### Important Exam Information:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Information</th>
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<tbody>
<tr>
<td><strong>Reading Extensions</strong></td>
<td>At registration, candidates must select from one of six reading extensions. The readings for each extension appear at the end of this document. The study note package includes all extensions. Seventy-five percent of the exam points will come from the core readings and will be common for all candidates. The remaining twenty-five percent will be based on the readings for the selected extension. These questions may also draw on material from the core reading. Questions in both the core and the extension may be based on the case study.</td>
</tr>
<tr>
<td><strong>Exam Registration</strong></td>
<td>Candidates may register online or with an application.</td>
</tr>
<tr>
<td><strong>Order Study Notes</strong></td>
<td>Study notes are part of the required syllabus and are not available electronically but may be purchased through the online store.</td>
</tr>
<tr>
<td><strong>Syllabus Readings</strong></td>
<td>Readings listed in this syllabus may include study notes, online readings and textbooks. Candidates are responsible for all readings in their entirety, including sections such as Appendices, unless it is stated otherwise in the syllabus.</td>
</tr>
<tr>
<td><strong>Introductory Study Note</strong></td>
<td>The Introductory Study Note has a complete listing of all study notes as well as errata and other important information.</td>
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<tr>
<td><strong>Case Study</strong></td>
<td>This case study will also be provided with the examination. Candidates will not be allowed to bring their copy of the case study into the examination room. There is a single case study. However, within the case study are instructions as to which parts are applicable to all candidates and which parts apply to each extension.</td>
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<tr>
<td><strong>Past Exams</strong></td>
<td>Past Exams from 2012-present are available on SOA website.</td>
</tr>
<tr>
<td><strong>Updates</strong></td>
<td>Candidates should be sure to check the Updates page on the exam home page periodically for additional corrections or notices.</td>
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The six topics that follow are the core learning objectives and readings for this examination. All candidates are responsible for this material.

### 1. Topic: Enterprise Risk Management Framework and Process

<table>
<thead>
<tr>
<th>Learning Objectives</th>
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<tbody>
<tr>
<td>The candidate will understand the ERM framework and process and be able to apply them to organizations.</td>
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<table>
<thead>
<tr>
<th>Learning Outcomes</th>
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<tbody>
<tr>
<td>The Candidate will be able to:</td>
</tr>
<tr>
<td>a) Recommend an appropriate framework for an organization’s enterprise risk management and an acceptable governance structure.</td>
</tr>
<tr>
<td>b) Demonstrate an understanding of the perspectives of regulators, rating agencies, stock analysts, auditors and company stakeholders and how they evaluate the risks and the risk management of an organization.</td>
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<tr>
<td>c) Demonstrate how to articulate an organization’s risk appetite, desired risk profile, quantified risk tolerances, risk philosophy and risk objectives.</td>
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<tr>
<td>d) Assess the overall risk exposure arising from an organization's current and emerging risks.</td>
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<tr>
<td>e) Propose ERM solutions or strategies that effectively manage risk under different real (case study) and hypothetical situations facing financial and non-financial organizations.</td>
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<table>
<thead>
<tr>
<th>Resources</th>
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<tbody>
<tr>
<td>o Ch. 8: Risk Identification</td>
</tr>
<tr>
<td>o Ch. 14: Quantifying Particular Risks</td>
</tr>
<tr>
<td>o Ch. 13: Liquidity Risk (excluding section 13.4)</td>
</tr>
<tr>
<td>• ERM-101-12: Measurement and Modeling of Dependencies in Economic Capital, Ch. 4-5</td>
</tr>
<tr>
<td>• ERM-106-12: Economic Capital-Practical Considerations, Milliman</td>
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<tr>
<td>• ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses</td>
</tr>
<tr>
<td>• ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework</td>
</tr>
<tr>
<td>• ERM-119-14: Aggregation of Risks and Allocation of Capital (sections 4-7, excluding section 6.3)</td>
</tr>
<tr>
<td>• ERM-131-18: Leveraging COSO Across the Three Lines of Defenses</td>
</tr>
<tr>
<td>• ERM-133-19: Emerging Risks and Enterprise Risk Management, pp. 2-6</td>
</tr>
<tr>
<td>• ERM-134-21: Group Insurance, Skwire, 2021, Ch. 41: Risk Based Capital Formulas</td>
</tr>
<tr>
<td>• ERM-135-20: Risk Management and the Rating Process for Insurance Companies</td>
</tr>
<tr>
<td>• ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)</td>
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</tbody>
</table>
• ERM-137-20: ORSA and the Regulator
• ERM-140-20: Risk Adjustments for Insurance Contracts under IFRS 17: Chapter 3: Risk Adjustment Techniques & Chapter 7: Validation of Risk Adjustments
• ERM-142-20: Data Quality is the Biggest Challenge
• ERM-143-20: Internal Controls Toolkit, Doxey, Ch. 1, pp. 11-17 & 27-35
• ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9-38
• Risk Appetite: Linkage with Strategic Planning Report
• National Risk Management A Practical ERM Approach for Federal Governments, CAS, CIA and SOA, Mar 2018, pp. 11-22
• Economic Scenario Generators: A Practical Guide, pp. 7-17 (pp. 97-112 background only)
### 2. Topic: Risk Categories and Identification

