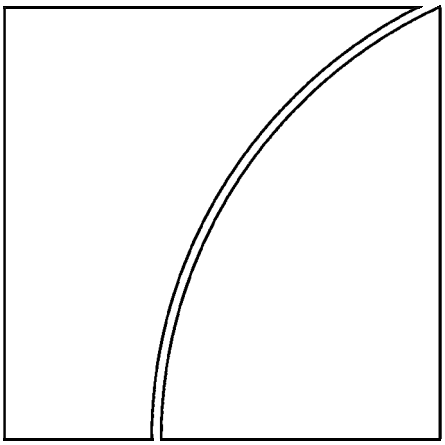
Basel Committee
on Banking Supervision



Observed range of practice in key elements of Advanced Measurement Approaches (AMA)

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Observed range of practice in key elements of Advanced Measurement Approaches (AMA)

I. Background

The work of the Standards Implementation Group's Operational Risk Subgroup (SIGOR)[1] focuses on the practical challenges associated with the development, implementation and maintenance of an operational risk (OR) management and measurement framework that meet the requirements of Basel II,[2] particularly as they relate to the Advanced Measurement Approaches (AMA). The SIGOR's mandate is to identify and participate in resolving the practical challenges associated with the successful development, implementation and maintenance of an AMA framework. This report, consistent with this mandate, outlines the range of practice based on responses from the 2008 Loss Data Collection Exercise (2008 LDCE hereafter) and supervisory observations.

This report also updates the 2006 SIGOR report entitled '*Observed range of practice in key elements of the Advanced Measurement Approach (AMA)*' (2006 *Observed Range of Practice* hereafter). The 2006 *Observed Range of Practice* report described the practices that members observed in relation to some of the key internal governance, data and modelling challenges that faced the industry. The report also catalogued key supervisory issues observed among AMA banks[3] operating in member countries and provided the international community of banking supervisors with a means of framing and discussing the evolution of industry practice. The 2006 *Observed Range of Practice* report also proved to be a valuable resource for both banks and national supervisors in their respective implementation processes.

The 2006 *Observed Range of Practice* document identified that a wide range of practice was emerging during the implementation of banks' AMA frameworks. The diversity in practice is consistent with the evolutionary nature of operational risk management as an emerging risk management discipline. To encourage growth in the discipline, the Basel II Framework intentionally provides banks with a significant degree of flexibility in developing operational risk management frameworks under the AMA. This flexibility, however, does not suggest that supervisors are prepared to accept any practice or process that the banks adopt in implementing their AMA frameworks. On the contrary, supervisors are concerned with identifying and encouraging bank operational risk practices that achieve robust and effective operational risk management and measurement systems that are consistent with safety and soundness and level playing field objectives.

Since the publication of the 2006 *Observed Range of Practice* report, SIGOR members have seen considerable evolution in the risk measurement and risk management practices associated with the operational risk discipline in general and in the AMA more specifically. These evolutionary changes have had a marked effect on how AMA banks address key

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[1] The SIGOR was formerly known as AIGOR, the Accord Implementation Group Operational Risk subgroup, prior to 2009.

[2] 'Basel II Framework' and 'Basel II', used interchangeably in this report, refer to the Basel Committee paper *International Convergence of Capital Measurement and Capital Standards: A Revised Framework (November 2005)*.

[3] In this paper, an AMA bank refers to a bank that is targeting or has implemented the AMA approach in its implementation of Basel II.

internal governance, data and modelling challenges. To evaluate these changes and promote further maturation of industry operational risk practices, the SIGOR believes that an update to the 2006 *Observed Range of Practice* report is necessary to further engage the industry in maintaining high standards for what constitutes acceptable practice. Toward this end, the SIGOR's 2008 LDCE was expanded to include a questionnaire[4] that collected data on key practices associated with a bank's overall AMA framework. This report analyses questionnaire responses and also describes many of the key practices that the SIGOR members have observed during the supervisory reviews of their banks' AMA frameworks or through discussion with the industry.

[4] The questionnaire is reproduced in the Annex II of this report.

II. Executive Summary

(i) Purpose

This report:

- frames the discussion of observed practice in the management and measurement of operational risk, and identifies both emerging effective practices as well as practices that are inconsistent with supervisory expectations;
- highlights supervisory issues encountered in the supervisory reviews of operational risk, whether related to governance, data or modelling; and
- provides a resource for both banks and national supervisors to use in their respective implementation processes, and ongoing development/monitoring of AMA frameworks.

The Basel II Framework envisions that over time the operational risk discipline will mature and converge toward a narrower band of effective risk management and risk measurement practices. Understanding the current range of observed operational risk management and measurement practices, both within and across geographic regions, contributes significantly to the SIGOR's efforts to establish consistent supervisory expectations. Through the analysis of existing practices, the SIGOR is better able to promote the maturation of operational risk practices and support supervisors in developing more consistent regulatory expectations. As such, this report provides supervisors with an opportunity to individually engage banks in discussions of their operational risk management and measurement practices relative to their peers in domestic and international markets.

This report does not purport to define best practices. However, in the course of cataloguing and updating the range of observed practice, it is reasonable to expect the SIGOR to begin identifying practices that might fall outside the range of what supervisors consider acceptable, and to highlight effective and sound operational risk practices.[5] The SIGOR is best placed to make such judgements in light of both its broad membership and each member's responsibilities to supervise the implementation of the AMA frameworks within its jurisdictions. Moreover, establishing a supervisory perspective on the acceptable range of practice is an explicit part of the SIGOR's mandate.

The observations in this report do not constitute new rules or revisions to the Basel II Framework. Neither does the content reduce or supersede the discretion of national supervisors to act in a manner that is consistent with their unique regulatory approach. As a result, actions taken by SIGOR members in response to the observations in this report may vary due to differing jurisdictional implementation legislation and supervisory approaches. Further, the status of banks accredited to use an AMA framework will not be affected by the observations and conclusions of this report.

(ii) Report Format

This report mirrors the organisational structure used in the 2006 *Observed Range of Practice* report to provide continuity and the ability to assess changes in AMA practices. As such, the

[5] Additional reference tools to assist in converging existing practices, where beneficial, include the supervisory guidelines already issued by other supervisors at a national or regional level (eg guidance issued by the Committee of European Banking Supervisors (CEBS) or the Australian Prudential Regulation Authority (APRA)).

report's narrative describes specific internal governance, data and modelling practices used by participating AMA banks.[6] Wherever possible, the range of practice is reported in aggregate and within four geographic areas (see Table 1 below). Relevant references to the Basel II Framework are also included, along with a brief discussion of the significant issues and challenges raised by each practice.

The discussion of the issues and associated challenges includes references to the 2006 *Observed Range of Practice* report, but is tailored to highlight findings from the 2008 LDCE questionnaire and recent supervisory reviews. The description of the 2008 range of practice reflects the language used in the LDCE questionnaire. Readers are referred to the questionnaire, and more specifically to individual questions, for addition detail and specific definitions provided to respondents to assist in completing the questionnaire. Changes in the range of practice since 2006 are noted. Finally, each description concludes with a discussion of supervisory observations associated with that specific AMA framework practice.

(iii) Scope of the Exercise

The SIGOR's 2008 Loss Data Collection Exercise, including the range of practice questionnaire, was distributed to the industry in May 2008. Participation in the exercise was voluntary and was open to banking organisations at the group-wide level that were implementing or using one of the Basel II approaches for calculating operational risk capital. For reporting range of practice results, the SIGOR decided to use only the responses from banks that have been accredited to use an AMA framework and those that member supervisors deemed to be serious AMA candidates.[7] Consequently, the results that follow in this report highlight reasonably well established and mature practices.

The 2008 LDCE range of practice questionnaire addresses many of the major components of an AMA framework, including governance, data collection, use of the four elements,[8] and modelling/measurement of operational risk. In total, 42 AMA banking institutions completed the questionnaire. The following table summarises the geographic breakdown of participating banks.

Additionally, the 2008 LDCE range of practice questionnaire provides more detail on specific practices and issues than that reported in the 2006 *Observed Range of Practice* report. However, the questionnaire did not address all of the issues explored in 2006. As a result, this report primarily focuses on those practices addressed by both the 2006 report and the 2008 LDCE range of practice questionnaire. Readers should be aware that many important AMA framework issues, including the use test and how operational risk capital is allocated to business lines, are not explicitly addressed in 2006 or 2008. Further, as the 2008 LDCE questionnaire was distributed to participating banks in May 2008, individual bank practices may have changed from those detailed in this

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[6] Some of the challenges and corresponding practices covered in this report may also be relevant to banks implementing the Standardised Approach (TSA) and, to a lesser extent, the Basic Indicator Approach (BIA). Guidance from the Basel Committee for TSA and BIA banks includes the relevant sections of Basel II and *Sound Practices for the Management and Supervision of Operational Risk (February 2003)*, which is also applicable to AMA banks.

[7] AMA accreditation has not been completed in several jurisdictions.

[8] The Basel II accord requires that AMA banks incorporate internal loss data, external loss data, scenario analysis, and business environment and internal control factors (BEICFs) into the modelling of operational risk capital.

ROP Table 1

Geographic Distribution of Participating Banks

Geographic Location	Number of Participating Banks
Australia	5
Europe[9]	20
Japan	7
North America	10

report. Nevertheless, given the wide participation of banks and the passage of time, the 2008 questionnaire provides data that summarises a more well developed AMA range of practice than what was presented in 2006. The analysis of the 2008 questionnaire also details practices that were in place in participating banks before the disruptions in the credit and liquidity markets in the last half of 2008.

(iv) Conclusions and observations

SIGOR has seen a maturation of practice in many areas of operational risk management and measurement. Nevertheless, there continues to be a wide and diverse range of practice in key governance, data and modelling processes that raise numerous issues regarding the consistency and reliability of AMA capital estimates within the industry. These key issues are listed below. With respect to each, the SIGOR believes that further enhancement and evolution of practice is appropriate. Toward this end, the SIGOR will continue to engage the industry in discussion to facilitate convergence of practice, where appropriate, and will undertake policy initiatives to clarify supervisory expectations, when necessary.

Internal governance:

- *Scenario analysis.* The current range of practice identifies a lack of consistent controls to address scenario analysis bias. The SIGOR encourages the industry to continue to develop and improve AMA governance standards for scenario analysis, and will formulate additional guidance if needed to assist the industry.

- *Maintaining integrity of BEICFs*. There is little use of internal/external audit to review the integrity of BEICFs. Supervisors expect more active internal/external audit involvement in the review of a bank's use of BEICFs as AMA frameworks continue to mature.

Data:

- *Legal Event Losses.* Loss amounts from legal events tend to be used for risk measurement purposes after the legal events are entered into the loss database. There is, however, a broad range of practice for when the loss amounts from legal events are used as a direct input into the model quantifying operational capital, which raises questions of transparency and industry consistency in how these operational risk exposures are quantified for capital purposes. The SIGOR

[9] By agreement of national supervisors, South African AMA banks are included in the European geographic breakdown.

encourages less variation how legal settlements are treated and recorded as operational risk loss events, given their considerable impact on regulatory capital modelling.

- *Gross versus Net Internal Loss Amounts.* The absence of definitions in the Basel II text for 'gross loss' or 'recoveries' and varying loss data collection practices among AMA banks results in differences in the loss amounts recorded for similar events. This practice may lead to potentially large differences in banks' respective capital calculations. The range of practice is broad, particularly with regard to how AMA banks use 'net losses (gross loss net of non-insurance recoveries)' for risk quantification purposes. The SIGOR believes a more consistent practice to the use of 'net losses' is needed.

- *Data collection thresholds.* Data collection thresholds vary widely across institutions and types of activity. Some institutions prefer to apply high thresholds that avoid enlarging their databases with events that are judged to be immaterial while others choose lower thresholds in order to obtain more information for risk management purposes. Banks should be aware of the impact that their choice of thresholds have on operational risk capital computations. The SIGOR believes the differences in how internal loss data is used or restricted in AMA capital models are significant and that the range of practice should narrow.

Modelling / quantification:

- *Granularity.* The granularity of an AMA reflects the degree to which the framework separately models individual operational risk exposures. Currently there is considerable diversity across banks in the choice of granularity of their models that may be driven as much by modeller's preferences as by actual differences in operational risk profiles. Under Basel the number of ORCs employed in an AMA model should be sufficient to capture the major dirvers of operational risk within the institution. Banks should test the relevance of their choice of classes in order to ensure the homogeneity of the classes and verify that other divisions would not have been better suited to their risk profile. The SIGOR also believes it is desirable to progressively narrow the current range of practice in terms of how ORCs are used to modelling operational risk capital.

