.3	32.9	33.3	32.6
Outside the scope of CAS and should remain so.	2.3	3.8	1.8	0.0	2.3	2.7	2.8	2.2
Blank	2.3	2.6	2.4	0.0	2.9	1.4	4.2	1.6

### Treat/Exploit Risks – Operational

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	1.6	3.8	0.6	0.0	0.6	4.1	4.2	0.5
All CAS members need to know about this area and some should be expert.	38.1	33.8	41.2	25.0	36.4	45.2	31.9	40.2
Some CAS members should know about this area.	50.2	50.0	49.1	66.7	51.7	45.2	48.6	51.1
Outside the scope of CAS and should remain so.	7.4	8.8	6.7	8.3	8.5	4.1	9.7	6.5
Blank	2.7	3.8	2.4	0.0	2.9	1.4	5.6	1.6

### Treat/Exploit Risks – Strategic

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	2.3	3.8	1.8	0.0	1.7	4.1	5.6	1.1
All CAS members need to know about this area and some should be expert.	40.5	36.3	44.2	16.7	39.8	45.2	36.1	41.8
Some CAS members should know about this area.	48.2	52.5	44.2	75.0	48.3	45.2	48.6	48.4
Outside the scope of CAS and should remain so.	5.8	3.8	6.7	8.3	7.4	2.7	4.2	6.5
Blank	3.1	3.8	3.0	0.0	2.9	2.7	5.6	2.1

### Monitor & Review (all risk types)

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
All CAS members should be expert in this area.	1.9	1.3	2.4	0.0	1.7	2.7	5.6	0.5
All CAS members need to know about this area and some should be expert.	56.4	53.8	59.4	33.3	54.5	60.3	50.0	58.7
Some CAS members should know about this area.	32.3	28.8	32.1	58.3	34.7	27.4	29.2	33.7
Outside the scope of CAS and should remain so.	4.7	10.0	1.8	8.3	4.0	5.5	8.3	3.3
Blank	4.7	6.3	4.2	0.0	5.1	4.1	6.9	3.8

**Question 19:****To which of the following organizations do you belong?**

The percentages in the table represent the percentage of respondents that indicated that they belong to the particular organization.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
Global Association of Risk Professionals (GARP)	2.3	5.5	1.0	0.0	2.5	1.1	5.8	0.9
Risk and Insurance Management Society (RIMS)	1.7	4.4	0.5	0.0	2.0	0.0	4.7	0.5
Association for Investment Management and Research (AIMR)	1.7	1.1	2.1	0.0	2.5	0.0	1.2	1.9
American Institute of Certified Public Accountants (AICPA)	0.7	0.0	1.0	0.0	1.0	0.0	1.2	0.5
International Association of Financial Engineers (IAFE)	0.7	1.1	0.5	0.0	0.0	1.1	1.2	0.5
Society of Actuaries (SoA)	3.7	7.7	1.6	6.7	3.0	3.4	4.7	3.3
Other	16.4	23.1	13.5	13.3	15.8	17.2	17.4	15.6
None	40.6	33.0	43.2	53.3	41.6	41.4	36.0	42.7

Written responses to “Other (please specify)”

- Society of CPCU’s (6 responses)
- CIA (5)
- ARIA (4)
- Institute of Actuaries (3)
- AFIR (2)
- ASTIN (2)
- CCA (2)
- Institute of Actuaries of Australia (2)
- Society of Insurance Research (2)
- ASPA
- CAJPA
- International Anti-Fad Management Society
- National Association of Insurance Women
- PARMA
- PRIMA
- RAA

**Question 20:****Which of the following designations do you hold?**

The percentages in the table represent the percentage of respondents that indicated that they hold the particular designation.

	All	Vendor Group	Industry Group	Other	Fellows	Associates	Experts	Non-experts
MBA	4.0	3.3	3.6	13.3	4.5	3.4	4.7	3.8
Ph.D.	2.7	3.3	2.1	6.7	2.5	3.4	4.7	1.9
Financial Risk Manager (FRM)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Associate in Risk Management (ARM)	4.0	6.6	2.6	6.7	4.0	3.4	4.7	3.8
Chartered Property Casualty Underwriter (CPCU)	7.4	8.8	6.8	6.7	9.4	2.3	3.5	9.0
Chartered Financial Analyst (CFA)	0.7	2.2	0.0	0.0	0.5	0.0	1.2	0.5
Fellow or Associate of Society of Actuaries (FSA/ASA)	5.4	7.7	3.6	13.3	5.0	5.7	9.3	3.8
Certified Public Accountants (CPA)	0.7	0.0	1.0	0.0	0.5	1.1	1.2	0.5
Associate in Reinsurance (ARe)	3.4	2.2	4.2	0.0	4.0	2.3	3.5	3.3
Other	12.4	14.3	12.0	6.7	8.9	17.2	7.0	14.7
None	36.2	29.7	37.5	60.0	36.6	37.9	31.4	38.4

## Written responses to “Other (please specify)”

- MS (including applied math, psychology, economics and statistics) (7)
- FCIA (5)
- MA in Mathematics (2)
- AIM
- ARP
- Associate in Insurance Accounting and Finance (AIAF)
- Associate in Regulation and Compliance (ARC)
- Associate in Underwriting
- B.Sc.
- Broker license
- Certified Professional Insurance Woman
- ChFC
- CLU
- FCA
- FIA
- FIAA

**Question 21:**

**Given the Advisory Committee's charge to identify research and education that the CAS should undertake in the area of ERM, what other information would you like to share to assist the Committee in fulfilling this charge?**

**Research**

- Investigate what exists first.
- More work needs to be done on correlation/dependency structures. In particular, many financial risks are affected by macroeconomic factors. A better understanding of econometrics would be valuable for better projections of the overall risk profile.
- Literature search for firm-wide approaches to risk management, especially PCAS and "Collective Risk," AFIR, and other actuarial papers.
- Research should be undertaken in the statistical and business aspects of dealing with ERM so that actuaries will have some tools to fall back upon.
- ERM means different things to different people. A simple ERM could be a "basket aggregate" of insurance coverages to the more sophisticated "enterprise" which would include Financial (foreign exchange), Human Capital (employee recruitment/retention), Legal (Internet Liability, Professional liability, contract liability), Natural (ice storms), Operational (supplier failure), Political (confiscation/nationalization), Technological (cyber property), and the Insurance risk wrapped together. It is not just a simple ERM topic, it will need to be identified as to the scope of what you want to undertake. Also, the subject is difficult to sell to a Risk Manager. It is the CFO and the CEO who will be able to have the larger perspective in order to grasp this concept. ERM is slowly getting some attention. One of the problems is the high cost of modeling the individual client's risk. Unless there is some payback to the client they are reluctant to engage such a large project. We also have some tremendous competition from our CFA folks who seem to be able to do it cheaper. Remember that ERM is one or two steps away from a DFA.
- Committee on Theory of Risk research agenda eventually gets around to exploring the relationship between catastrophes and financial economics. It is important to get there, and subsequently review the steps we took on the way there.
- I think ERM should be treated as any other actuarial discipline where certain actuaries should become experts and the rest have a basic knowledge of the subject. A personal lines or BOP actuary does not need to be an expert in ERM from the customer's standpoint; this is an area that pertains to a certain insured group and those that price and analyze that group are the only necessary experts.
- Should link up with a GARP or IAFE and develop research program.
- My impression is that the CAS approach is primarily academic at this time and not yet an aggressive business approach worthy of CEO and Board attention. Key research should be some examples in which casualty actuarial contributions were crucial to survival and growth of an organization.