#### Learning Objectives

The candidate will understand the types of risks faced by an entity and be able to identify and analyze these risks.

#### Learning Outcomes

The Candidate will be able to:

- a) Describe different definitions and concepts of risk
- b) Discuss risk taxonomy, including an awareness of how individual risks might be categorized in different ways
- c) Identify and analyze specific risks faced by an organization, including but not limited to: financial, environmental, operational, legal, reputational and strategic risks

#### Resources

  - Ch. 8: Risk Identification
  - Ch. 13: Liquidity Risk (excluding section 13.4)
  - Ch. 18: Credit Risk Management (excluding Appendices)
- ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses
- ERM-130-18: AAA Model Governance Practice Note
- ERM-133-19: Emerging Risks and Enterprise Risk Management, pp. 2-6
- ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)
- ERM-137-20: ORSA and the Regulator by AAA
- ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9-38
- *Risk Appetite: Linkage with Strategic Planning Report*
## 3. Topic: Risk Modeling and Aggregation of Risks

### Learning Objectives

The candidate will understand the concepts of risk modeling and be able to evaluate and understand the importance of risk models.

### Learning Outcomes

The Candidate will be able to:

a) Demonstrate how each of the financial and non-financial risks faced by an organization can be amenable to quantitative analysis

b) Demonstrate organization-wide risk aggregation techniques that illustrate the concept of risk diversification by incorporating the use of correlation

c) Evaluate and select appropriate copulas as part of the process of modelling multivariate risks

d) Demonstrate the use of scenario analysis and stress testing in the measurement of current and emerging risks

e) Demonstrate the importance of the tails of distributions, tail correlations, and low frequency / high severity events, and the use of extreme value theory to analyze these situations

f) Demonstrate an understanding of model and parameter risk

g) Evaluate and select appropriate models to handle diverse risks, including models that use a stochastic approach

### Resources

  - Ch. 14: Quantifying Particular Risks
  - Ch. 7: Portfolio Risk: Analytical Methods  
  - Ch. 9: Forecasting Risk Correlations (section 9.3 only)  
  - Ch. 12: Monte Carlo Methods  
  - Ch. 18: Credit Risk Management (excluding Appendices)
- ERM-101-12: Measurement and Modeling of Dependencies in Economic Capital, Ch. 4-5
- ERM-104-12: Study Note on Parameter Risk, Venter and Sahasrabuddhe (excluding section 3)
- ERM-106-12: Economic Capital-Practical Considerations, Milliman
- ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses
- ERM-110-12: Derivatives: Practice and Principles, Recommendations 9-24 & Section III
- ERM-119-14: Aggregation of Risks and Allocation of Capital (sections 4-7, excluding section 6.3)
- ERM-120-14: IAA Note on Stress Testing and Scenario Analysis (pp. 1-6, 14-17 & 19-25)
Counterparty Credit Risk

- ERM-137-20: ORSA and the Regulator
- ERM-138-21: Quantitative Enterprise Risk Management, Hardy, Ch. 6: Extreme Value Theories
- ERM-139-21: Quantitative Enterprise Risk Management, Hardy, Ch. 7: Copulas
- ERM-140-20: Risk Adjustments for Insurance Contracts under IFRS 17: Chapter 3: Risk Adjustment Techniques & Chapter 7: Validation of Risk Adjustments
- Risk Appetite: Linkage with Strategic Planning Report
- Modeling Tail Behavior with Extreme Value Theory, Risk Management, Sep 2009
- A New Approach for Managing Operational Risk, Ch. 8
- Economic Scenario Generators: A Practical Guide, pp. 7-17 (pp. 97-112 background only)
- Parameter Uncertainty, CAS, CIA and SOA, 2017
# 4. Topic: Risk Measures