- *Dependence/correlation*. There remains a wide range of practice in how AMA banks approach and model dependence/correlation. Given the uncertainties in calculating correlations, supervisors encourage more robust methods for calculating meaningful dependence relationships among operational losses. Additionally, when estimating capital, AMA institutions should demonstrate that their models do not underestimate the probability of joint extreme events and given these uncertainties, should include a suitable margin of conservatism in the calculation of dependence.

- *Distributional assumptions*. Nearly all banks model the severity and frequency distributions separately. While it is common for banks to use the Poisson distribution for estimating frequency, there is still a very wide range of practice for the choice of the severity distribution. The SIGOR has identified principles in this paper that will help institutions choose distributions that are consistent with the underlying data. The SIGOR believes banks should employ these or similar principles as part of their normal process to test the appropriateness of the choice of distributional assumptions.

- *Use of the four elements*. The combination and weighting of the four elements is a significant issue for many banks, given the many possible combination techniques.

This is an area where the range of practices is particularly broad and can complicate comparisons among banks. While the industry has made progress in the use of BEICFs, many banks still are not using them in their measurement frameworks. Scenarios are widely used; however their use in risk measurement methodologies varies considerably from bank to bank. The SIGOR believes that further convergence of practice in these areas is desirable. In addition to having a credible, transparent, well documented and verifiable approach for the weighting of the four elements in their measurement system, banks should understand the impact of every element on their capital calculation and the element's role in the measurement framework.

- *Validation*. Given the multiple measurement frameworks and the "model risk" inherent in the estimation of operational risk exposures, the SIGOR believes banks should perform additional activities in order to ensure the soundness of the capital measurement process. These activities may include: internal validation of model inputs, methodology and outputs by reviewers with suitable expertise; more internal (or external) audit involvement; sensitivity and uncertainty analysis of capital (testing the accuracy of the capital estimate); and back testing and benchmarking comparisons.

III. Internal governance issues

Definition / scope

The Basel Committee has used various documents and other initiatives to actively promote the adoption and implementation of sound corporate governance practices by banks and the assessment of those practices by supervisors.[10] The effective management of operational risk has always been a fundamental element of banks' risk management programmes; however, Basel II introduced a new dimension in the form of separate capital requirements for operational risk, and expectations for the management of operational risk as a distinctive risk discipline. Improvements in internal governance and other aspects of a bank's risk management and measurement framework are expected to coincide with the increased focus on operational risk.

Internal governance issues related to the management of operational risk are not unlike those encountered in the management of credit or market risk. However, because of the more pervasive nature of operational risk and the relatively recent evolution of operational risk management as a distinct discipline, appropriate management responses to operational risk challenges may differ from those in other risk areas.

Although operational risk management is still a relatively young risk discipline, the SIGOR has seen the development of practices in several areas of internal governance, particularly in the governance structure used to manage operational risk. The governance structure commonly adopted by participants relies on three lines of defence – business line management, independent corporate operational risk function, and independent review and validation. The implementation of these three lines of defence varies, depending on the risk management approach of banks and the flexibility provided by national supervisors.

The first line of defence is typically business line management. Fundamentally, sound operational risk governance recognises that business units are responsible for identifying and managing the risks in relation to the activities and processes for which they are responsible.

A functionally independent corporate operational risk function (CORF)[11] is typically the second line of defence, generally complementing the business line's operational risk management activities. The CORF has a reporting structure independent of the risk generating businesses (business lines) and is responsible for the design, maintenance, and ongoing development of the AMA framework within the bank. This function includes the operational risk measurement and reporting processes, risk committees, and board reporting to fulfil its responsibilities for the oversight of the framework and operational risk profile. The CORF also has responsibility for ensuring that the AMA Framework is consistently implemented, to the extent possible, across all business lines and that it actively challenges the business lines inputs to and outputs from the bank's risk measurement and reporting systems. A CORF must have sufficient numbers of personnel skilled in the management and measurement of operational risk to effectively address its many responsibilities.

The third line of defence is an independent review and validation of the AMA framework, performed on a periodic basis. Review and validation should include both risk measurement

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[10] These efforts were evidenced by the publication of the report *Enhancing corporate governance for banking organisations (February 2006)*.

[11] In many jurisdictions, the independent corporate operational risk function is know as the corporate operational risk management function.

and risk management, and the related inputs and outputs. Those performing the assessment must be competent and appropriately trained, functionally independent with minimal opportunities to improperly influence the AMA framework, not part of the CORF, and not involved in the development, implementation and operation of the AMA framework. This independent review function is typically provided by the bank's internal audit which tests the framework to ensure its overall effectiveness, but may involve other suitably qualified parties from within the bank or from external sources.

One of the most critical components of this third line of defence is the independent validation of an AMA bank's risk measurement methodology. In developing systems for the independent review and validation function, banks must develop and maintain rigorous procedures for independent validation of the operational risk measurement processes, including model development. Independent validation ensures that the risk measurement approach used by the bank is sufficiently robust, and provides appropriate transparency of inputs, assumptions, processes, and outputs (eg through stress testing). Specifically, the independent validation function must ensure that the AMA framework and risk measurement methodology results in a credible estimate of operational risk capital that reflects the operational risk profile of the bank. Validation work requires unique skills and expertise. SIGOR members have found independent validation is generally performed by independent external parties, such as specialists in operational risk methodologies and systems. However, some banks have satisfied their national supervisors that their own internal audit functions have the expertise necessary to conduct the review. For additional discussion of validation, please see Section IV Modelling / quantification issues.

Specific topics and corresponding practices

(i) Independent internal /external challenge

Basel II requires an independent assessment by internal and/or external parties of the operational risk management and measurement framework. This independent challenge covers the activities of business units and the operational risk management and measurement function. Independent challenge also plays a central role in both validating the operational risk management framework and ensuring data integrity and comprehensiveness.

Basel text

"Internal and/or external auditors must perform regular reviews of the operational risk management processes and measurement systems. This review must include both the activities of the business units and of the independent operational risk management function." (paragraph 666(e))

"The validation of the operational risk measurement system by external auditors and/or supervisory authorities must include the following:

- *verifying that the internal validation processes are operating in a satisfactory manner; and*
- *making sure that data flows and processes associated with the risk measurement system are transparent and accessible. In particular, it is necessary that auditors and supervisory authorities are in a position to have easy access, whenever they judge it necessary and under appropriate procedures, to the system's specifications and parameters." (paragraph 666(f))*

"The Committee recognises that the AMA soundness standard provides significant flexibility to banks in the development of an operational risk measurement and management system. However, in the development of these systems, banks must have and maintain rigorous procedures for operational risk model development and independent model validation …." (paragraph 668)

Issues/background

The independent challenge process within an AMA bank has two main components: the review of the operational risk management processes, including related data systems, and the validation[12] of its AMA model. While these activities are distinct, they share one critical element – the need for independence in the assessment process. The existence of an independent challenge process is central if AMA banks are to establish an effective operational risk management framework. The 2008 LDCE range of practice questionnaire collected data regarding how challenge functions are used to review the four primary AMA data elements – internal loss data, external loss data, scenario analysis and business environment and internal control factors (BEICFs).

The independent challenge process used to review the use of the four data elements will typically fall within the traditional boundaries of internal and/or external audit responsibilities. Challenge function reviews should be sufficiently broad and detailed to permit appropriate attestations regarding the activities of the functioning of, and controls within, relevant operational risk data systems. However, questions may arise as to whether a bank's audit staff has the expertise and familiarity with the operational risk management function to engage capably the challenge process. If, to compensate, operational risk experts accompany audit personnel, or if other challenge functions are developed, senior management must ensure that the challenge is sufficiently independent of the operational risk management function whose work is under review.

2008 Range of Practice Results

(a) Overview (Tables 2A, 2B, 2C, 2D)

The most common challenge functions used to maintain the integrity of data elements are review by a risk control function, review by internal or external audit, benchmarking/ comparative analytics with other data elements, or benchmarking/comparative analytics based on experience or expertise. Use of subject matter experts as a part of a risk control function is common among AMA banks. These experts may be bank employees or contracted from external sources.

The relative use of the challenge functions does change, depending on the data element. While review by a risk control function is the primary challenge function used to test and verify each of the four data elements, comparisons with experience or expertise are more frequently used to challenge scenario analysis (76%)[13] and BEICFs (52%). Given the inherent problems AMA banks have with the transparency of external data (see *ROP Table 2B*), internal or external audit reviews of external data are undertaken in 45% of banks.

[12] The Basel Committee's SIG-Validation group issued a paper entitled "Studies on the Validation of Internal Rating Systems" (WP N.14 BCBS) that, while focusing on credit risk, outlines principles of validation that are applicable to validating operational risk quantification methodologies.

[13] Values with the parenthetical notes represent the percentage of responding AMA banks responding affirmatively to the specific question.

ROP Table 2A

Challenge Function Characteristics: Internal Loss Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Review by a Risk Control Function	40	95%	5	100%	19	95%	7	100%	9	90%
Review by Internal or External Audit	39	93%	5	100%	18	90%	7	100%	9	90%
Review by Business Peers	10	24%	3	60%	3	15%	3	43%	1	10%
Comparisons with Other Data Elements	26	62%	2	40%	16	80%	4	57%	4	40%
Comparisons with Experience or Expertise	18	43%	1	20%	10	50%	3	43%	4	40%
Other	4	10%	0	0%	2	10%	1	14%	1	10%
Not Defined	1	2%	0	0%	0	0%	0	0%	1	10%

Note: Banks were able to select more than one answer per question.

The use of challenge functions at the regional level is similar, but some differences are evident. For example, in Australia and Japan, AMA banks use internal/external audit more frequently than in other regions, and more consistently across the four data elements. North American AMA banks generally do not compare results with other data elements as frequently as do other regions.

(b) Internal Loss Data (Table 2A)

There are three primary challenge functions used to maintain the integrity of internal loss data: review by a risk control function (95%), review by internal/external audit (93%), and comparisons with other data elements (62%). Other less frequently used challenge functions include comparisons with experience or expertise (43%) or review by business peers (24%). The regional experience is generally similar. European banks compare internal loss data more frequently with other data elements, and North American banks less frequently. Japanese (43%) and Australian banks (60%) more often review internal loss data by business peers.

ROP Table 2B

Challenge Function Characteristics: External Loss Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Review by a Risk Control Function	33	79%	4	80%	16	80%	6	86%	7	70%
Review by Internal or External Audit	19	45%	4	80%	5	25%	6	86%	4	40%
Review by Business Peers	10	24%	4	80%	4	20%	1	14%	1	10%
Comparisons with Other Data Elements	20	48%	2	40%	11	55%	4	57%	3	30%
Comparisons with Experience or Expertise	15	36%	2	40%	9	45%	2	29%	2	20%
Other	3	7%	0	0%	2	10%	1	14%	0	0%
Not Defined	1	2%	0	0%	0	0%	0	0%	1	10%

Note: Banks were able to select more than one answer per question.

(c) External Loss Data (Table 2B)

The challenge function most often used to maintain the integrity of external data is review by a risk control function (79%). Other methods used include comparisons with other data elements (48%), review by internal/external audit (45%) or comparisons with experience or expertise (36%). The range of practice at the regional level is similar, though Australian (80%) and Japanese (86%) banks more often review external data by internal or external audit. Australian banks more often review external data by business peers (80%).

(d) Scenario Analysis (Table 2C)

Four challenge functions are used in a majority of AMA banks to maintain the integrity of scenario analysis. These functions include review by a risk control function (93%), review by internal/external audit (83%), comparisons by experienced or expert staff (76%) or comparisons with other data elements (62%). Nearly half of AMA banks (43%) also have scenario analysis data reviewed by business peers. There are minor regional variations. Fewer Australian and North American banks compare scenario results with either other data elements, or with experience or expertise. More banks in Europe and Japan maintain integrity by comparing scenario analysis with experience or expertise, or comparing scenarios with other data elements.