- Correlation issues between risks.
- Parameter risk will kill you. Don't expect usage to outpace practicality.
- Despite Shaun Wang's excellent work, I think more should be done in the area of estimating correlation structures and generating correlated variates. In particular, the measurement of correlation between indicated loss reserves and economic variables needs to be developed.
- The ERM Special Interest Seminar was very good. It was great to see actuaries thinking about operational risks in a broad context.
- CAS should work with finance academics on valuation models for inefficient markets (i.e., those where arbitrage-free pricing models don't apply).
- Like Black-Scholes, Property Catastrophe, and other models that are useful for business, we should have an ERM Lite model available for CAS use. I believe Lite versions should suffice on most occasions, until one wants to get the more detailed examination, in which case consultants who have broad knowledge in the specific model and industry expertise are invaluable.
- Research and take a position on the various competing ways to determine capital adequacy in the P/C industry.
- Quantification and modeling of risk. Integrated risk modeling.

### **Education**

- Don't add to exams until there's good material, and other material is removed.
- I think this is a great area for P/C actuaries to be involved in.
- Option Theory – Risk structures to exploit knowledge have often included options, some explicit and some implicit. Recognizing and anticipating the incentives these options create for the different parties involved is necessary for proper exploitation.
- ERM should be included as an exam topic, and seminars should be offered if there is enough interest to support them. While this topic would seem to be an ideal area of concentration for a casualty actuary, the actual performance of this function is often based either on the interest of the individual actuary or the political set-up of the company management. Many actuaries are happily and fully employed doing other tasks. Many companies focus their listening based on top management preferences rather than formal education qualifications.
- The education of actuaries will continue to break apart into specialties. ERM could be such a specialty. Most CAS members do compliance work and have no benefit in studying ERM rather than something else.

- While this has been developed since my time as a student, I believe that the Actuarial Control Cycle course taught by Macquarie and other universities for the Institute of Actuaries of Australia covers a range of enterprise risk management topics and could be worthy of consideration by the committee.
- Actual ERM deals are very few and do not represent a significant source of income; therefore, they should not be heavily emphasized in the CAS educational process.
- Not all actuaries will be involved (or will possess the skills to be capable of being involved) in ERM. We are not generalists but specialists and some people will not develop beyond certain limitations/interests, and that is OK. Keep in mind that most people that take the time to respond to this survey will likely have a passing interest in ERM so the results will be skewed towards a higher need than actually exists in the market today and in the near future. Think about it. DFA was recently added to the syllabus and people still work in the area--self study and on the job training is FINE for very specific areas. Many will not go beyond being rate filing actuaries, ever.
- I would like to learn much more about Enterprise Risk.
- Should link up with a GARP or IAFE and develop certificate program.
- The Procrustean bed of a uniform approach to enterprise risk management means that less capable consultants can perform engagements resembling enterprise risk management. All organizations are not alike. Clear description of the variety of organizational goals and diagnostic tools to decide risk management strategies are most needed for CAS education. Processes should not be emphasized until we have a foundation in place.
- I believe that the CAS should make the members aware of enterprise risk issues, but should NOT try to become an educator. The CAS has already wandered too far from actuarial core competencies. There is plenty of information and educational resources available through treasury and financial seminars to facilitate the learning process for those who seek expertise in this area. This is not an area for ALL actuaries.
- We need a lot of education. Basel Capital, ECOR, EVA, EVT, etc., are all unfamiliar concepts that we need to know. We need more management training too so that we can add value to the operations of any company - not just Insurance or Financial Services Companies.
- See your question 16. You ask about "CAS special interest seminars", but make no reference to 'normal' meetings and seminars. I predict that if you hold a special interest seminar on ERM, you will get some of the members. If instead, you hold an introductory session at the spring and fall meetings and the ratemaking and reserving seminars, you will get dozens, if not hundreds of people at each session.
- I recently attended a luncheon where H. Felix Kloman spoke briefly about this very subject. I think he would be a very good speaker/educator about the identification/integration of risk analysis. I think RIMS might also be a very good source for education/seminars.

- What really struck me after attending the special interest seminar in San Francisco, was how it seems many people know about this topic, but it seems the education is seriously lacking. How does one go about doing an ERM project, start to finish? I have no clue and would like very much to know.
- The CAS can't be all things to all people. CAS actuaries may decide to pursue this path, but it is not for everyone. I wouldn't put the info on the ACAS exams as these are a building block, not specifics. General mention on the FCAS exams should provide a start.
- Emphasize simple models for assessing hazard/financial risk that can be set up, run, and rerun quickly. Sacrifice mathematical sophistication in favor of more understandable models. "Black box" DFA models are to be discouraged.
- The Advisory Committee should issue a call for Forum papers on enterprise risk management, including a paper that surveys all methods for quantifying and assessing risks (per question 10). The survey should include general description, data requirements, strengths, and weaknesses.
- In an overloaded syllabus which has historically trained "generalists", I believe that other than mild knowledge and testing of students is beyond the scope of the formal education process. This is an advanced topic, needed by only the senior-most company officers / or consulting actuaries.
- I think the necessary education to produce an enterprise risk manager is far more encompassing than what the CAS should offer. Investment and accounting expertise can be picked up in other organizations. We can't expect to put students through 8 years of exams learning the fundamentals of how to work with property casualty type contingencies, only to need to tack on a few more to try and teach non-insurance accounting and business skills to students. Business skills that teach the wide range of items that need to be considered in the ERM process can't be taught in a syllabus type context. Furthermore, not every actuary needs to be skilled at the level of detail required to be a top-notch ERM. I have no problems in adding something like this material to the syllabus (very brief) so students are exposed to this area of practice. However given how poorly the CAS tests over DFA, I think learning about ERM would probably be best handled by special interest seminars. Disclaimer: I took Part 8 this spring, it was a poor exam, yes I'm still bitter.
- Question #18 – I think could be better categorized as some should know about area and some should be expert in area. I think it is unrealistic to think all should know about the subject. There are still other areas of expertise that are needed and should be specialized in as well.
- Seminars should present cutting edge topics. This year's ERM seminar presented a good perspective from Ford, but insurance companies aren't doing anything, except providing some capital markets products. I haven't seen anything that is truly combining P&C risk with some other type.
- We could use some better "practitioner" literature on how to combine DFA-type analysis of hazard risks with operational, financial and strategic risks.