## Learning Objectives

The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

## Learning Outcomes

The Candidate will be able to:

a) Determine risk exposures using common risk measures (e.g., VaR and TVaR) and compare the properties and limitations of such measures

b) Analyze quantitative financial and non-financial data using appropriate statistical methods to assist in quantifying risk

c) Analyze risks that are not easily quantifiable, such as liquidity, operational, and environmental risks.

## Resources

  - Ch. 9: Some Useful Statistics (background only)
  - Ch. 14: Quantifying Particular Risks
  - Ch. 7: Portfolio Risk: Analytical Methods
  - Ch. 9: Forecasting Risk and Correlations
  - Ch. 12: Monte Carlo Methods
  - Ch. 13: Liquidity Risk (excluding section 13.4)
  - Ch. 18: Credit Risk Management (excluding Appendices)
- ERM-106-12: Economic Capital – Practical Considerations, Milliman
- ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework
- ERM-133-19: Emerging Risks and Enterprise Risk Management, pp. 2-6
- ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)
- ERM-137-20: ORSA and the Regulator
- ERM-140-20: Risk Adjustments for Insurance Contracts under IFRS 17: Chapter 3: Risk Adjustment Techniques & Chapter 7: Validation of Risk Adjustments
- ERM-142-20: Data Quality is the Biggest Challenge
<table>
<thead>
<tr>
<th>Resource</th>
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<tbody>
<tr>
<td>A New Approach for Managing Operational Risk, Ch. 8</td>
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</tbody>
</table>
## 5. Topic: Risk Management Tools and Techniques

### Learning Objectives

The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

### Learning Outcomes

The Candidate will be able to:

- a) Demonstrate risk optimization and analyze the risk and return trade-offs that result from changes in the organization’s risk profile
- b) Demonstrate application of the following responses to risk, including consideration of their costs and benefits: avoidance, acceptance, reduction without transfer, and transfer to a third party
- c) Demonstrate the use of controls for retained and residual risks
- d) Demonstrate how derivatives, synthetic securities, and financial contracting may be used to reduce risk within a static or dynamic hedging program
- e) Determine an appropriate choice of mitigation strategy for a given situation, which balances benefits with inherent costs (including exposure to moral hazard, credit, basis and other risks)
- f) Demonstrate the use of tools and techniques for identifying and managing credit and counterparty risk
- g) Analyze how ALM and other risk management principles can be used to establish investment policy and strategy, including asset allocation
- h) Demonstrate possible risk management strategies for non-financial risks
- i) Choose appropriate techniques to measure, model and manage various financial and non-financial risks faced by an organization

### Resources

  - Ch. 16: Responses to Risk
  - Ch. 7: Portfolio Risk: Analytical Methods
  - Ch. 18: Credit Risk Management (excluding Appendices)
- ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses
- ERM-110-12: Derivatives: Practice and Principles, Recommendations 9-24 & Section III
- ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework
- ERM-115-13: Creating an Understanding of Special Purpose Vehicles, PWC
- ERM-120-14: IAA Note on Stress Testing and Scenario Analysis (pp. 1-6, 14-17 & 19-25)
- ERM-122-16: Chapter 1 of *Captives and the Management of Risk*, 3rd Edition, Kate Westover
### Counterparty Credit Risk

- ERM-128-17: The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States (III, IV & VI)
- ERM-130-18: AAA Model Governance Practice Note
- ERM-131-18: Leveraging COSO Across the Three Lines of Defenses
- ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)
- ERM-137-20: ORSA and the Regulator
- ERM-143-20: Internal Controls Toolkit, Doxey, Ch. 1, pp. 11-17 & 27-35
- ERM-147-21: Working with Inherent and Residual Risk
- ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9-38
- **Risk Appetite: Linkage with Strategic Planning Report**
### 6. Topic: Capital Management