ROP Table 2C

Challenge Function Characteristics: Scenario Analysis

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Review by a Risk Control Function	39	93%	4	80%	19	95%	7	100%	9	90%
Review by Internal or External Audit	35	83%	5	100%	16	80%	7	100%	7	70%
Review by Business Peers	18	43%	3	60%	8	40%	3	43%	4	40%
Comparisons with Other Data Elements	26	62%	2	40%	14	70%	7	100%	3	30%
Comparisons with Experience or Expertise	32	76%	3	60%	17	85%	7	100%	5	50%
Other	3	7%	0	0%	2	10%	1	14%	0	0%
Not Defined	1	2%	0	0%	0	0%	0	0%	1	10%

Note: Banks were able to select more than one answer per question.

(e) BEICFs (Table 2D)

Challenge functions are not used as extensively to maintain the integrity of BEICFs as they are for the other three data elements. Three review processes are used in at least half of the reporting AMA banks: review by a risk control function (81%), review by internal/external audit (74%), or comparisons with experience or expertise (52%). Regional results are generally consistent, though 100% of Australian and Japanese banks have internal/external audit review of BEICFs.

Supervisory Observations

The frequency of use of key challenge functions within AMA banks is not unexpected and is in broad alignment with the expectations of the Basel II Framework. AMA banks' primary reliance on a risk control function for review of the data elements is appropriate, particularly if the control function is sufficiently independent of the sourcing and use of the data element. However, AMA operational risk control functions are found within CORF or within lines of business. Often the CORF and/or embedded operational risk managers are also responsible for the collection of internal and external loss data or to facilitate the scenario development process.

ROP Table 2D

Challenge Function Characteristics: BEICFs

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Review by a Risk Control Function	34	81%	4	80%	15	75%	7	100%	8	80%
Review by Internal or External Audit	31	74%	5	100%	12	60%	7	100%	7	70%
Review by Business Peers	11	26%	2	40%	4	20%	2	29%	3	30%
Comparisons with Other Data Elements	15	36%	2	40%	6	30%	3	43%	4	40%
Comparisons with Experience or Expertise	22	52%	3	60%	11	55%	3	43%	5	50%
Other	3	7%	0	0%	1	5%	1	14%	1	10%
Not Defined	1	2%	0	0%	0	0%	0	0%	1	10%

Note: Banks were able to select more than one answer per question.

It is important that the CORF function and embedded operational risk managers have appropriate challenge functions in place to ensure the accuracy and reliability of their processes. Additional challenge functions, like independent verification and validation of the four data elements, are also needed. Given its extensive use, internal/external audit appears to serve this role for most AMA banks, particularly for maintaining the integrity of internal loss data and scenario analysis results.

There is a relatively low reliance on internal/external audit to review bank processes that use external data. The SIGOR will continue to encourage banks to make greater use of external data and to implement strong challenge functions when using external data (eg how external data events are selected and how external data events are excluded from consideration).

Despite the increased use of BEICFs in the modelling of operational risk (see Modelling / quantification issues in Section V below), use of internal/external audit to maintain the integrity of BEICFs is relatively low. Integration of BEICFs into the AMA framework, whether as a risk management tool or as a part of the risk measurement methodology, is a core expectation of supervisors. Supervisors expect more active internal/external audit involvement in the review of a bank's use of BEICFs, as AMA frameworks continue to mature. They also expect more work to be done in the comparison of the AMA elements. The

Basel II framework requires that scenario analysis and BEICFs be compared with actual loss experience to ensure their reasonableness (paragraphs 675 & 676).[14]

(ii) Scenario analysis governance

Scenario analysis is one of the four data elements that banks must incorporate into their AMA frameworks and modelling methodologies. This section takes up the challenges of setting up appropriate governance processes and ensuring a strong challenge function is a part of the design and implementation of scenario analysis. Section V, Modelling / quantification issues takes up the challenges posed in appropriately integrating scenario analysis into the operational risk quantification methodology.

Basel text

"A bank must use scenario analysis of expert opinion in conjunction with external data to evaluate its exposure to high-severity events. This approach draws on the knowledge of experienced business managers and risk management experts to derive reasoned assessments of plausible severe losses. For instance, these expert assessments could be expressed as parameters of an assumed statistical loss distribution. In addition, scenario analysis should be used to assess the impact of deviations from the correlation assumptions embedded in the bank's operational risk measurement framework, in particular, to evaluate potential losses arising from multiple simultaneous operational risk loss events. Over time, such assessments need to be validated and re-assessed through comparison to actual loss experience to ensure their reasonableness." (paragraph 675)

Issues/background

Scenario analysis is an important component in the estimation of a bank's operational risk exposure[15] and in creating more effective operational risk management processes. Scenario analysis also may be used to supplement the lack of internal or appropriate external data. However, dependence on the skill and expertise of participants makes the scenario analysis process fundamentally subjective in nature. As such, an improperly structured scenario analysis process that does not have appropriate challenge functions or that does not consider potential biases exposes a bank to significant governance risks, including overlooking risks that are known or unknown. There are a number of ways in which assessment biases can be mitigated, including calibration of the structure of the questions asked and consideration of a range of possible frequencies and severities based on reasoned estimates.

Despite the high degree of subjectivity involved, scenario analysis complements the use of the other three data elements by providing a perspective that is forward-looking, risk sensitive and reflective of the risk of extreme events. The subjectivity of scenario analysis can be mitigated, primarily through the design and quantification of scenarios, as well as through appropriate governance structures and strong challenge processes. Challenge functions can occur across three different organisational dimensions – review by senior

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[14] Use of internal loss data to validate BEICFs has some potential limitations. For example, the effectiveness of internal controls is not always directly related to internal operational risk loss events and soundly implemented BEICFs may be successful in preventing losses. Nevertheless, comparison of internal operational losses to relevant BEICFs may identify gaps in controls or reporting tools (eg Key Risk Indicators (KRIs), Key Performance Indicators (KPIs), or Key Control Indicators (KCIs)), and provides bank management with a more complete assessment of the overall operational risk control environment.

[15] See also Table 18 – Elements Direct Effect on OpR Capital.

management (at the business line and group level), review by business line peers and functional experts (eg audit, IT, HR, infrastructure) not involved in the scenario process and review by the corporate operational risk function. The extent of this multilayer governance structure is dependent upon how scenario analysis is implemented within an organisation, as well as the relative importance (influence) of scenarios in the calculation of operational risk capital.

The incorporation of scenario analysis into a bank's operational risk management or measurement framework must be consistent with sound internal governance principles. Scenario analysis development may vary in many respects, including the rigour in which scenarios are developed, the comprehensiveness of scenario workshops, and how scenarios are updated. Each of these factors can have a significant impact on the effectiveness of a bank's scenario analysis efforts.

2006 Observed Range of Practice

Banks' use of scenario analysis in calculating operational risk capital varies widely. Among the banks that do use scenarios, the following common features can be observed in the range of practice:

- the documentation provided for the scenario analysis process is often less comprehensive than for other aspects of the AMA framework. There is little guidance available to benchmark scenarios or promote consistency of scenarios across banks.
- the rigour applied to scenario development varies greatly, particularly in the depth and quality of governance structures and challenge functions.

2008 Range of Practice Results

(a) Inputs/Structure (Tables 3A, 3B, 3C, 3D)

A vast majority of banks use workshops (90%) that involve multiple individuals and business units, or have individual meetings (69%) to gather scenario data. In some instances, AMA banks also use questionnaires (19%). Questionnaires are more frequently used in Japan (43%) and not used at all in North America. *(Table 3A)*

Nearly all of the participating AMA banks (90%) use internal and external loss data as inputs into the scenario analyses process; but 40% of AMA banks also use financial indicators. Use of internal and external data is consistent across the regions. Financial indicators are also an important input in all regions (40% or higher) except North American banks (10%). *(Table 3B)*

Most of the participating AMA banks (79%) develop both group-wide scenarios that affect the entire organisation and scenarios specific to a business line. To a lesser extent (62%), AMA banks also develop more granular scenarios that are specific to subgroups of a major business line. This result is reasonably consistent across the regions. *(Table 3C)*

ROP Table 3A

Scenario Analysis Range of Practice Comparisons:
Banks using the following Methods to gather Scenario Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Workshops involving multiple Employees/Units	38	90%	5	100%	20	100%	6	86%	7	70%
Series of Individual Meetings/Interviews	29	69%	2	40%	17	85%	5	71%	5	50%
Questionnaires	8	19%	1	20%	4	20%	3	43%	0	0%
Voting	1	2%	0	0%	0	0%	1	14%	0	0%

* Other selections written in included *Regular Meetings* (3 banks) and *Other* (2 banks).
Note: Banks were able to select more than one answer per question.

ROP Table 3B

Scenario Analysis Range of Practice Comparisons:
Banks using the following Inputs in the Scenario Analysis Process

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Internal Loss Data	38	90%	5	100%	19	95%	7	100%	7	70%
External Loss Data	38	90%	5	100%	18	90%	7	100%	8	80%
Financial Indicators	17	40%	2	40%	11	55%	3	43%	1	10%

* Other selections written in included *BEICFs* (22 banks), *Expert Opinion* (17 banks), and *Other* (2 banks).
Note: Banks were able to select more than one answer per question.

ROP Table 3C

Scenario Analysis Range of Practice Comparisons: Banks developing the following Types of Scenarios

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Group-wide Scenarios that may affect entire Organisation	33	79%	4	80%	16	80%	6	86%	7	70%
Scenarios Specific to a Business Line	33	79%	5	100%	15	75%	6	86%	7	70%
Scenarios Specific to a Business Line Subgroup	26	62%	4	80%	11	55%	6	86%	5	50%
Other	3	7%	0	0%	3	15%	0	0%	0	0%

Note: Banks were able to select more than one answer per question.

Less than half of the reporting banks answered that they address all of the scenario biases explicitly. Scenario biases, when addressed in the scenario development process, typically include overconfidence[16] (40%), motivational[17] (33%), availability[18] (31%), partition

[16] Bias of overconfidence is the underestimation of risk due to the number of observed events being small. Overconfidence can arise as scenario analysis predictions are made to most closely represent the available data, despite evidence being insufficient or information being irrelevant. Overconfidence can also arise if small data samples are highly representative (stereotypical) of a population, such that an illusion of validity is created despite the evidence being scanty, unreliable or outdated. This often leads to an over-interpretation of findings and predictability may be overestimated. (A. Wilson, 1994, Cognitive factors affecting subjective probability assessment, Institute of Statistics and Decision Sciences (ISDS) Discussion Paper #94-02, Duke University, Durham, N.C.)

[17] Motivation bias is the misrepresentation of information due to respondents' interests in conflict with the goals and consequences of the assessment. Further, motivational bias is where the assessor seeks to improve the apparent position of the situation by modifying the estimate. The bias arises when the person making the assessment has an interest in influencing the results of the analysis. (Hillson & Hullet, 2004, Assessing Risk Probability: Alternative Approaches, Proceedings of PMI Global Congress 2004 EMEA, Prague, Czech Republic.)

[18] Availability bias is the overestimation of events that respondents had closer or more recent contact with. Further, frequency estimates may be biased according to the ease with which the expert is able to recall relevant information. Personally experienced events are usually more prominent, as are events occurring more recently. These effects can cause an upward bias on the frequency assessment. Attempts to assess previously unencountered events are largely affected by the ease of imaginability or the ability to construct relevant scenarios. (Kahneman & Tversky, 1974, Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124-1131.)

dependence[19] (26%) and anchoring (26%).[20] More Australian and North American banks answered that they address scenario bias explicitly, with Europe and Japan less so. (Table 3D).

ROP Table 3D

Scenario Analysis Range of Practice Comparisons:
Banks explicitly addressing the following Bias in the Scenario Process

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Overconfidence	17	40%	1	20%	7	35%	4	57%	5	50%
Availability	13	31%	2	40%	6	30%	2	29%	3	30%
Anchoring	11	26%	2	40%	2	10%	1	14%	6	60%
Motivational	14	33%	2	40%	5	25%	2	29%	5	50%
Partition Dependence	11	26%	2	40%	3	15%	2	29%	4	40%
Other	5	12%	0	0%	2	10%	0	0%	3	30%

Note: Banks were able to select more than one answer per question.

(b) Updating Scenarios (Table 4)

Scenarios are most frequently updated between review dates when a major organisational change occurs (79%), when a major operational loss is incurred (74%), when a new business or product line (67%) is introduced, when major changes in operations (60%) occur, or when a major change in computer systems (57%) is implemented. Australia and Japan are the regions most likely to update their scenario analysis between review dates as a result of a wide variety of circumstances.