# APPENDIX

## Casualty Actuarial Society Membership Survey on Enterprise Risk Management

### Introduction

The CAS Board of Directors established the CAS Advisory Committee on Enterprise Risk Management to identify research and education that the CAS should undertake in the area of enterprise risk management. A key step in the Committee's work is to identify the current level of knowledge, the source of that knowledge, and the desired level of knowledge of the CAS membership as respects enterprise risk management. Your participation in this survey will greatly assist the Committee in its efforts.

Please complete and return the survey even if you are not presently involved in the area of Enterprise Risk Management. This alone provides valuable information to the committee. You should be able to complete the survey in about 15 minutes.

### Background

We define and explain some terms and concepts to help you to better understand the questions in the survey.

### Enterprise Risk Management

The Advisory Committee's working definition of *Enterprise Risk Management* is:

"The process by which organizations in all industries assess, control, exploit, finance and monitor risks from all sources for the purpose of increasing the organization's short and long term value to its stakeholders."

Note the term "*exploit*" risk. This term is used to highlight the fact that the ERM process can be used not just to mitigate or transfer risk, but also to take advantage of the risks present within a firm, and their relationships to the firm's environment.

### Types of Risk

The advisory committee categorizes the types of risk that are subject to Enterprise Risk Management as follows:

- *Hazard* – traditional property/casualty risk, including catastrophic loss, business interruption risk, and environmental risk; health and safety risk; human resources related risk.
- *Financial* – price (e.g., interest rate, foreign exchange, commodity); liquidity (e.g., cash flow, opportunity cost); credit (e.g., default).
- *Operational* – operations (e.g., customer satisfaction, human resources, product development, capacity, efficiency, product/service failure, trademark/brand erosion); empowerment (e.g., leadership, change readiness); information technology (e.g., relevance, availability); integrity (e.g., management fraud, reputation); information risk – business reporting (e.g., budgeting and planning, accounting information, pension fund, investment evaluation, taxation).
- *Strategic* – competition, customer wants, technological innovation, capital availability, regulatory, political, etc.

## Enterprise Risk Management Process

The Advisory Committee considers the Enterprise Risk Management process as comprising the following steps:

- *Establish Context* – includes understanding the strategic (external) context (e.g., organization/environment relationship, stakeholder communication policies, “Strengths, Weaknesses, Opportunities and Threats” (SWOT) analysis), the organizational (internal) context (e.g., goals, objectives, oversight structure, common language and criteria), and the risk management context (e.g., units covered, coordination throughout organization).
- *Identify Risks* – includes documenting the conditions and events that represent material threats to the organization’s achievement of its strategic objectives or represent areas to exploit for competitive advantage.
- *Analyze/Quantify Risks* – includes creating probability distributions of outcomes for each material risk.
- *Integrate Risks* – includes aggregating all risk distributions, reflecting correlations and portfolio effects, and expressing results in terms of the organization’s common language and criteria.
- *Assess/Prioritize Risks* – includes both quantitative and qualitative determination of the contribution of each risk to the aggregate risk profile.
- *Treat/Exploit Risks* – includes both operational and financial responses.
- *Monitor and Review* – includes continual gauging of the risk environment and the performance of the risk management processes.

### **About the Survey**

Your participation in this survey will greatly assist the Committee in determining the current level of activity of CAS members in Enterprise Risk Management (ERM), and where the research and education needs are most critical.

In completing the survey, please understand that the Advisory Committee recognizes that most CAS members are involved in the analysis of property/casualty hazard risk and that this can be construed as a part of Enterprise Risk Management work. However, what the Advisory Committee is looking for is how involved the CAS membership is in the identification, quantification, and treatment of all types of risk in an enterprise-wide context.

**Please return the survey by May 25, 2001 to:**

Casualty Actuarial Society,  
1100 N. Glebe Rd, #600  
Arlington, VA, 22201  
Fax to: 703-276-3108  
E-mail to: [office@casact.org](mailto:office@casact.org)

## CAS Membership Survey on Enterprise Risk Management

1. Please indicate your type of employment (*please check one*):
  - a.  Academic
  - b.  Broker/Agent
  - c.  Consultant
  - d.  Government
  - e.  Life, Accident, and Health Insurance
  - f.  Organization Serving Insurance Business
  - g.  Property/Liability Insurance
  - h.  Reinsurance
  - i.  Retired
  - j.  Other
  
2. Please indicate your CAS membership status (*please check one*):
  - a.  Fellow                      \_\_\_\_\_ Year Attained
  - b.  Associate                      \_\_\_\_\_ Year Attained
  - c.  Affiliate                      \_\_\_\_\_ Year Attained
  
3. Which of the following describes how you attained your knowledge of Enterprise Risk Management (ERM)?  
(*Please identify and rank all that apply in order of importance, with 1 = most important.*)
  - a.  From others in my company.
  - b.  From CAS Examination materials.
  - c.  Through seminars/courses presented by: (*please specify*) \_\_\_\_\_
  - d.  Through self-study of the literature.
  - e.  Through on-the-job learning.
  - f.  From specific readings/textbooks. (*please specify*) \_\_\_\_\_
  - g.  Other (*please specify*) \_\_\_\_\_
  - h.  I have no current knowledge of ERM.

4. Which of the following best describes your level of knowledge, involvement, and interest in ERM? *(Please check one.)*
- a.  I consider myself somewhat of an expert in ERM and devote a considerable portion of my time to ERM projects.
  - b.  I am familiar with ERM and have been involved with some ERM projects.
  - c.  I have some understanding of the ERM concept, but have never been involved with an ERM project.
  - d.  I am not very familiar with ERM, but am interested to learn about it.
  - e.  I have no interest in ERM.