<table>
<thead>
<tr>
<th>Learning Objectives</th>
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</thead>
<tbody>
<tr>
<td>The candidate will understand the concept of economic capital, risk measures in capital assessment and techniques to allocate the cost of risks within business units.</td>
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<tbody>
<tr>
<td>The Candidate will be able to:</td>
</tr>
<tr>
<td>a) Demonstrate a conceptual understanding of economic measures of value and capital requirements (e.g., EVA, embedded value, economic capital, regulatory measures, and accounting measures) and their uses in decision-making processes</td>
</tr>
<tr>
<td>b) Apply risk measures and demonstrate how to use them in value and capital assessment</td>
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<tr>
<td>c) Propose techniques of attributing the “cost” of risk/capital/hedge strategies to business units in order to gauge performance (e.g. returns on marginal capital)</td>
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<tr>
<td>d) Demonstrate the ability to develop a capital model for a hypothetical organization</td>
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<td>• ERM-106-12: Economic Capital – Practical Considerations, Milliman</td>
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<td>• ERM-119-14: Aggregation of Risks and Allocation of Capital (sections 4-7, excluding section 6.3)</td>
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<td>• ERM-134-21: Group Insurance, Skwire, 2021, Ch. 41: Risk Based Capital Formulas</td>
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<td>• ERM-137-20: ORSA and the Regulator</td>
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<tr>
<td>• <a href="#">Risk Appetite: Linkage with Strategic Planning Report</a></td>
</tr>
</tbody>
</table>
READING EXTENSIONS

The following are the resources for the six extensions. They apply risk management across the set of learning objectives for this examination. Candidates are responsible only for the readings in the extension for which they registered.

RETIREMENT BENEFITS

- ERM-321-14: LDI Evolution: Implementing Dynamic Asset Allocation Strategies that Respond to Changes in Funded Status
- ERM-327-17: Pension Funding Strategy
- ERM-330-17: Liability Relative Investing I
- ERM-332-20: Longevity Risk Management
- ERM-334-22: Beyond the ARC: Innovative Funding Strategies from the Public Sector
- ERM-621-21: Liability Driven Investment Explained (Ch. 1 & 2 background only)
- ASOP 51: Risk Assessment in Practice
- Pension Risk Transfer, 2014, pp. 1-46 (pp. 7-10 background only)
- Corporate Pension Risk Management and Corporate Finance: Bridging the Gap between Theory and Practice in Pension Risk Management, Aug 2015
- Embedded Options in Pension Plans, 2014, sections 6-10 (pp. 8-16 background only)
- Quantifying Defined Contribution Risk, Risk Management, Mar 2009
INDIVIDUAL LIFE AND ANNUITIES

- ERM-331-17: Quantifying the Mortality-Longevity Offset
- ERM-401-12: Mapping of Life Insurance Risks
- ERM-405-14: Secondary Guarantee Universal Life - Practical Considerations (excluding sections 1, 2, and 7 Introduction, Overview and Principle-based Reserve Sections)
- ERM-409-14: A Brief Primer on Financial Reinsurance
- ERM-410-14: Coinsurance and its Variants
- ERM-412-17: Surrenders in the Life Insurance Industry, sections 1-4
- ERM-413-17: Hedging for Liabilities in Life Insurance Companies
- ERM-414-17: A Tale of Two Formulas
- ERM-415-17: Strategic Risk Management in Insurance: Navigating the Rough Waters Ahead
- ERM-418-19: Low Interest Rates and the Implications on Life Insurers
- ERM-420-20: Variable Annuity Volatility Management: An Era of Risk Control, pp. 1-27
- ERM-421-20: The Specter of Antiselection
- ERM-422-20: Mortality Improvement: Understanding the Past and Framing the Future
- Life Insurance for the Digital Age: An End-to-End View, Product Matters, Nov 2017
- Earnings Emergence: Insurance Accounting Under Multiple Financial Reporting Bases, Jul 2018
- An Overview of Population Models of Epidemics, Apr 2020
GROUP AND HEALTH