[19] Partition dependence refers to whether the respondents' knowledge was distorted by discrete choices or buckets within which their responses had to be represented. Clemen and Fox, 2005 further explains that people typically anchor on a uniform probability distribution across given events in the state space. Consequently, assessed probabilities may vary with the state space chosen and the number of events identified. Insufficient adjustment creates a bias towards a 1/n probability for each known event. This leads to the underestimation of low frequency events and overestimation of high frequency events. Experts with greater expertise may show relatively less partition dependence, but the effect remains evident even among probability experts. (Subjective probability assessment in decision analysis: Partition dependence and bias toward the ignorance prior, Management Science, Vol. 51, No. 9, September 2005, pp1417-1432.)

[20] Anchoring is a respondent's bias towards information presented in background materials to survey questions or within the questions themselves. Different starting points (anchors) will often yield different estimates of probability. The subsequent adjustment from the anchor is typically insufficient. This creates a tendency for experts to overestimate success probabilities and to underestimate failure probabilities. This insufficient adjustment results in estimates of extreme values (eg the 99.9th percentile) being understated, and as a result the assessed probability distribution will typically be too tight. (Kahneman & Tversky, 1974,)

ROP Table 4

Circumstances Triggering an Update of Scenarios

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
New business or new product	28	67%	4	80%	13	65%	5	71%	6	60%
Major operational loss	31	74%	5	100%	15	75%	6	86%	5	50%
Major change in computer systems	24	57%	4	80%	11	55%	5	71%	4	40%
Major change in organisation (includes reorganisations, mergers, and acquisitions)	33	79%	4	80%	17	85%	5	71%	7	70%
Major change in operations	25	60%	4	80%	12	60%	4	57%	5	50%
Outsourcing	20	48%	4	80%	10	50%	2	29%	4	40%

* Other selections written in included *Major External Event/Loss* (3 banks) and *Other* (7 banks).

Note: Banks were able to select more than one answer per question.

Supervisory Observations

As expected, scenario workshops are the preferred method used by AMA banks to develop scenario analyses. When appropriately structured, workshops are an effective technique for stimulating management to identify key strategic operational risks facing their businesses. While AMA banks broadly use internal and external loss data for scenario analysis, the relatively low use of BEICFs reflects the need, yet unsolved, of identifying reliable metrics that relate the volumes/outcome of BEICFs with the bank's true operational risk exposure.

The current range of practice, particularly the lack of consistent controls to address scenario bias and the wider inclusions of BEICFs, suggests that AMA banks need to further develop and strengthen overall scenario analysis governance. Challenge processes, particularly those addressing scenario biases, should be strengthened to ensure greater consistency and robustness of scenario assessments. Further, based on SIGOR members' supervisory reviews, documentation of the scenario elicitation process and scenario results are not always complete, nor fully transparent of the underlying processes used. It is important that all aspects of the scenario process be thoroughly documented and supported. The May 2009 Basel Committee Document entitled "Principles for sound stress testing practices and supervision" provides further guidance and principles on the use of stress testing and scenario selection. The SIGOR encourages the industry to continue to develop and improve

governance standards used by AMA banks for scenario analysis, and will follow and assess this work, formulating additional guidance when necessary.

(iii) Business environment and internal control factors (BEICFs)

BEICFs are indicators of a bank's operational risk profile that reflect underlying business risk factors and an assessment of the effectiveness of the internal control environment. Like scenario analysis, they provide a forward-looking element to an AMA by considering Business Environment indicators (eg the rate of growth, employee turnover, and new product introductions) and Internal Control Factors (eg findings from the challenge process, internal audit results, and system downtime). As one of the four data elements of an AMA framework, BEICFs should be incorporated, either directly or indirectly, into the operational risk measurement process.

Incorporating BEICFs into an AMA framework endeavours to ensure that key drivers of operational risk are captured and that a bank's operational risk capital estimates are sensitive to its changing operational risk profile. Typically, BEICFs are integrated into the AMA framework as a tool to improve risk management and as a part of the risk measurement process. When used for risk measurement, BEICFs are used directly (ie scorecards) as an input into the modelling process to derive the initial operational risk capital amount, or indirectly as an input to the operational risk modelling. BEICFs are also used as an *ex post* adjustment to corporate level or business line allocations of operational risk capital, based on the underlying change in the business or internal control environment. BEICFs are often indirectly used as an input into the scenario analysis process (see Section V).

Basel text

"In addition to using loss data, whether actual or scenario-based, a bank's firm-wide risk assessment methodology must capture key business environment and internal control factors that can change its operational risk profile. These factors will make a bank's risk assessment more forward-looking, more directly reflect the quality of the bank's control and operating environments, help align capital assessments with risk management objectives, and recognise both improvements and deterioration in operational risk profiles in a more immediate fashion. To qualify for regulatory capital purposes, the use of these factors in a bank's risk measurement framework must meet the following standards:

- *the choice of each factor needs to be justified as a meaningful driver of risk, based on experience and involving the expert judgement of the affected business areas. Whenever possible, the factors should be translatable into quantitative measures that lend themselves to verification.*
- *the sensitivity of a bank's risk estimates to changes in factors and the relative weighting of the various factors need to be well reasoned. In addition to capturing changes in risk due to improvements in risk controls, the framework must also capture potential increases in risk due to greater complexity of activities or increased business volume.*
- *the framework and each instance of its application, including the supporting rationale for any adjustments to empirical estimates, must be documented and subject to independent review within the bank and by supervisors.*
- *over time, the process and the outcomes need to be validated through comparison to actual internal loss experience, relevant external data and appropriate adjustments made." (paragraph 676)*

Issues/background

In principle, a bank with strong internal controls in a stable business environment will have, all else being equal, less exposure to operational risk than a bank with internal control weaknesses, rapid growth, or recently introduced new products. Accordingly, banks are expected to assess the level and trends in operational risk and related control structures across the organisation. The results of these assessments should be built into the risk management and measurement aspects of a bank's AMA methodology. The assessments should be current and comprehensive, and should identify the critical operational risks facing the bank. The assessment process should be sufficiently flexible to encompass a bank's full range of activities (including new activities), changes in internal control systems or a change in the business environment (eg increased business). The challenges in this area include determining which BEICFs to consider and whether to build them directly or indirectly into the risk measurement model.

As BEICFs are to be incorporated in a bank's capital calculation, management must ensure that the BEICF risk assessment process is appropriate and that the results reasonably reflect the risks of the bank. For example, if a bank reduces its operational risk estimate on the strength of robust internal control factors, then there should be some validation process for ensuring that the impact of internal control factors on the final capital estimate is plausible, prudent and consistent with actual experience. However, BEICF inputs and outputs are much more difficult to incorporate into a bank's modelling methodologies than the other three elements as they are typically not measured by loss amounts. As a result BEICFs often rely on more subjective processes and procedures, which can make validation of BEICFs more difficult than other aspects of a bank's AMA framework.

2006 Observed Range of Practice

Banks have tended to focus much less on this AMA element than on the collection of internal loss data or the development of scenarios. In general, while banks have developed a variety of approaches for incorporating BEICFs into their management of operational risk (eg risk and control self-assessments (RCSAs), key risk indicators, key performance indicators, or key control indicators (KRI/KPI/KCIs), most consider the application of BEICFs in the risk measurement system as the most challenging of the four required AMA elements. Most banks have developed methodologies to capture key BEICFs, but few are able to substantiate how they quantify the impact of those factors on the capital calculation. As a consequence, the practice for many banks is still very much in its formative stages.

One of the applications of BEICFs is in the development of scorecards, the results of which are used to assess operational risk drivers and controls at a bank's chosen level of granularity and then adjust the measured operational risk capital amount on the basis of these assessments. Another use of BEICFs is as part of the risk and control identification process in the development of operational risk scenarios. A much less common practice is the use of BEICFs as a direct statistical input or adjustment within the AMA model.

2008 Range of Practice Results

(a) Use (Tables 5A, 5B, 6)

Over the last three years, AMA banks have made significant progress in the development of BEICF tools. All AMA banks now use some type of BEICF tool for risk management and/or risk quantification. The most commonly used BEICFs tools are RCSAs (98%), audit results

(90%), and KRIs/KPIs (81%).[21] Use of the three major BEICF tools across the globe is similar, though KRIs/KPIs are used in only 43% of Japanese AMA banks. Nearly all of AMA banks use RCSAs (95%), audit results (88%), or KRIs/KPIs (81%) as tools to manage operational risk. (*Tables 5A, 5B*).

ROP Table 5A

Use of BEICF Tools

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	42		5		20		7		10	
Using RCSAs	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
For Risk Management Purposes	40	95%	5	100%	19	95%	6	86%	10	100%
Used Directly or Indirectly for Risk Quantification	32	76%	3	60%	16	80%	6	86%	7	70%
Not Used	1	2%	0	0%	0	0%	1	14%	0	0%
Using KRI/KPIs	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
For Risk Management Purposes	34	81%	5	100%	18	90%	3	43%	8	80%
Used Directly or Indirectly for Risk Quantification	19	45%	3	60%	12	60%	2	29%	2	20%
Not Used	8	19%	0	0%	2	10%	4	57%	2	20%

Note: Banks were able to select more than one answer per question.

[21] These numbers are calculated by deducting from 100% the percentage of banks in which the BEICF tool is not used.

ROP Table 5B

Use of BEICF Tools

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Using Audit Scores/Audit Findings	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
For Risk Management Purposes	37	88%	4	80%	17	85%	7	100%	9	90%
Used Directly or Indirectly for Risk Quantification	18	43%	3	60%	8	40%	2	29%	5	50%
Not Used	4	10%	1	20%	2	10%	0	0%	1	10%
Using Other BEICF Tools	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
For Risk Management Purposes	8	19%	1	20%	3	15%	2	29%	2	20%
Used Directly or Indirectly for Risk Quantification	8	19%	1	20%	3	15%	2	29%	2	20%
Not Used	12	29%	3	60%	4	20%	5	71%	0	0%

Note: Banks were able to select more than one answer per question.

While use of BEICF tools *(Table 6)* for risk quantification was limited in 2006, AMA banks have now more widely included BEICFs in their AMA frameworks. However, challenges remain in substantiating how AMA banks quantify the impact of BEICFs on the capital calculation. Most AMA banks also use BEICFs as an indirect input to risk quantification (69%), though only 14% use BEICFs in a way that directly affects the total amount of AMA Capital (direct input into the model (7%) and as an ex-post adjustment to AMA capital (7%)). RCSAs *(Table 5)* are the most frequently used BEICF tool for risk quantification (76%), followed by KRIs/KPIs (45%) and audit results (43%). Regional use of BEICF tools for risk quantification follows generally similar patterns, although Australia and Europe more often use KRIs/KPIs. In addition, North American banks (50%) typically use BEICFs for ex-post adjustments of AMA capital allocation at the business level, and Europe (5%) considerably less so.

ROP Table 6

Incorporation of Elements into the AMA Framework - BEICFs

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Use of BEICFs	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Risk management	42	100%	5	100%	20	100%	7	100%	10	100%
Indirect input into risk quantification	29	69%	5	100%	14	70%	7	100%	3	30%
Direct input into the model	3	7%	0	0%	2	10%	0	0%	1	10%
Ex-post adjustment a of AMA capital allocation at the consolidated level	3	7%	0	0%	3	15%	0	0%	0	0%
Ex-post adjustment a of AMA capital allocation at the business level	7	17%	1	20%	1	5%	0	0%	5	50%
Not used	0	0%	0	0%	0	0%	0	0%	0	0%
Other	6	14%	0	0%	6	30%	0	0%	0	0%

(b) Updates of BEICFs (Table 7A, 7B, 7C)

There is a wide range of practice in the frequency with which BEICF tools are updated:

- RCSAs (*Table 7A)* are updated generally either on an annual basis (43%), a quarterly to semi-annual basis (26%), or semi-annually to annually (24%).
- KRIs/KPIs (*Table 7B)* are updated more frequently, typically monthly to quarterly (52%).
- Audit results (*Table 7C)* are updated to reflect the risk based nature of the audit process, with a wide range of practice noted. Audit scores or findings are most often reviewed when triggered (26%), or updated more frequently on a monthly (19%), annual (19%), quarterly (14%) or semi-annual basis (17%).

There is some regional variation in how BEICFs are updated. AMA banks in Europe (85%) and Japan (71%) typically update RCSAs less frequently than other regions.