*Note: If you answered C, D, or E to question 4, please proceed to question 10 on page 5. Otherwise, please continue to question 5.*

5. Approximately what percentage of your time over the past 12 months have you been involved in ERM projects? *(Please check one.)*
- a.  Over 75%
  - b.  Between 50% and 75%
  - c.  About 50%
  - d.  Between 25% and 50%
  - e.  Less than 25%
6. Which of the following aspects of ERM projects have you personally been involved in? *(Please check all that apply.)*
- a. Identification of risks on an enterprise-wide scale:
    - Hazard risk – property/casualty
    - Hazard risk – other (e.g., health, safety, HR-related)
    - Financial risk
    - Operational risk
    - Strategic risk
  - b. Analysis/quantification of hazard risk:
    - Property/casualty hazard risks
    - Other types of hazard risk *(please specify)* \_\_\_\_\_

c. Analysis/quantification of financial risks:

- Credit risk
- Foreign exchange risk
- Interest rate risk
- Liquidity risk
- Other (*please specify*) \_\_\_\_\_

d. Analysis/quantification of operational risks:

- Operations
- Information Technology
- Integrity
- Information risk
- Other (*please specify*) \_\_\_\_\_

e. Analysis/quantification of strategic risk:

- Competition
- Customer wants
- Technological innovation
- Capital availability
- Regulatory
- Political
- Other (*please specify*) \_\_\_\_\_

f. Integrated risk analysis including the following categories:

- Integration of various types of property/casualty hazard risks faced by an entity (e.g., property catastrophe risk with automobile liability).
- Integration of property/casualty hazard risks with other types of hazard risk faced by an entity (e.g., workers compensation with health risk).
- Integration of hazard risk, financial risk, operational risk, and/or strategic risk.

g. Assessment or prioritization of risks faced by an entity.

- hazard
- financial
- operational
- strategic

h.  Recommending ways to treat or exploit risks that have been identified, quantified, and assessed.

i.  Monitoring of changes in the risk environment and performance of the risk management processes.

7. What other types of practitioners have you worked with in an ERM project?  
(Please check all that apply.)

- a.  Academics
- b.  Accountants
- c.  Actuaries - life/health
- d.  Actuaries - pension
- e.  Actuaries - property/casualty
- f.  Brokers
- g.  Economists
- h.  Financial analysts
- i.  HR professionals
- j.  Internal auditors
- k.  IT professionals
- l.  Lawyers
- m.  Marketing professionals
- n.  MBAs/Management consultants
- o.  Operations experts
- p.  Risk managers
- q.  Risk specialists (e.g., currency risk expert)
- r.  Strategy and organization experts
- s.  Underwriters
- t.  Others (please specify) \_\_\_\_\_

8. Which of the following best describes your primary role in the ERM projects that you have been involved with? (Please check one.)

- a.  Project leader. (If checked, please proceed to Question 10 on the next page.)

Part of a team of practitioners with my role being:

- b.  Primary technical analyst for all risks.
- c.  Primary technical analyst for hazard risk, but a secondary role in other risks.
- d.  "Integrator" of all risks.
- e.  Other (please specify) \_\_\_\_\_

9. For those ERM projects in which you were one of several practitioners involved with the ERM process, in general which practitioner served as the project leader?  
(Please check only one.)

- a.  Academics
- b.  Accountants
- c.  Actuaries - life/health
- d.  Actuaries - pension
- e.  Actuaries - property/casualty
- f.  Brokers

- g.  Economists
- h.  Financial analysts
- i.  HR professionals
- j.  Internal auditors
- k.  IT professionals
- l.  Lawyers
- m.  Marketing professionals
- n.  MBAs/Management consultants
- o.  Operations experts
- p.  Risk managers
- q.  Risk specialists (e.g., currency risk expert)
- r.  Strategy and organization experts
- s.  Underwriters
- t.  Others (*please specify*) \_\_\_\_\_

10. Please indicate your level of understanding of the following, using the scale  
1 = no or low understanding, 2 = medium understanding, 3 = high understanding.

- a.  Basel Capital Accord
- b.  Causal modeling
- c.  Credit Risk Models (e.g., Credit metrics.)
- d.  Dynamic Financial Analysis (DFA)
- e.  Economic capital
- f.  Economic Cost of Ruin (ECOR) or Expected Policyholder Deficit (EPD)
- g.  Economic Value Added (EVA)
- h.  Extreme Value Theory (EVT)
- i.  Fuzzy logic
- j.  Generalized Autoregressive Heteroskedastic (GARCH) models
- k.  Net Present Value (NPV)
- l.  Options Pricing Theory (e.g., Black-Scholes model)
- m.  Real Options
- n.  Return on Risk Adjusted Capital (RORAC)
- o.  Risk Adjusted Return on Capital (RAROC)
- p.  Risk Mapping
- q.  Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis
- r.  System Dynamics models
- s.  Value at Risk (VAR)
- t.  Tail VAR
- u.  Other ERM-relevant metrics, models and concepts (*please specify*) \_\_\_\_\_

11. Please indicate your level of ability to quantify/model the following types of risk, using the scale 1 = no or low ability, 2 = medium ability, 3 = high ability.

- a.  hazard – property/casualty
- b.  hazard – non property/casualty (e.g., health, safety, HR-related)
- c.  financial
- d.  operational
- e.  strategic

12. In the future, which of the following best describes the role you believe CAS members should play in the ERM process? (*Please check all that apply.*)
- a.  As the project leader.
  - b.  As a project team member with primary responsibility for all risk quantification work.
  - c.  As a project team member with primary responsibility for all hazard risk quantification work.
  - d.  As a project team member with primary responsibility for all property/casualty risk quantification work.
  - e.  As a risk “integrator”.
  - f.  Other (*please specify*) \_\_\_\_\_
  - g.  None
13. How would you rate the relative importance of increasing your knowledge of ERM?
- a.  Low importance
  - b.  Medium importance
  - c.  High importance
14. How important is it for CAS members to become better trained in ERM?
- a.  Low importance
  - b.  Medium importance
  - c.  High importance
15. Please indicate how involved actuaries should be with respect to ERM in the following industry groups, using the scale 1 = no or low involvement, 2 = medium involvement, 3 = high involvement.
- a.  Property/casualty insurance industry only
  - b.  All financial services
  - c.  Any industry
16. Please rank the relative importance of the following potential sources of ERM education for current CAS members, using a scale 1 = no or low importance, 2 = medium importance, 3 = high importance.
- a.  CAS Special Interest Seminars
  - b.  CAS Examination Syllabus
  - c.  Other professional organizations’ seminars/syllabi (*please specify*) \_\_\_\_\_
  - d.  Business school
  - e.  Self-study
  - f.  On-the-job learning
  - g.  Other (*please specify*) \_\_\_\_\_

17. On the risk type / process grid below, please indicate the level of expertise **you currently possess**, using the scale 1 = no or low level of expertise, 2 = medium level of expertise, and 3 = high level of expertise.