- Group Insurance, Skwire 8th Edition, Ch. 44: Enterprise Risk Management for Group Health Insurers
  (candidates may also use 7th Edition, Ch. 42)
- ERM-513-13: Extending the Insurance ERM Criteria to the Health Insurance Sector
- ERM-521-17: Risk Transfer Formula for Individual and Small Group Markets under the Affordable Care Act
- ERM-522-17: Risk Selection Threatens Quality of Care for Certain Patients: Lessons from Europe’s Health Insurance Exchanges
- ERM-523-18: Why are Many Co-Ops Failing?
- ERM-524-18: Life, Health and Annuity Reinsurance, Ch. 18
- ERM-526-19: The Risk of Pricing New Insurance Products: The Case of Long-Term Care
- ERM-528-20: Assessing the Health-Care Risk: The Clinical-VaR, a Key Indicator for Sound Management
- ERM-529-20: RBC Calculation Examples
- ERM-532-21: Shared Savings Model Risk in the MSSP Program
- ERM-533-21: Building a Successful Value-Based Payer Contracting Strategy
- ERM-534-21: What is Value-Based Healthcare?
- ERM:535-22: How Have Health Spending and Utilization Changed During the Coronavirus Pandemic?
- ASOP 46: Risk Evaluation in Enterprise Risk Management
- ASOP 47: Risk Treatment in Enterprise Risk Management
- ASOP 55: Capital Adequacy Assessment (excluding Appendices)
- ASOP 56: Modeling (excluding Appendices)
- Risk & Mitigation for Health Insurance Companies, 2012
- Time to Update your Trend Process?, Health Watch, Feb 2018
- Large Group Medical Insurance Reserves, Liabilities, and Actuarial Assets, AAA Public Policy Practice Note, Aug 2013
INVESTMENT

  - Ch. 8: Multivariate Models
  - Ch. 11: VAR Mapping
  - Ch. 17: VAR and Risk Budgeting in Investment Management (excluding sections 17.3 and 17.4)
- ERM-613-17: Managing Investment Portfolios, Maginn and Tuttle, 3rd Edition Ch. 6, sections 4 & 5 only
- ERM-615-19: The Devil is in the Tails: Actuarial Mathematics and the Subprime Mortgage Crisis
- ERM-617-19: Chapters 17 (pp. 365-377), 19 (pp. 397-425) and 29 (pp. 670-686) of *Options, Futures and other Derivatives*, Hull, John, 10th Edition, 2018
- ERM-619-20: Correlation: Pitfalls and Alternatives
- ERM-620-21: The Evolution of LDI and Role of a Completion Manager
- ERM-621-21: Liability Driven Investment Explained
GENERAL INSURANCE

- ERM-708-13: Natural Catastrophe Loss Modeling
- ERM-712-16: Catastrophe Modelling: Guidance for Non-Catastrophe Modelers
- ERM-721-22: Understanding BCAR for U.S. Property/Casualty Insurers (excluding Appendices)
- ERM-724-21: Failures and Near Misses in Insurance: Overview of the Causes and Early Identification, (sections 1, 2, 5 & 6 only)
- CIA Research Paper on Quantification of Variability in P&C Liabilities, Nov 2012 (excluding Appendices)
- Risk-Adjusted Performance Measurement for P&C Insurers, CAS, Oct 2010 (excluding Appendix B)
- Cyber Risk is Opportunity, Risk Management Newsletter, Dec 2016
GENERAL CORPORATE ERM

- ERM-414-17: A Tale of Two Formulas
- ERM-811-15: Agency Theory and Asymmetric Information
- ERM-812-15: Valuation for Mergers and Acquisitions, Ch. 1
- ERM-814-15: Cognitive Bias and their Implications on the Financial Market
- ERM-817-17: Speech by SEC Staff: The Role of Compliance and Ethics in Risk Management
- ERM-819-19: Exchange Rate Risk Measurement and Management
- ERM-822-20: Non-Financial Risk Convergence and Integration
- ERM-823-21: The Role of Human Resource Management in Risk Management
- ERM-824-21: Strategic Crisis Management: A Basis for Renewal and Crisis Prevention
- ERM:825-21: Understanding and Managing the IT Risk Landscape (excluding Section 3.7 & Appendices)
- ERM-826-21: Machine Decisions: Governance of AI and Big Data Analytics
- ERM-827-21: SEC Staff Accounting Bulletin: No. 99 – Materiality (excluding footnotes)
- ERM-828-21: Developing a Business Continuity Strategy for a Post-Pandemic World
- ERM-831-22: Managing 21st-Century Political Risk
- Incentive Compensation/Risk Management – Integration Incentive Alignment and Risk Mitigation, Beal et al.
- A New Approach for Managing Operational Risk, Jul 2010, sections 5-7, 9 & 10
- Risk Aggregation and Diversification, Apr 2016 (excluding Appendices)
- Integration of Risk Management into Strategic Planning, Apr 2016