ROP Table 7A

Updating BEICF Tools: RCSAs

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Updating RCSAs	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Annually	18	43%	1	20%	15	75%	1	14%	1	10%
Semi-annually to Annually	10	24%	2	40%	2	10%	4	57%	2	20%
Quarterly to Semi-Annually	11	26%	2	40%	5	25%	0	0%	4	40%
Monthly to Quarterly	2	5%	0	0%	0	0%	0	0%	2	20%
More frequently than Monthly	0	0%	0	0%	0	0%	0	0%	0	0%
Reviewed when triggered	5	12%	0	0%	3	15%	1	14%	1	10%
Not Used	1	2%	0	0%	0	0%	1	14%	0	0%

Note: Banks were able to select more than one answer per question.

Supervisory Observations

Incorporating BEICFs into a bank's risk measurement process has progressed since supervisors conducted the 2006 range of practice review. Going forward, discussions between banks and supervisors will continue to focus on several key principles, including the identification of meaningful BEICFs; the most effective means to quantify BEICFs; and ways to incorporate BEICFSs into an AMA model. For purposes of assessing the reasonableness of internal control factor assessments, banks should periodically compare their actual loss experience with the results of these assessments over time.[22]

RCSAs, KRI thresholds and 'triggers', loss data, and scorecards all provide valuable input to a bank's understanding of its business environment and internal controls. Observations in 2006 suggested that the banks pursuing an AMA methodology tended to focus much less on BEICFs than on either the collection of internal/external loss data or the development of scenarios. Today, BEICFs are more widely used for both risk management and risk quantification. The expanding use of BEICFs is more closely aligning with supervisory expectations as AMA frameworks mature.

[22] See footnote 13.

ROP Table 7B

Updating BEICF Tools: KRI/KPIs

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Updating KRI/KPIs	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Annually	4	10%	0	100%	3	15%	0	0%	1	10%
Semi-annually to Annually	4	10%	1	20%	3	15%	0	0%	0	0%
Quarterly to Semi-Annually	8	19%	2	40%	5	25%	0	0%	1	10%
Monthly to Quarterly	22	52%	2	40%	13	65%	2	29%	5	50%
More frequently than Monthly	2	5%	0	0%	2	10%	0	0%	0	0%
Reviewed when triggered	4	10%	0	0%	3	15%	0	0%	1	10%
Not Used	8	19%	0	0%	2	10%	4	57%	2	20%

Note: Banks were able to select more than one answer per question.

ROP Table 7C

Updating BEICF Tools: Audit and Other Tools

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Updating Audit Scores/Audit Findings	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Annually	8	19%	0	0%	6	30%	1	14%	1	10%
Semi-annually to Annually	7	17%	1	20%	2	10%	3	43%	1	10%
Quarterly to Semi-Annually	6	14%	3	60%	2	10%	0	0%	1	10%
Monthly to Quarterly	8	19%	0	0%	1	5%	2	29%	5	50%
More frequently than Monthly	0	0%	0	0%	0	0%	0	0%	0	0%
Reviewed when triggered	11	26%	0	0%	8	40%	1	14%	2	20%
Not Used	4	10%	1	20%	2	10%	0	0%	1	10%
Updating Other Tools	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Annually	1	2%	0	0%	0	0%	0	0%	1	10%
Semi-annually to Annually	1	2%	0	0%	0	0%	1	14%	0	0%
Quarterly to Semi-Annually	3	7%	1	20%	1	5%	1	14%	0	0%
Monthly to Quarterly	3	7%	0	0%	2	10%	0	0%	1	10%
More frequently than Monthly	0	0%	0	0%	0	0%	0	0%	0	0%
Reviewed when triggered	2	5%	0	0%	2	10%	0	0%	0	0%
Not Used	6	14%	3	60%	3	15%	0	0.0%	0	0%

Note: Banks were able to select more than one answer per question.

IV. Data issues

Definition / scope

The nature and quality of operational risk data collected by an AMA bank affects not only the outcome of the bank's quantification process but also its operational risk management decisions. As a result, Basel II prescribes certain guidelines a bank's operational risk data must satisfy before the bank will qualify for an AMA. These standards relate principally to the characteristics of the data; how data is collected and how it is used. The purpose of the standards is to provide insight into supervisors' minimum expectations regarding data integrity and comprehensiveness, both of which are critical to the effective implementation of an AMA.

AMA operational risk data can be grouped into the following four categories: internal loss data, external loss data, scenario data and data related to a bank's business environment and internal controls. This section of the report focuses primarily on internal and, to a lesser extent, on external data.

AMA operational risk data has multiple functions, including risk quantification, risk management, accounting and other forms of reporting. Some data are suitable for more than one application, whereas other data are single-purpose.

Specific topics and corresponding practices

(i) Date of occurrence of internal legal event losses

Frequently, operational risk losses arising from legal events are not identified by the affected bank until months after the date of their occurrence. A question then arises about the date that a bank should assign such losses within its internal loss database. In legal cases the usual sequence of dates related to operational risk losses is:

- date of occurrence;
- date of discovery;
- date of accounting (legal reserve is made for a probable estimated loss in profit and loss accounts that is updated quarterly or annually); and finally
- date of agreement or settlement.

Basel text

"[A] bank should collect information about the date of the event …The level of detail of any descriptive information should be commensurate with the size of the gross loss amount." (paragraph 673, third bullet)

Issues/background

While Basel II requires AMA banks to record the date of an event, it does not provide any additional guidance. Choices about the date of occurrence of a large internal loss can have a significant impact on the assessment of a bank's operational risk profile at a given point in time and over time. Banks' practices in this area tend to be strongly influenced by accounting or provisioning practices, which could generate results that are inconsistent with a bank's true operational risk profile.

2006 Observed Range of Practice

Banks generally assign one of three dates to an individual operational risk loss: date of occurrence, date of discovery, or accounting date. Of the three, banks tend to favour the date of occurrence or date of discovery over the accounting date. Litigation cases are a notable exception for which banks lean towards the accounting date or the date on which the case is settled, if different from the accounting date. This may be related to banks' preference for the 'certainty' criterion in the accounting guidance for recognising such losses in some jurisdictions, and concerns that early public recognition of potential settlements could increase the likelihood and size of legal losses.

2008 Range of Practice Results (Tables 8A, 8B, 8C)

There is a broad range of practice in terms of how legal events are recorded into AMA internal loss databases. The recording of loss amounts resulting from legal events (*Table 8A)* tends to be later than when legal events are first entered into the database (with or without loss amounts). Two-thirds of the AMA banks enter legal events (with or without loss amounts) into the database at discovery (38%) or upon establishing a legal reserve (29%). Of the remaining third, most use criteria other than the settlement date to determine when legal losses are entered into the loss database. Most Japanese banks first enter legal events (with or without loss amounts) at discovery (71%).

ROP Table 8A

Internal Loss Data Capture of Legal Events:
Date of Events Entering into Database

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
At discovery	16	38%	2	40%	8	40%	5	71%	1	10%
Upon establishing a legal reserve	12	29%	1	20%	7	35%	0	0%	4	40%
At settlement	4	10%	1	20%	1	5%	1	14%	1	10%
No response	0	0%	0	0%	0	0%	0	0%	0	0%

* Other selections written in included *When an accounting entry is made* (3 banks) and *Other* (7 banks).

Loss amounts for legal events (Table 8B) are typically entered after the loss event has been entered into the AMA internal loss database.[23] Half of AMA banks record loss amount at discovery (17%) or when a legal reserve is established (33%). Other dates used to enter

[23] Banks often use estimates where the loss amounts are recorded pending completion of the legal processes; the estimates are then updated as the litigation progresses.

legal loss amounts into the database include settlement (19%), when an accounting entry is made (17%), or another date (14%). As would be expected, the dates for recording the legal loss amounts into AMA loss databases differ across regions.

ROP Table 8B

Internal Loss Data Capture of Legal Events:
Date of Loss Amounts Entering into Database

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
At discovery	7	17%	1	20%	3	15%	3	43%	0	0%
Upon establishing a legal reserve	14	33%	1	20%	9	45%	0	0%	4	40%
At settlement	8	19%	1	20%	4	20%	2	29%	1	10%
No response	0	0%	0	0%	0	0%	0	0%	0	0%

* Other selections written in included *When an accounting entry is made* (7 banks) and *Other* (6 banks).

More significantly, there is a broad range of practice when loss amounts from legal events are used as a direct input into the AMA capital quantification (Table 8C). Just over a quarter of AMA banks use the date of establishing a legal reserve in the AMA calculation. Other dates used include settlement date (12%), accounting date (10%), date of discovery (17%), or when first confirmed or validated (7%). Dates for using legal losses in AMA quantification models vary markedly across regions, with Europe using the most diverse set of dates.

ROP Table 8C

Internal Loss Data Capture of Legal Events:
Date of Loss Amounts used in the AMA Model

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
At discovery	7	17%	0	0%	1	5%	6	86%	0	0%
Upon establishing a legal reserve	11	26%	1	20%	6	30%	0	0%	4	40%
At settlement	5	12%	0	0%	3	15%	0	0%	2	20%
No response	1	2%	1	20%	0	0%	0	0%	0	0%

* Other selections written in included *Once confirmed/ validated* (3 banks), *When an accounting entry is made* (4 banks), *Not used in Model* (4 banks), and *Other* (7 banks).

Supervisory Observations

The current range of practice appears to be broad, particularly in context of the dates when legal losses are first used for quantification. This is a change in practice since the 2006 Observed Range of Practice report when settlement and accounting dates were the most frequently used dates. Consistent with supervisory expectations, AMA banks are now more frequently using the date when a legal reserve is established for both entering the event and loss amount into the database, as well as the date for incorporating the legal event into the quantification model. Given the time-lag between initiation of a legal case and its conclusion, supervisors believe using the date when a legal reserve is established adds consistency and better reflects the banks' operational risk profile.[24]

Using the date of occurrence, and alternatives such as discovery date and accounting date owing to their availability and relative objectivity, may be justified for both risk management and capital calculation purposes. Using the accounting date also offers the advantage of being able to more readily reconcile a bank's internal loss database with its general ledger.

While, as noted above, there are legitimate arguments justifying the use of a variety of dates for entering legal events and legal event loss amounts into the database, the diverse use of dates for quantification purposes does raise questions as to whether AMA banks' quantification of their operational risk profile properly reflects all known operational risk exposures. The wide range of practice also raises questions of transparency and industry consistency in how operational risk exposures are quantified for capital purposes. The

[24] It is considered a good practice to include legal events as scenarios, in the interim. That is, from discovery date until the date of accounting of the legal reserve, these events are already known even if they are not yet included in the data base and they should enrich the AMA framework as scenario points until they are considered actual data.

SIGOR will do further work to encourage less variation in how legal settlements are first included in the AMA for quantification, given that in several regions these losses are one of the most significant sources of operational risk with considerable impact on regulatory capital modelling.

(ii) Allocation of internal losses across business lines and event types

An individual operational risk event can lead to losses in multiple business lines, while losses arising from a single event can sometimes span multiple event types. As in the case of events that trigger losses over a period of time, questions arise regarding how banks should treat these losses for risk measurement purposes and how they should be reflected in banks' internal loss databases.

Basel text

"A bank must develop specific criteria for assigning loss data arising from an event in a centralised function (eg an information technology department) or an activity that spans more than one business line …" (paragraph 673, fourth bullet)

"Any banking or non-banking activity which cannot be readily mapped into the business line framework, but which represents an ancillary function to an activity included in the framework, must be allocated to the business line it supports. If more than one business line is supported through the ancillary activity, an objective mapping criteria must be used." (Annex 8, paragraph (b))

Issues/background

Allocating losses that occur in a centralised business function or losses from a single operational risk event affecting multiple business lines affects both the measurement and management of operational risk. Also, from a risk management perspective, the failure to allocate such losses or inappropriate allocation sends the wrong signal to business line management and undermines the internal credibility of the capital allocation process.

2006 Observed Range of Practice

Generally, banks have adopted one of two practices in this area: (i) allocating the entire loss to the business line for which the impact is greatest, or (ii) allocating the loss on a pro-rata basis across the affected business lines. In the case of losses from a single event, the former practice seems to have been implemented more widely. Practice is more evenly divided with respect to losses occurring in a centralised function.