Process Step*	Risk Type*			
	Hazard	Financial	Operational	Strategic
Establish Context (all risk types)				
Identify Risks				
Analyze/Quantify Risks				
Integrate Risks (all risk types)				
Assess/Prioritize Risks				
Treat/Exploit Risks				
Monitor & Review (all risk types)				

\* Refer to definitions in the Background section.

18. On the risk type/ process grid below, please indicate the level of knowledge you believe is **necessary for CAS members to have by the year 2005**. Use the scale below:

- 5 = All CAS members should be expert in this area.  
 6 = All CAS members need to know about this area and some should be expert.  
 7 = Some CAS members should know about this area.  
 8 = Outside the scope of CAS and should remain so.

Process Step*	Risk Type*			
	Hazard	Financial	Operational	Strategic
Establish Context (all risk types)				
Identify Risks				
Analyze/Quantify Risks				
Integrate Risks (all risk types)				
Assess/Prioritize Risks				
Treat/Exploit Risks				
Monitor & Review (all risk types)				

\* Refer to definitions in the Background section.

19. To which of the following organizations do you belong?

- a. \_\_\_ Global Association of Risk Professionals (GARP)  
 b. \_\_\_ Risk and Insurance Management Society (RIMS)  
 c. \_\_\_ Association for Investment Management and Research (AIMR)  
 d. \_\_\_ American Institute of Certified Public Accountants (AICPA)  
 e. \_\_\_ International Association of Financial Engineers (IAFE)  
 f. \_\_\_ Society of Actuaries (SoA)  
 g. \_\_\_ Other (*please specify*) \_\_\_\_\_  
 h. \_\_\_ None

20. Which of the following designations do you hold?

- a.  MBA
- b.  Ph.D.
- c.  Financial Risk Manager (FRM)
- d.  Associate in Risk Management (ARM)
- e.  Chartered Property Casualty Underwriter (CPCU)
- f.  Chartered Financial Analyst (CFA)
- g.  Fellow or Associate of Society of Actuaries (FSA/ASA)
- h.  Certified Public Accountants (CPA)
- i.  Associate in Reinsurance (ARe)
- j.  Other (*please specify*) \_\_\_\_\_
- k.  None

21. Given the Advisory Committee's charge to identify research and education that the CAS should undertake in the area of ERM, what other information would you like to share to assist the Committee in fulfilling this charge?

**Research:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Education:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Optional  
Name: \_\_\_\_\_ Company \_\_\_\_\_

**Please return the survey by May 25, 2001. Thank you for your participation.**

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## **A Sampling of Risk-Related Regulatory, Rating Agency and Corporate Governance Guidelines and Requirements**

There are a number of regulatory, rating agency and corporate governance guidelines and regulations that ERM programs and policies need to consider. The more prominent of these are described below.

### ■ General Industry

- Cadbury Report, et al (UK) — the London Stock Exchange has adopted a set of principles — the Combined Code — that consolidates previous reports on corporate governance by the Cadbury, Greenbury and Hampel committees. This code, effective for all accounting periods ending on or after December 23, 2000 (and with a lesser requirement for accounting periods ending on or after December 23, 1999), makes directors responsible for establishing a sound system of internal control and reviewing its effectiveness, and reporting their findings to shareholders. This review should cover all controls, including operational and compliance controls and risk management. The Turnbull Committee issued guidelines in September 1999 regarding the reporting requirement for non-financial controls.
- Dey Report (Canada) — commissioned by the Toronto Stock Exchange and released in December 1994, it requires companies to report on the adequacy of internal control. Following that, the clarifying report produced by the Canadian Institute of Chartered Accountants, “Guidance on Control” (CoCo report, November 1995) specifies that internal control should include the process of risk assessment and risk management. While these reports have not forced Canadian listed companies to initiate an ERM process, they do create public pressure and a strong imperative to do so. In actuality, many companies have responded by initiating ERM processes.
- Australia/New Zealand Risk Management Standard — a common set of risk management standards issued in 1995 that call for a formalized system of risk management and for reporting to the organization’s management on the performance of the risk management system. While not binding, these standards create a benchmark for sound management practices that includes an ERM system.

### ■ Financial Services Industry

- Basel Committee:
  - The Basel Committee on Banking Regulation and Supervisory Practices was established in 1974 (originally called the Cooke Committee) in response to the erosion of capital in leading global banks. The committee meets under the auspices of the Bank for International Settlements (BIS) but is not part of the BIS. The committee consists of representatives from the central banks/supervisory authorities of the G10 countries + Luxembourg. The committee has no legal authority, but the governments of the representatives on the committee have always legislated to make the recommendations part of their own national law. The standards set by the committee are widely

regarded to be best practice and a large number of other countries that are not formally represented on the committee have implemented the proposals. In the U.S., the Federal Reserve has adopted the Basel Capital Accord (“Basel I” – see below).

- “Basel I” — the 1988 Basel Capital Accord established a framework to calculate a minimum capital requirement for banks. The Accord focused on credit risk and was crude in its recognition of the relative risk of different loans. A number of amendments were made to the Accord (prior to “Basel II” – see below), the most significant of which is the market risk amendment in 1996; this extended the 1988 Accord to cover market risk and allowed for the use of internal models to quantify regulatory capital.
- “Basel II” — in 1999 the Basel Committee issued a draft proposal for a new accord and accepted comment. Based on feedback, the Committee issued a revised proposal in 2001 for review and comment. In this New Basel Capital Accord, proposed for implementation in 2004, among other changes a capital charge for operational risk is included as part of the capital framework. The charge reflects the Committee’s “realization that risks other than market and credit” can be substantial. Operational risk is defined as “the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events”. The new capital adequacy framework is proposed to apply to insurance subsidiaries of banks and may apply to insurance companies as insurance and banking activities converge.
- OSFI (Canada) — the Office of the Supervisor of Financial Institutions supervisory framework defines “inherent risk” to include credit risk, market risk, insurance risk, operational risk, liquidity risk, legal and regulatory risk and strategic risk. It states that “Where independent reviews of operational management and controls have not been carried out or where independent risk management control functions are lacking, OSFI will, under normal circumstances, make appropriate recommendations or direct that appropriate work be done.”
- FSA (UK) — the Financial Services Authority (FSA – the recently created regulator of all UK financial services businesses) is introducing a system of risk based supervision which will create a single set of prudential requirements organized by risk rather than by type of business. Regulated businesses will have to demonstrate that they have identified all material risks and have adequate systems and financial resources to manage and finance such risks, including market risk, credit risk, operational risk and insurance risk. There is also likely to be a requirement for formal documentation of the whole process in a format that is readily accessible to the FSA.

- Insurance Industry
  - A.M. Best — in its *Enterprise Risk Model: A Holistic Approach to Measuring Capital Adequacy*, A.M. Best describes its VaR-based method for determining the adequacy of capital for rating purposes. The report states: “The Enterprise Risk Model is a modular system designed to capture all risks, including noninsurance and non-U.S. related risks. VaR methodologies are somewhat controversial in insurance circles, but they are the standard for other financial-services organizations. More importantly, A.M. Best believes that VaR-based methodologies provide a more accurate assessment of risk and required capital, since they use observable market metrics. Beyond its application in the rating process, the model can also be a useful tool for financial managers, since the VaR framework provides a natural springboard to other applications, including risk-adjusted return on capital (RAROC) and dynamic financial analysis (DFA). The Enterprise Risk Model quantifies the risk to the future surplus – net worth – of an organization arising from a change in underlying risk variables, such as credit risk, insurance risk, interest rate risk, market risk and foreign exchange risk. The model also quantifies the benefits of diversification as it takes a macro view of the correlations among risks within an organization...Like other VaR-based models, it is calibrated to measure the risks over a defined holding period – one year -- for a given level of statistical confidence – 99%.”
  - Moody’s — in its *One Step in the Right Direction: The New C-3a Risk-Based Capital Component*, June 2000, Moody’s Investors Service states that it will use the new method devised by the NAIC and the American Academy of Actuaries for measuring a life insurance company’s C-3a (interest-rate) risk, as it incorporates a cash-flow testing requirement for annuity and single premium life products and is more consistent with industry advances in dynamic cash-flow testing: “...the revised calculation is a more accurate barometer of the amount of capital required to support an insurer’s interest-sensitive business, as it explicitly incorporates asset-liability mismatches in determining the appropriate amount of required regulatory capital for a company. Consequently, the new calculation should help discourage companies from taking unwarranted asset-liability risk.”
  - S&P — in its *Revised Risk-Based Capital Adequacy Model for Financial Products Companies* Standard & Poor’s states: “Standard & Poor’s Insurance Capital Markets Group has developed a new, risk-based capital adequacy model to analyze the credit, financial market, and operational risks of companies that are offering products or are using sophisticated risk management techniques that are not considered under the existing Rating Group’s capital models. The model will also determine these companies’ capital adequacy. The primary application of the model will be to analyze specialized financial product companies (FPCs) that are subsidiaries of insurance companies or that are credit enhanced by insurance companies.... The model may also be applied to portions of insurance companies that control or mitigate their risks to a greater extent than is implied by the capital charges applied in the standard life/health capital adequacy model, which bases charges for interest-rate risk and credit risk on industry averages and liability types rather than company-specific exposure.”

- NAIC — The National Association of Insurance Commissioners:
  - Risk Based Capital (RBC) — Following a detailed examination of the growing diversity of business practices of insurance companies conducted in 1990, the NAIC concluded that minimum capital requirements placed on companies needed to be increased to protect consumers. The NAIC adopted life/health risk-based capital requirements in December 1992 and adopted Property/Casualty risk-based capital requirements in December 1993. Although risks involved in these two segments of the industry are very different, the NAIC was able to develop a consistent two-step approach to setting risk-based capital requirements for individual companies:
    - Step 1 involves the calculation of a company’s capital requirement and total adjusted capital, based on formulas developed by NAIC for each industry.
    - Step 2 calls for comparison of a company’s total adjusted capital against the risk-based capital requirement to determine if regulatory action is called for, under provisions of the Risk-Based Capital for Insurers Model Act. The model law sets the points at which a commissioner is authorized and expected to take regulatory action.
  - Interest rate risk — the NAIC’s Life Risk-Based Capital Working Group, in conjunction with the American Academy of Actuaries Life Risk-Based Capital Task Force, has finalized the development of an improved method for measuring a company’s interest-rate risk. The method, which is effective for the year-end 2000 statements, “incorporates a cash-flow testing requirement for annuity and single premium life products and makes the RBC C-3a calculation more consistent with recent industry advances in dynamic cash-flow testing...The task force has recognized the need to accurately incorporate these additional risks into the RBC formula. They have stated that equity indexed annuities (EIAs) and variable products with secondary guarantees will be incorporated in a future C-3a update. This would be consistent with the task force’s goal of upgrading C-3a from a measure of interest-rate risk to a more complete measure of asset/liability risk.”
- APRA (Australia) — a feature of ongoing reforms to the regulation of general insurers is a layer of four standards covering the subjects of capital adequacy, liability valuation, reinsurance arrangements and operational risk. The Australian Prudential Regulation Authority (APRA) is implementing an approach based on development of, and compliance with, a range of risk management strategies. These strategies will need to deal with the myriad interlocking risks involved in managing a general insurance company. Each company will need to have its strategy agreed upon by APRA and will then be responsible for managing compliance. APRA has made it clear that an internal enterprise risk model with appropriate specifications will go a long way toward meeting compliance objectives.

## ERM Learning Objectives

### INTRODUCTION

These Learning Objectives are expressed in terms of the knowledge required of an *expert*<sup>\*</sup> in enterprise risk management (ERM).

The Learning Objectives are organized within the sequential steps of the Risk Management Process:

- *Establishing Context* – Achieving a full understanding of the present conditions in which the organization operates; this includes understanding the external context (e.g., organization/environment relationship, stakeholder communication policies), the internal context (e.g., business objectives, oversight structure, key performance indicators), and the risk management context (e.g., units covered, degree of coordination throughout organization).
- *Identifying Risks* – Documenting the conditions and events that represent material threats to the organization’s achievement of its objectives or represent areas to exploit for competitive advantage.
- *Analyzing/Quantifying Risks* – Calibrating and, wherever possible, creating probability distributions of outcomes for each material risk.
- *Integrating Risks* – Aggregating all risk distributions, reflecting correlations and portfolio effects, and expressing results in terms of impact on the organization’s key performance indicators (i.e., the “aggregate risk profile”).
- *Assessing/Prioritizing Risks* – Determining the contribution of each risk to the aggregate risk profile, and prioritizing accordingly.
- *Treating/Exploiting Risks* – Developing strategies for controlling or exploiting the various risks.
- *Monitoring and Reviewing* – Continual gauging of the risk environment and the performance of the risk management strategies.

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\* Note: With regard to the examination syllabus through 2005, the level of knowledge need not be at the “expert” level for all subject areas. Hence, for syllabus purposes during this period, the required knowledge level should be calibrated to conform to the “Desired Depth of Knowledge” within the table on the following page, for each element of the ERM Framework.