2008 Range of Practice Results (Table 9)

The current range of practice is similar to what was observed in 2006. More than two-thirds of banks allocate internal losses affecting multiple business lines on either a pro-rata basis (36%) or by allocating the entire loss to the business line where the impact is greatest (33%). Ten percent of the participating banks use no allocation methodology. The remaining banks use some other methodology, such as allocating the loss in the business line where it originated.

Regionally, there are differences. Most Australian banks allocate losses to the business line where the impact is greatest, while most North American and European banks allocate losses affecting multiple business lines on a pro-rata basis.

ROP Table 9

Allocation of Losses Affecting Multiple Business Lines

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Allocating the entire loss to the business line for which the impact is greatest	14	33%	4	80%	6	30%	3	43%	1	10%
Allocating the loss on a pro-rata basis	15	36%	0	0%	9	45%	0	0%	6	60%
No allocation method	4	10%	0	0%	2	10%	1	14%	1	10%

* * Other selections written in included *Allocating the loss in the business line where it originated* (4 banks) and *Other* (5 banks).

Supervisory Observations

There seems to be a broad consensus on the allocation of internal losses affecting multiple business lines on either a pro-rata basis (36%) or allocating the full amount of a loss to the business line in which the impact is greatest (33%), driven in part by concerns that alternative approaches could lead to an understatement of risk. Where losses are allocated across business lines or event types, perhaps for risk management purposes, banks are expected to identify the related losses in their internal loss databases and take these relationships into account when calculating capital requirements.

The range of practice for allocating losses has not changed markedly since 2006 and is acceptable from a supervisory perspective, only if AMA banks continue to have processes in place that aggregate the allocated losses for risk quantification purposes.

(iii) Collection of gross versus net internal loss amounts

A net internal loss amount is the loss incurred by a bank after taking into account recoveries from clients, insurance or other sources.

Basel text

"Aside from information on gross loss amounts, a bank should collect information about … any recoveries of gross loss amounts … The level of detail of any descriptive information should be commensurate with the size of the gross loss amount." (paragraph 673, third bullet)

Issues/background

Basel II does not define 'gross loss' or 'recoveries'. Because the amounts involved can be significant, different practices among banks can result in significant differences in the gross loss amount recorded for similar events, and may result in correspondingly significant differences in capital calculations.

2006 Observed Range of Practice

Banks generally collect information about recoveries, including gross loss amounts. In the case of many banks, the gross loss amount recorded in the internal loss database is the actual gross loss amount less any recoveries that occur within a specified period of time. Typically, this period of time ranges from the same day to a few days. Some banks, however, believe that much longer periods might be appropriate in the case of certain types of events, where full recovery is anticipated based on the nature of the underlying transaction and/or counterparty.

2008 Range of Practice Results (Table 10)

A broad range of practice exists among AMA banks, with most banks (43%) using 'gross loss after all recoveries (except insurance)' as the value used for capital quantification.

ROP Table 10

Definition of Loss Amount and the Use of Recovery Data in AMA Models

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	42		5		20		7		10	
Number of Banks using Internal Loss Data as a Direct Input into Model	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
	32	76%	4	80%	12	60%	7	100%	9	90%
Loss amount used as the AMA input	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Gross Loss before any Recoveries	12	29%	2	40%	5	25%	2	29%	3	30%
Gross Loss after all Recoveries except Insurance Recoveries	18	43%	1	20%	12	60%	2	29%	3	30%
Net Loss (Gross Loss net of all Recoveries)	6	14%	0	0%	0	0%	3	43%	3	30%
Other	5	12%	1	20%	3	15%	0	0%	1	10%

Note: Table includes only those banks which used internal loss data as a direct input into their AMA model.

Note: Banks were able to select more than one answer per question.

More than a quarter of AMA banks (29%) use 'gross loss before any recoveries,' with only a few banks (14%) using 'net loss (gross loss net of all recoveries).'' A small number of AMA banks (12%) use other definitions.

Regionally, the distribution varies markedly. Sixty percent of European banks use 'gross loss after recoveries (except insurance).' In North America, no one definition is used by a majority of banks. Australian and European AMA banks do not use the definition 'net loss (gross loss net of all recoveries),' however Japanese (43%) and North American (30%) AMA banks do.[25]

Supervisory Observations

The range of practice is broad, particularly with regard to the use of 'net losses' (gross loss net of all recoveries) for AMA risk quantification. Use of 'net losses' poses challenges to the banks and supervisors in determining the percentage of insurance and other risk mitigating offsets embedded in the calculation of the operational risk capital charge. Because differing definitions of loss amounts may result in significant differences in capital calculations, the SIGOR will further review this issue to determine if a more consistent practice pertaining to the use of 'net losses' is appropriate.

(iv) Internal loss collection thresholds

Loss collection thresholds are *de minimis* levels above which loss amounts must be collected or recorded in a bank's internal loss database.

Basel text

"A bank must have an appropriate de minimis gross loss threshold for internal loss data collection, for example €10,000. The appropriate threshold may vary somewhat between banks and within a bank across business lines w event types. However, particular thresholds should be broadly consistent with those used by peer banks."

Background/issues

The choice of loss collection thresholds can significantly affect the calculation of expected loss and, to some extent, the shape of the estimated loss distribution and estimates of unexpected loss. Where reconciliation with the general ledger may be considered beneficial, higher thresholds may make it more difficult to reconcile the general ledger with the loss database.

2006 Observed Range of Practice

Most banks tend to rely on expert judgement rather than more empirical methods to set loss collection thresholds. Most banks use the same threshold for all business lines, although many have introduced different thresholds for different business lines.

Some banks have set thresholds but have chosen nonetheless to collect data under the threshold. For many banks, this data is used to analyse expected loss. Some banks include such losses in their capital calculation but do not collect the same detailed information about these losses as they do for losses above the threshold.

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[25] Since the time of collecting data for the LDCE, Japanese bank practice has changed significantly. Japanese banks now follow the same practice as European and Australian banks.

2008 Range of Practice Results (Table 11)

(a) Thresholds for Internal Loss Data Collection

A majority of banks (64%) reported thresholds less than €10,000. The threshold ranges were fairly evenly spaced, with 19% reporting between €0 and €1,000, 19% banks reporting between €1,000 and €5,000, 19% banks reporting between €5,000 and €10,000, and 17% banks reporting between €10,000 and €20,000. Only 7% of banks reported a zero threshold, and 2% had a threshold over €20,000. Five banks did not provide a threshold.

ROP Table 11

Loss Data Collection Thresholds Used

Number and Percentage of Banks

	All Participating AMA Banks	
Number of AMA Banks	42	
Loss Data Collection Threshold	**# of Banks**	**% of Banks**
€ 0	3	7%
€0 < T < €1,000	8	19%
€1,000 ≤ T < €5,000	8	19%
€5,000 ≤ T < €10,000	8	19%
€10,000 ≤ T	9	21%
Threshold not provided	5	12%
All *	41	98%

* Excludes 1 participating AMA bank whose loss data practices raises questions regarding the actual threshold used.

(b) Use of Internal Loss Data for Quantification (Table 12)

There is a wide range of practice in setting criteria for using data for modelling purposes. Half of the participating AMA banks (50%) place restrictions on the use of data based on loss amount. As might be expected, many AMA banks (43%) limit the use of high frequency/low severity events (under €20,000) for modelling purposes. Most European banks (50%) limit the use of smaller losses.

Nearly a half of AMA banks (48%) limit the use of internal loss data based on date. In addition to limiting the use of internal loss data based on size or date, more than half of participating AMA banks (62%) limit use based on some other criteria (boundary events (eg credit related loses), subsidiary losses, etc.). Within regions, there is a wide diversity of practice in how banks limit the use of internal loss data.

ROP Table 12

Number of AMA banks that do not directly use all internal losses for modelling

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Criteria for Discarding Data: Loss Amount	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
No Restriction	21	50%	3	60%	8	40%	4	57%	6	60%
Restriction	21	50%	2	40%	12	60%	3	43%	4	40%
≤ €10,000	16	38%	0	0%	10	50%	3	43%	3	30%
€10,001 to €20,000	2	5%	1	20%	0	0%	0	0%	1	10%
> €20,000	3	7%	1	20%	2	10%	0	0%	0	0%
Criteria for Discarding Data: Date	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
No Restriction	22	52%	3	60%	12	60%	1	14%	6	60%
Restriction	20	48%	2	40%	8	40%	6	86%	4	40%
Criteria for Discarding Data: Other	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
No Restriction	16	38%	3	60%	5	25%	0	0%	8	80%
Restriction	26	62%	2	40%	15	75%	7	100%	2	20%

* Other selections written in include *Boundary events* (10 banks), *Not used directly for modelling* (4 banks), *Certain subsidiaries* (4 banks), and *Other* (9 banks).

Supervisory Observations

Ideally, internal loss collection thresholds are based on statistical evidence showing that losses below the threshold have an immaterial impact on capital calculations. Threshold decisions may also take into account the cost/benefits of collecting data below a certain level, as well as considering the benefits of collecting the data for risk management purpose. In any case, banks should be aware of the impact of their thresholds on capital.

The range of practice on restricting the use of internal loss data for modelling purposes is broad and not uniform across jurisdictions. Use of differing assumptions and criteria for internal loss data may result in differences in capital calculations. Further, where appropriate statistical techniques may exist to estimate the loss information below the threshold, establishing excessive thresholds could render this statistical exercise unreliable or meaningless. The SIGOR will do further work to determine if the differences in how internal loss data is used/restricted in AMA capital models are significant.

(v) Mapping of internal loss data to 8x7 matrix

Internal operational risk loss data can be broadly categorised along two dimensions, business line and event type. The Basel II business line and event type categories form an 8x7 matrix into which a bank can map its internal losses.

Basel text

"To assist in supervisory validation, a bank must be able to map its historical internal loss data into the relevant level 1 supervisory categories defined in Annexes 8 and 9 and to provide these data to supervisors upon request. It must have documented, objective criteria for allocating losses to the specified business lines and event types. However, it is left to the bank to decide the extent to which it applies these categorisations in its internal operational risk measurement system." (paragraph 673, bullet 1)

Issues/background

There is no requirement for banks to map their internal loss data into the standard 8x7 matrix on an ongoing basis for internal use. But banks must 'be able to' map their internal loss data to the 8X7 matrix for supervisors, when requested. There remains some question regarding the degree of standardisation that should be expected.

2006 Observed Range of Practice

Banks' approaches to classifying their internal loss data vary from country to country, in part reflecting the differences of view within the supervisory community. Some banks have developed their own matrix for classifying operational risk losses, whereas others use the standard 8x7 matrix from Basel II. The in-house matrix developed by some banks often uses a business line breakdown based on a client rather than product dimension. Some banks have developed an in-house matrix based on causes rather than events.

2008 Range of Practice Results (Tables 13A, 13B)

The 2008 Loss Data Collection Exercise asked banks to provide loss data consistent with the Basel business line definitions. For the AMA banks using other business line categories, they were asked to provide a mapping of their business lines to the Basel categories. The SIGOR encountered few problems in mapping non-Basel business line definitions to the Basel categories. A summary of loss frequency using the 8x7 matrix follows, and is also included in the Loss Data Collection Exercise paper.

ROP Table 13A

Sum of Annualised Frequencies by Business Line and Event Type.

AMA Approach

Sum of Annualised Frequencies	Internal Fraud	External Fraud	Employment Practices and Workplace Safety	Clients, Products, and Business Practices	Damage to Physical Assets	Business Disruption and System Failures	Execution, Delivery, and Process Management	All
Corporate Finance	3	9	18	78	2	2	53	164
Trading & Sales	24	6	77	363	10	133	2,079	2,693
Retail Banking	723	4,602	930	1,510	165	222	2,588	10,739
Commercial Banking	51	484	70	396	23	53	966	2,043
Payment & Settlement	11	137	22	40	21	26	298	555
Agency Services	3	6	9	29	6	24	642	719
Asset Management	9	8	25	70	2	16	368	498
Retail Brokerage	76	27	119	1,990	1	9	490	2,713
Unallocated	45	82	384	56	38	13	204	822
All	946	5,361	1,654	4,531	269	498	7,687	20,946

Losses of € 20,000 or more; years of stable data capturing. See LDCE paper for additional information.

Supervisory Observations

Irrespective of a bank's approach to classifying its internal loss data, all banks must be able to map their internal loss data to the standard 8x7 matrix. Based on the results of the 2008 LDCE, AMA banks were able to provide sufficient information to SIGOR, to allow mapping of their internal loss data to the Basel 8 x 7 matrix.