## DESIRED DEPTH OF ERM KNOWLEDGE

<b>Key to Table Below:</b>		
<b>Code</b>	<b>Desired Knowledge Level</b>	<b>Education Implication</b>
<b>1</b>	All CAS members should be expert in this area	On exam syllabus – core subject (similar to ratemaking, reserving)
<b>2</b>	...	On exam syllabus – moderate treatment (similar to accounting)
<b>3</b>	All CAS members need to know about this area	On exam syllabus – light treatment (similar to underwriting)
<b>4</b>	...	On exam syllabus – very light introductory treatment (similar to claims)
<b>5</b>	...	Continuing Ed – annual ERM seminar (similar to CLRS)
<b>6</b>	Some CAS members should know about this area	Continuing Ed – special interest and/or limited attendance seminars (similar to M&A)
<b>7</b>	...	Continuing Ed – Special tracks/sessions within existing CAS (and non-CAS) meetings/seminars
<b>8</b>	...	Self-study/on-line courses/university courses (CAS to maintain bibliography)
<b>9</b>	Outside the scope of CAS	N/A
<b>Note: Any exam syllabus item (codes 1 - 4) also carries continuing education/self-study implications (codes 5 – 8); any continuing education item (codes 5 – 7) also carries self-study implications (code 8)</b>		

<b>Depth of ERM Knowledge Within CAS Desired by 2005:</b>				
ERM Overview		<b>2</b>		
<b>Process Step</b>	<b>Risk Type</b>			
	Hazard	Financial	Operational	Strategic
Establish Context	<b>3</b>			
Identify Risks	<b>5</b>	<b>6</b>	<b>7</b>	<b>7</b>
Analyze/Quantify Risks	<b>1</b>	<b>2</b>	<b>4</b>	<b>4</b>
Integrate Risks	<b>2</b>			
Assess/Prioritize Risks	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>
Treat/Exploit Risks	<b>4</b>	<b>4</b>	<b>6</b>	<b>6</b>
Monitor & Review	<b>5</b>			

## LEARNING OBJECTIVES

In addition to the requirements cited in the Learning Objectives specific to each Risk Management Process step below, the ERM expert should have a working knowledge of:

- Economics
- Business finance and accounting
- Statistics and stochastic modeling
- Project management

### I. Establishing Context

This first step in the Risk Management Process involves achieving a full understanding of the present conditions in which the organization operates. This includes understanding the external context (e.g., organization/environment relationship, stakeholder communication policies), the internal context (e.g., business objectives, oversight structure, key performance indicators), and the risk management context (e.g., units covered, degree of coordination throughout organization).

Regarding this step, the expert should be able to:

- Identify the key business issues in the organization's industry, including growth prospects, degree of competition, barriers to entry, supply and demand levels, product differentiation, price elasticity, regulatory environment, etc.
- Analyze the organization's competitive position within its industry.
- Articulate the organization's mission/vision/strategic objectives
- Identify the organization's various specific business objectives and constraints (e.g., financial, social, political, legal) and the interplay among them.
- Identify the organization's business model, management and governance structure, decision-making processes and systems.
- Interpret the organization's financial statements and key performance indicators.
- Evaluate the practical implications of the major stakeholders' (e.g., shareholders, employees, clients) expectations of the organization.
- Determine the organization's key assets.
- Conduct a strengths/weaknesses/opportunities/threats (SWOT) analysis.
- Elicit and describe the organization's risk management objectives.
- Describe the organization's risk control processes.
- Formulate risk management mission statement, policies and guidelines.

### II. Identifying Risks

This second step in the Risk Management Process involves documenting the conditions and events that represent material threats to the organization's achievement of its objectives or represent areas to exploit for competitive advantage.

The scope of risks includes the following Risk Types:

- *Hazard* risks, such as:
  - Liability suits (e.g., operations, products, environmental)

- Fire and other property damage
- Windstorm and other natural perils (including catastrophes)
- Theft and other crime
- Personal injury, disease, disability (including work-related injuries and diseases)
- Business interruption
- *Financial* risks, such as:
  - Price (e.g. asset value, interest rate, foreign exchange, commodity)
  - Liquidity (e.g. cash flow, call risk, opportunity cost)
  - Credit (e.g. default, downgrade).
  - Inflation/purchasing power
  - Hedging/basis risk
- *Operational* risks, such as:
  - Business operations (e.g. customer satisfaction, human resources, product development, capacity, efficiency, product/service failure, trademark/brand erosion)
  - Empowerment (e.g., leadership, change readiness)
  - Information technology (e.g. relevance, availability)
  - Integrity (e.g., management fraud, reputation)
  - Information/business reporting (e.g., budgeting and planning, accounting information, pension fund, investment evaluation, taxation)
- *Strategic* risks, such as:
  - Competition
  - Customer wants
  - Demographic and social/cultural trends
  - Technological innovation
  - Capital availability
  - Regulatory and political trends

Regarding this step, the expert should be able to:

- Generate a comprehensive list of risks that may affect the organization's objectives, using a systematic application of appropriate risk detection techniques, such as:
  - Expert interviewing
  - Site inspections
  - Checklists
  - Document and data reviews
  - Scenario analysis
- Identify the area of impact (i.e., on earnings, cash flow, etc.) of each risk.
- Identify the possible causes and scenarios underlying each risk.
- Qualitatively determine the materiality of each risk in the context of the organization's objectives, and considering the potential correlation with other hazard, financial, strategic and operational risks.
- Select and rank order the risks for further analysis.
- Classify the risks in a manner that is meaningful to their mitigation, for example:
  - Separate the risks that can be simply and immediately mitigated from those that require a substantial capital outlay or a change in strategic direction.
  - Determine those risks requiring rigorous quantification and modeling.

### **III. Analyzing and Quantifying Risks**

This third step in the Risk Management Process involves calibrating and, wherever possible, creating probability distributions of outcomes for each material risk.

Regarding this step, the expert should be able to:

- Identify and access the sources of relevant external data on the quantification of risks relevant to the organization's industry.
- Collect and organize the necessary internal data on the quantification of risks unique to the organization.
- Understand and apply appropriate risk quantification approaches, depending on the nature and availability of data and expert input, including but not limited to:
  - Probability distribution fitting to historical data
  - Extreme Value Theory
  - Regression over variables that affect risk
  - Causal modeling
  - Influence diagrams
  - Fuzzy logic
  - Delphi method
  - Judgement
- Express the risks in terms of a probability distribution of outcomes.
- Assess the effectiveness of existing control measures (managerial, technical, procedural, financial, insurance, etc.).
- Modify the probability distributions as appropriate to reflect the impact of existing control measures.
- Provide estimates of the timing and duration of the outcomes in the context of the organization's objectives and strategies.
- Determine the present value of the future stream of contingent financial outcomes.
- Validate the qualitative rank ordering of risks (from process step II) under various quantitative risk expressions, such as:
  - In the context of the organization's objectives and strategies, using the organization's key performance metrics (e.g., net operating earnings, probability of ruin, growth in embedded value).
  - In the context of impact on the organization's social and other non-financial objectives (e.g., commitment to the community, commitment to employees).
- Determine a suitable model for the particular business situation:
  - Identify, through the application of statistical tests, the frequency and severity probability distributions and parameters that best fit the data.
  - Assess the variability of the parameters and the goodness of fit of the model, to determine the confidence that should be given to the model output in making decisions.
  - Consider the quality and credibility of the data.
  - Conduct sensitivity testing of the models and assumptions.
  - In the absence of an actuarial or other established quantitative model or data for a given situation, make reasonable judgments using sound business logic.

#### IV. Integrating Risks

This fourth step in the Risk Management Process involves aggregating all risk distributions, reflecting correlations and portfolio effects, and expressing results in terms of impact on the organization's key performance indicators (i.e., the "aggregate risk profile").

Regarding this step, the expert should be able to:

- Determine and document the correlations and causes of interaction among the various hazard, financial, operational and strategic risks, using appropriate qualitative and quantitative techniques including but not limited to:
  - Influence diagrams/event tree analysis
  - Decomposition analysis
  - Analysis of variance
  - Multiple regression analysis
  - Econometric methods
  - Neural networks
- Understand different models and types of analysis commonly used to aggregate risks, know their common features and differences, and apply them appropriately.
- Identify and describe the importance of reliances, assumptions and other simplifications (such as the inclusion or exclusion of certain risks) in the model or analysis that could have a material effect on the results.
- Create an aggregate risk profile (i.e., an aggregate probability distribution) of all material risks, reflecting the probability distributions of the individual risks and their correlations, using appropriate techniques, including but not limited to:
  - Monte Carlo simulation
  - Statistical convolution
  - Causal modeling
  - Dynamic Financial Analysis (DFA) and other structural simulation models
  - Mean/variance/covariance (MVC) and other statistical analytic models
- Create an aggregate risk distribution in terms of the organization's key performance metrics.

#### V. Assessing/Prioritizing Risks

This fifth step in the Risk Management Process involves determining the contribution of each risk to the aggregate risk profile, and prioritizing accordingly.

Regarding this step, the expert should be able to:

- Determine the appropriate *risk* measures and organizational tolerances against these measures, such as:
  - Solvency-related measures (related to the "tail" of the distribution)
    - Value at Risk (VaR)
    - Tail VaR
    - Probability of ruin/default

- Expected Policyholder Deficit (EPD)/Economic Cost of Ruin (ECOR)
- Shortfall risk
- Risk Based Capital (RBC)
- Insurance Regulatory Information System (IRIS) tests
- Rating agency models
- Basel Capital Accord measures
- Volatility measures (related to the “center” of the distribution)
  - Variance/semi-variance
  - Standard deviation/downside standard deviation
  - Mean average deviation
  - Below-Target-Risk (BTR)
- Qualitative measures, such as the impact on:
  - The community
  - Employees
  - Brand reputation and image
  - Investor perceptions
- Determine the *reward* measures and benchmarks appropriate to the organization’s objectives, such as:
  - Expected operating earnings
  - Growth in book value
  - Growth in Embedded Value
  - Economic Value Added (EVA)
  - Total return on equity
  - Return on Risk Adjusted Capital (RORAC)
  - Risk Adjusted Return on Capital (RAROC)
- Use appropriate techniques to determine the marginal contribution of each risk to the aggregate risk profile.
- Perform stress testing to determine whether and to what degree the importance of individual risks varies under different risk and reward metrics.
- Prioritize risks according to their marginal impact on the aggregate risk profile.
- Decompose the impact of each high-priority risk in order to inform its treatment.

## **VI. Treating/Exploiting Risks**

This sixth step in the Risk Management Process involves developing strategies for controlling or exploiting the various risks.

Regarding this step, the expert should be able to:

- Identify and evaluate the various financial, operational and strategic techniques to avoid, control, transfer/finance or capitalize on the various types and combinations of risk; such techniques include but are not limited to:
  - Exposure avoidance
  - Loss prevention
  - Loss reduction
  - Segregation of exposure units
  - Contractual transfer

- Insurance/reinsurance
- Risk retention vehicles (e.g., captives, pools)
- Use of financial markets (e.g., lines of credit, derivatives, securitization), including:
  - Arbitrage
  - Futures vs. forward contracts
  - Spot and forward markets
  - Options and swaps
  - Exotic options
  - Foreign exchange
- Evaluate alternate risk financing tools and techniques such as:
  - Special risk insurance solutions
  - Funding alternatives
  - Derivatives
  - Contingent capital
 and their impact on results, such as:
  - Reducing Cost of Risk (COR),
  - Stabilizing COR over time,
  - Strengthening the balance sheet,
  - Optimizing tax position,
  - Leveraging risk-bearing capacity.
- Incorporate the evaluation of key strategies in a consistent, comprehensive model; these strategies include but are not limited to:
  - Capital structure (i.e., financial leverage)
  - Capital allocation
  - Exposure management
  - Asset allocation
  - Reinsurance
- Evaluate strategies by using an optimization framework, which includes:
  - Determining the risk and reward characteristics of each strategy
  - Comparing the strategies in an “efficient frontier” analysis
  - Determining optimal strategies that maximize the organization’s objectives and satisfy its constraints
- Develop a comprehensive risk management strategy and rationale that includes:
  - Evaluating the various options for managing risks.
  - Determining which risks should be controlled and which risks should be exploited for competitive advantage given the nature of the risk and the organization’s capabilities.
  - Constructing an integrated plan of action for control and exploitation of these risks.
  - Demonstrating the business case for the risk management strategy, using sound business logic.
- Develop a comprehensive decision framework by which the organization can evaluate new threats/opportunities in a consistent manner.

## **VII. Monitoring & Reviewing**

This seventh step in the Risk Management Process involves continual gauging of the risk environment and the performance of the risk management strategies.

Regarding this step, the expert should be able to:

- Track changes in the business context and risk environment, by:
  - Keeping current with organizational priorities/objectives.
  - Continually updating the organization's risk profile.
  - Keeping current with regulatory requirements.
  - Keeping current with risk management best practices.
  - Timely detection of future threats and opportunities.
- Measure the performance of the implemented strategies, by:
  - Tracking results against reward measures.
  - Measuring departures from expected results against volatility constraints.
  - Tracking compliance with legal and regulatory requirements.
- Track changing risk factors and use different processes for identifying and sourcing risks such as:
  - "Fish bone" diagrams
  - Run charts
  - Samplings
- Back-test models and assumptions, and make appropriate adjustments.
- Revise strategies as appropriate.
- Determine how often risk models and analyses need to be updated.