ROP Table 13B

Distribution of Annualised Frequencies by Business Line and Event Type.

AMA Approach

Distribution across Event Type	Internal Fraud	External Fraud	Employ-ment Practices and Work-place Safety	Clients, Products, and Business Practices	Damage to Physical Assets	Business Disrup-tion and System Failures	Execu-tion, Delivery, and Process Manage-ment	All
Corporate Finance	2%	5%	11%	47%	1%	1%	32%	100%
Trading & Sales	1%	0%	3%	13%	0%	5%	77%	100%
Retail Banking	7%	43%	9%	14%	2%	2%	24%	100%
Commercial Banking	2%	24%	3%	19%	1%	3%	47%	100%
Payment & Settlement	2%	25%	4%	7%	4%	5%	54%	100%
Agency Services	0%	1%	1%	4%	1%	3%	89%	100%
Asset Management	2%	2%	5%	14%	0%	3%	74%	100%
Retail Brokerage	3%	1%	4%	73%	0%	0%	18%	100%
Unallocated	5%	10%	47%	7%	5%	2%	25%	100%
All	5%	26%	8%	22%	1%	2%	37%	100%

Losses of € 20,000 or more; years of stable data capturing. See LDCE paper for additional information.

(vi) Validation of internal loss data

The validation of internal loss data refers to the steps banks take to assess the comprehensiveness and overall integrity of their internal loss data and the integrity of the data collection process.

Basel text

"Internal and/or external auditors must perform regular reviews of the operational risk management processes and measurement systems. This review must include both the activities of the business units and of the independent operational risk management function." (paragraph 666(e))

"Banks must track internal loss data according to the criteria set out in this section. The tracking of internal loss event data is an essential prerequisite to the development and functioning of a credible operational risk management system. Internal loss data is crucial for tying a bank's risk estimates to its actual loss experience …." (paragraph 670)

"Internal loss data is most relevant when it is clearly linked to a bank's current business activities, technological processes and risk management procedures. Therefore, a bank must have documented procedures for assessing the ongoing relevance of historical loss data, including those situations in which judgement overrides, scaling, or other adjustments may be used, to what extent they may be used and who is authorised to make such decisions." (paragraph 671)

"Internally generated operational risk measures used for regulatory capital purposes must be based on a minimum five-year observation period of internal loss data, whether the internal loss data is used directly to build the loss measure or to validate it. When the bank first moves to the AMA, a three-year historical data window is acceptable (this includes the parallel calculations in paragraph 46)." (paragraph 672)

"A bank's internal loss data must be comprehensive in that it captures all material activities and exposures from all appropriate sub-systems and geographic locations. A bank must be able to justify that any excluded activities or exposures, both individually and in combination, would not have a material impact on the overall risk estimates ..."(paragraph 673, second bullet)

Issues/background

Validation entails a review and assessment of both the process for collecting data and the contents of the internal loss database. It encompasses both data integrity and data comprehensiveness, and involves issues such as missing or incomplete data, and how a bank treats data from abandoned or new lines of business.

2006 Observed Range of Practice

The practices used by banks as a means of assessing the comprehensiveness and integrity of their internal loss data inlcude:

- reconciliation to the general ledger;
- reviews by the risk control function, including consistency checks across various internal reports (eg loss reports, control self-assessments);
- reviews by internal and external audit;
- examinations of inconsistencies in loss data across entities or business lines within the bank;
- features embedded in the loss data collection system such as pop-up user guides and decision trees;
- use of a centralised function to input internal loss data into the data repository, and;
- exception reports that are circulated to the relevant business lines and vetted by the risk control function.

When banks judge their internal loss data to be insufficient for risk measurement purposes, most supplement it with external data or scenario analysis, although both approaches introduce the need for additional validation work.

Bank practice also varies when it comes to dealing with internal loss data from abandoned lines of business. Some maintain a history of the data from abandoned lines of business in their internal loss databases for future reference, as necessary. Some banks exclude the data when they are able to conclude that there is no possibility of new losses arising from the abandoned line of business.

2008 Range of Practice Results (Table 2A)

The integrity of internal loss data is maintained through a number of processes. Almost all banks either review internal loss data by a risk control function (95%) or by internal/external audit (93%). Over half of AMA banks (62%) compare internal loss data with other data elements. Other less frequently used challenge functions include the review of internal loss data by employees who have operational risk experience or expertise (43%) or review by business peers (24%).

Regional practices differ only slightly. All Australian banks review internal loss data by a risk control function or by internal/external audit, though fewer rely on comparisons with other data elements (40%) or review by staff experts (20%). North American and Australian AMA banks (40%) typically do not compare results with other data elements as frequently as other regions.

Supervisory Observations

The range of practice for maintaining the integrity of internal loss data is in broad alignment with the expectations of the SIGOR. Supervisors are expecting banks to have robust challenge functions that maintain the integrity of internal loss data. An effective observed practice is the independent review by both internal and external parities to ensure that the data is of sufficient quality to support the banks risk management and risk measurement processes.

V. Modelling / quantification issues

Definition / scope

The flexibility provided in the AMA reflects both the relative infancy of the operational risk discipline as well as the desire of the Basel Committee to explore how best to obtain risk-sensitive estimates of operational risk exposure. While the industry has made significant progress in modelling operational risk, the range of practice continues to be broad, with a diversity of modelling approaches being adopted within AMA banks. These differences in modelling approaches, whether reflected in different correlation estimates, distributional assumptions, or other critical features of the model, clearly affect the AMA methodology of individual banks and, ultimately, the amount of capital resulting from the application of the AMA.

Decisions made by the bank on the critical features of its AMA model should be supported by quantitative and qualitative analysis and appropriately reflect the operational risk profile of the bank. While flexibility allows modelling to reflect individual bank risk profiles, it also raises the possibility that banks with similar risk profiles could hold different levels of capital under the AMA, if they rely on substantially different modelling approaches and assumptions. Clearly, there exists a trade-off between convergence and flexibility. Convergence within and across jurisdictions will depend on how supervisors view and assess particular modelling approaches, as well as on how AMA banks implement supervisory requirements.

Scope

The focus of this section is on those topics that may have a significant impact on banks' modelled operational risk capital estimates. These topics include:

- the granularity of AMA models;
- correlation/dependence assumptions in AMA models;
- distributional assumptions underpinning a bank's modelling of operational risk severity and frequency;
- issues associated with the use and combination of the required elements of an AMA model;
- the use of insurance as a risk mitigant; and
- the treatment of expected loss.

While these topics are discussed separately for the sake of clarity, most are intertwined. For example, appropriate modelling of correlation within and across operational risk categories (or units of measure), is integrally tied to how internal loss data is assembled and the level of granularity used in estimating a bank's operational risk exposure. Some of these topics are also closely related to topics covered under the other sections of this report.

The findings reveal that the range of practice is wide and in some cases it is not aligned with supervisory expectations. This is understandable, given that not all of the AMA banks have been accredited or given formal approval of their AMA frameworks. In cases where supervisory approval has been granted at the first available implementation date, supervisors will expect banks to raise their standards progressively as the AMA framework matures.

Going forward, supervisors will work where possible, on refining the range of acceptable practice to achieve more consistency in how operational risk is modelled. In any case, given the inherent flexibility that is embedded in the AMA measurement framework and the

numerous operational risk measurement methodologies available to banks, it is essential that banks assess and validate the soundness of the capital measurement process and its results. Such processes and activities may include:

- **Internal validation (IV)** of model inputs, methodology and model outputs. The banks should validate their measurement system on an ongoing basis. The main purpose of the IV unit is to give a reasoned and updated opinion on whether models work as predicted and whether their results are suitable for their various internal or supervisory purposes.
- **Internal audit**. As part of its activities, internal audit should review the operational risk measurement process and systems. A question from the 2008 LDCE range of practice is whether this review can be delegated to external audit. In several jurisdictions, this review function is specifically assigned to internal audit.[26]
- **In-depth sensitivity analysis**. Each material model assumption should be accompanied by rigorous sensitivity analysis so that resulting variations in capital are clearly understood. This analysis is particularly important in those decisions and assumptions that have a high degree of subjectivity.
- **Uncertainty analysis** (evaluation of the accuracy of the operational risk capital figure). The capital figure should be supplemented with appropriate computed confidence bands that identify the potential variability of the point estimate.
- **Backtesting** the capital estimates. Now that AMA models have been in use for a period of time, it is important that AMA banks measure, in some fashion, how well the models have performed against actual loss experience.
- **Benchmarking.** Comparing capital estimates with other indicators of operational risk exposure (eg financial or operational risk management indicators).

Specific topics and corresponding practices

(i) Granularity

The granularity of an AMA reflects the degree to which the quantification approach separately models individual operational risk exposures. An Operational Risk Category (ORC) or unit of measure is the level (for example, organisational unit, operational loss event type, risk category, etc.) at which the bank's quantification model generates a separate distribution for estimating potential operational losses. This term identifies a category of operational risk that is homogeneous in terms of the risks covered and the data available to analyse those risks.

Basel text

"A bank's risk measurement system must be sufficiently 'granular' to capture the major drivers of operational risk affecting the shape of the tail of the loss estimates." (paragraph 669(c))

[26] In most European countries, the United States and Japan, internal audit reviews the implementation of a bank's AMA framework. In other countries (ie Australia), review of a bank's operational risk measurement processes and systems is performed through an independent audit review. The review may be done by internal or external staff.

Issues/background

There is considerable diversity across banks in the granularity used to measure bank-wide operational risk exposure. The least granular approach uses a single ORC (or unit of measure) for all of a bank's operational risk exposures. An advantage of this approach is that only a single distribution of operational risk losses is estimated, allowing operational risk loss data to be pooled. Pooling helps to address issues related to data paucity. However, this approach may not reflect the true nature of the underlying losses, as losses may arise from different operational risk sources and often are not independent.

More granular approaches estimate potential operational risk losses by business line and/or operational risk event type. These approaches provide an ability to capture differences in operational risk exposures across business lines or event types.

2006 Observed Range of Practice

The granularity of operational risk measurement approaches is wide, and varies from bank to bank. At one end of the spectrum are those banks that have developed one model to estimate the operational risk exposure across the entire organisation. At the other end are those that have implemented separate models for each of the business lines and loss event types over which operational risk is being modelled. In between, there are banks that have adopted separate models for either different business lines or different operational loss event types. Irrespective of whether one model or a set of models is used to measure operational risk exposure, most banks have not yet undertaken sufficient analysis (statistical or other) to support their choice of granularity, or the assumptions underlying that choice. Instead banks tend to justify the choice of approach only on the basis of data availability.

2008 Range of Practice Results (Tables 14A, 14B)

Nearly three-fourths of reporting banks have 100 or fewer ORCs, with nearly half having 20 or fewer. Only one AMA bank uses a single ORC in their AMA model. A significant number of AMA banks (9%) have over 1,000 ORCs. (Table 14A)

Europe has the widest distribution of the number of ORCs used in AMA models, with a third of European banks using between 21 and 101 and another third using below 21 and above 500 ORCs, respectively. Japan has the narrowest distribution, with all of its reporting banks using 100 or fewer ORCs. Over half (57%) of Japanese banks use 9 or fewer ORCs. For banks using over 1000 ORCs, 3 are European and 1 Australian.

A vast majority (90%) of AMA banks use ORCs based on event type or business line designations. Just over 40% of AMA banks use a combination of event and business lines to define their ORCs, 29% use only event type and 21% use only business line designations. Among the "other criteria" used to designate ORCs, the most common is legal entity. Use of ORCs within regions is similar. (Table 14B)

ROP Table 14A

Number of Operational Risk Categories used in the AMA Model: Number of ORC used for Modelling

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
1	1	2%	0	0%	0	0%	0	0%	1	10%
2-9	10	24%	1	20%	3	15%	4	57%	2	20%
10-20	8	19%	2	40%	3	15%	0	0%	3	30%
21-100	12	29%	1	20%	6	30%	3	43%	2	20%
101-200	4	10%	0	0%	2	10%	0	0%	2	20%
201-500	2	5%	0	0%	2	10%	0	0%	0	0%
501-1000	0	0%	0	0%	0	0%	0	0%	0	0%
1001-2000	1	2%	0	0%	1	5%	0	0%	0	0%
2001-3000	1	2%	1	20%	0	0%	0	0%	0	0%
>3000	2	5%	0	0%	2	10%	0	0%	0	0%

Note: One AMA bank has missing ORC values.
Note: Banks were able to select more than one answer per question.

ROP Table 14B

Number of Operational Risk Categories used in the AMA Model: Number of ORC by Business Line, Event Type, or Other

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
ET	12	29%	2	40%	5	25%	2	29%	3	30%
BL	9	21%	1	20%	2	10%	1	14%	5	50%
ET/BL	17	40%	2	40%	7	35%	1	14%	7	70%

Notes 1 AMA bank has missing ORC values. Banks were able to select more than one answer per question.
* Other selections written in include *ET/Other* (5 banks). *BL/Other* (2 banks*), ET/BL/Other* (2 banks), and *Other* (8 banks).

Supervisory Observations

Basel II does not specify the degree of granularity required in modelling operational risk exposures, instead requiring that the risk measurement system be 'sufficiently granular' to capture the major drivers of operational risk affecting the operational risk capital outcome.

Generally speaking, as operational risk tends to be characterised by different sources, events and effects, granularity could be the tool by which banks recognise such differences in the model. Individual units of measure should be characterised by high levels of homogeneity, with loss events in a given unit of measure distributed fairly identically.

Banks should demonstrate that their choice of granularity takes into account use test considerations, and the nature and complexity of business activities and operational losses to which it is exposed. They should seek to identify ORCs within which losses are independent and identically distributed. This choice of granularity should be adequately supported by quantitative[27] and qualitative[28] analysis. Moreover, the sensitivity of the estimation of total annual loss to other risk class segmentations should also be tested. Supervisors expect banks to undertake further statistical or other analysis to support their choice of granularity and the assumptions that choice of granularity implies, and not justify their choice only on the basis of data availability.

As observed in the 2008 LDCE, there is a considerable range of practice in the level of granularity that banks use in their AMA models. A very high or very low granularity may raise supervisory concerns.

Models with a low granularity may not capture the real sources of operational risk and, therefore, the operational risk profile of the bank. These models imply that all the business lines and units of the bank are affected by operational risk in a similar way - an unrealistic assumption. Additionally, low granularity tends to generate lower operational risk capital outcomes because of an implicit assumption of zero correlation[29]. Therefore, banks that use models with low granularity and assume implicit zero correlations should demonstrate their right choice of granularity.

The findings in the 2008 LDCE reveal that some banks, although very few, use a very large number of units of measure. AMA banks that use models with extremely high granularity face potential challenges in terms of adequately categorising sources of their operational risk. Also, high granularity may pose other modelling challenges when summing up the operational risk exposure estimates in order to calculate the total bank operational risk capital. Further, it is unclear how AMA banks using large numbers of ORCs can provide the transparency necessary to provide insight into the diversification of the bank's operational risk and into the AMA capital quantification methodology.

Some other banks tend to justify their choice of granularity simply following the categorisation established by the regulatory matrix (ie business line or event type classes). Banks should test the relevance of their choice of classes in order to ensure the homogeneity of the

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[27] In-depth quantitative exploratory analysis of the losses (or the data that are input to each unit of measure) is necessary in order to understand the characteristics of the raw operational risk data.

[28] Banks should supplement the quantitative analysis of data in each unit of measure with a qualitative analysis of the similarities or differences of the ORCs.

[29] Banks with higher granularity that use explicit correlations have to demonstrate to its supervisor that "*its systems for determining correlations are sound, implemented with integrity, and take into account the uncertainty surrounding any such correlation estimates (Basel)*."

classes and verify that alternative categorisation schemes would not have been better suited to their risk profile and use test considerations. This should be supported, where possible, with statistical tests.

(ii) Correlation and dependence

Correlation is one measure of the dependency of potential operational risk losses across or within business lines and/or loss event types. The concept of correlation can be generalised to more complex dependency relationships (eg copulas) that recognise differences in dependencies across low- and high-severity operational risk events. Dependence structures could occur as a result of business cycles (ie economic difficulties that cause an increase in rogue trading and fraud), bank-specific factors (ie a new senior manager changes the control environment across a number of business lines) or cross-dependence of large events (eg flooding results in widespread looting and increases the number of fraudulent transactions).

Basel text

"Risk measures for different operational risk estimates must be added for purposes of calculating the regulatory minimum capital requirement. However, the bank may be permitted to use internally determined correlations in operational risk losses across individual operational risk estimates, provided it can demonstrate to the satisfaction of the national supervisor that its systems for determining correlations are sound, implemented with integrity, and take into account the uncertainty surrounding any such correlation estimates (particularly in periods of stress). The bank must validate its correlation assumptions using appropriate quantitative and qualitative techniques." (paragraph 669(d))

Issues/background

Modelling techniques usually assume independence of operational risk loss events within the same ORC. As such, banks using less granular approaches to operational risk modelling implicitly assume a correlation of zero between most of their operational risk losses. Given this assumption, when calculating consolidated operational risk capital, capital estimates for each ORC are simply added. Banks employing more granular modelling approaches may explicitly incorporate a dependence structure for operational risk losses incurred across those business lines and/or loss event types for which separate operational risk models are used.

A simple approach is to express dependence in terms of a measure of correlation that can range from 0 per cent, which suggests no linear relationship between events (ie independence, at least in the case of a joint normal distribution), and 100 percent, which implies simultaneous occurrence. In general, the higher the correlation that is assumed, the larger the operational risk capital outcome.[30] A more refined approach is to consider other dependence structures that assume correlation is different between tail and non-tail events, and within the tail.

2006 Observed Range of Practice

As is the case for granularity, the range of practice for incorporating dependence into operational risk modelling is broad. Generally, banks tend to be clustered in two groups: those that assume that operational risk loss events are independent, in terms of their

[30] This may not be true for extremely heavy-tailed distributions, such as those with infinite means.

frequency, severity or both, and those that assume a moderate degree of dependence. It is likely that the clustering in the first group is a consequence of the 'whole-of-bank' approach that many banks have adopted. This is not always the case, however, with some banks using a more granular modelling approach also making an assumption of independence between operational risk loss events. In many cases, the correlation measure is between business lines and/or loss event types rather than within these units of measure. A very small number of banks are considering incorporation of more complex dependence structures; however, this work is still very much in its infancy. To date, most banks have not stress tested their correlation assumptions and have yet to develop a defensible methodology to support the correlation assumptions that have been made.

2008 Range of Practice Results (Tables 15A. 15B, 15C)

The range of practice for incorporating dependence into operational risk modelling continues to be broad (*Table 15A*). Of the AMA banks surveyed, 29% do not model the dependencies or correlation estimates in their AMA. This percentage is higher in Australia (60%) and Japan (86%).

Expert judgement (40%) is the primary means used to estimate dependence, followed by internal loss data (36%) and external data (17%). European and North American banks use a combination of these sources. However, more North American banks use external loss data to estimate dependence (60%) than other regions (no banks use external loss in Australia and Japan, and only one bank in Europe).

ROP Table 15A

Dependency/Correlation Range of Practice

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	**42**		**5**		**20**		**7**		**10**	
Banks use the following to estimate dependence:	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Internal loss data	15	36%	1	20%	7	35%	1	14%	6	60%
External loss data	7	17%	0	0%	1	5%	0	0%	6	60%
Scenario data	4	10%	0	0%	3	15%	0	0%	1	10%
Expert judgment	17	40%	2	40%	9	45%	0	0%	6	60%
Other	10	24%	0	0%	8	40%	0	0%	2	20%
Dependence not modelled or estimated	12	29%	3	60%	2	10%	6	86%	1	10%

Note: Banks were able to select more than one answer per question.

Correlations are introduced into the modelling process (*Table 15B*) mainly by use of copulas (43%), with Gaussian copulas the most frequently used (36%). Less than a fifth of AMA banks (17%) use a correlation matrix to model dependence. A significant number of banks (31%) use methods other than a copula or correlation matrix. This broad range of practice generally is also seen at the regional level, though 40% of reporting banks in Australia and

Europe use a method other than a copula or correlation matrix. The percentage is lower in Japan and North America (14% and 20%, respectively). Most of respondents that use dependencies/correlation estimates use the dependence as an input in the model through aggregate losses (*Table 15C)*.

ROP Table 15B

Dependency/Correlation Range of Practice

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	**42**		**5**		**20**		**7**		**10**	
Correlations are introduced into the modelling process by:	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Copula*	18	43%	2	40%	10	50%	0	0%	6	60%
Gaussian copula	15	36%	2	40%	8	40%	0	0%	5	50%
t-copula	4	10%	0	0%	2	10%	0	0%	2	20%
Zero copula	1	2%	1	20%	0	0%	0	0%	0	0%
Correlation Matrix	7	17%	1	20%	4	20%	0	0%	2	20%
Other	13	31%	2	40%	8	40%	1	14%	2	20%

* Some banks use more than one copula, therefore the percentages are not mutually exclusive.
Note: Banks were able to select more than one answer per question.

ROP Table 15C

Dependency/Correlation Range of Practice

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	**42**		**5**		**20**		**7**		**10**	
Banks source and use dependency in modelling through:	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Frequency	9	21%	1	20%	7	35%	1	14%	0	0%
Severity	5	12%	0	0%	3	15%	0	0%	2	20%
Aggregate losses	14	33%	1	20%	6	30%	0	0%	7	70%
Other	6	14%	0	0%	6	30%	0	0%	0	0%

Note: Banks were able to select more than one answer per question.

Supervisory Observations

Granularity and dependence issues are closely related. Each operational risk estimate for each operational risk category should be built on a set of data that are, to the maximum extent possible, independent. In this context, the term correlation refers to the relationship between actual or constructed data belonging to different ORCs. The term correlation should be interpreted broadly to mean any type of dependence. Because much of a bank's estimated operational risk capital is generated through the tail of the distribution, the issue of dependency between large loss events is particularly relevant.

More granular models may use explicit dependence assumptions when aggregating statistical distributions across ORCs. By contrast, less granular models usually assume independence within each ORC. This kind of implicit dependence assumption (or in this case implicit independence assumption) is assessed by supervisors when assessing the bank's choice of granularity.

Banks that do not use explicit correlations in their models (and therefore do not have an approved model incorporating correlation) have to calculate their operational risk capital requirement as the sum of the individual operational risk measures arising from the different operational risk categories.

When calculating correlation assumptions, banks should take into account the scarcity of data.[31] The soundness of dependency assumptions should be demonstrated by qualitative and quantitative techniques. Qualitative techniques should add useful information and an economic explanation to the quantitative calculation.

When calculating correlated capital, banks should consider the uncertainties surrounding dependence modelling in operational risk. For example, although Gaussian copulas seem to be broadly used, they may not be the best choice for modelling operational risk, given they have no tail dependence and therefore may underestimate the probability of joint extreme events.

Finally, the use of explicit correlation may lead, in certain circumstances, to a lower capital number than the sum of capital measures calculated separately for each ORC. Further, the 2006 *Observed Range of Practice* report notes that "… where the loss distribution functions by business lines and/or loss event types are heavy-tailed, it is possible to consider dependence structures for which the operational risk capital outcome exceeds the sum of capital measures calculated separately for each business line and/or loss event."[32]

(iii) Modelling technique – distributional assumptions and estimation

Distributional assumptions underpin most, if not all, operational risk modelling approaches and are generally made for both operational risk loss severity and the frequency of operational risk loss events. One of the considerations in a bank's choice of distributions is the existence and size of the threshold above which data are captured and modelled.

[31] Basel II requires banks to take into account the uncertainty surrounding correlations, particularly during periods of stress.

[32] See footnote 8 of the 2006 Observed Range of Practice report.

Basel text

"Given the continuing evolution of analytical approaches for operational risk, the Committee is not specifying the approach or distributional assumptions used to generate the operational risk measure for regulatory capital purposes. However, a bank must be able to demonstrate that its approach captures potentially severe 'tail' loss events. Whatever approach is used, a bank must demonstrate that its operational risk measure meets a soundness standard comparable to that of the internal ratings-based approach for credit risk (ie comparable to a one year holding period and a 99.9th percentile confidence interval)." (paragraph 667)

"… A bank must have an appropriate de minimis gross loss threshold for internal loss data collection, for example €10,000. The appropriate threshold may vary somewhat between banks and within a bank across business lines and/or event types …." (paragraph 673, second bullet)

Issues/background

Modelling of operational risk exposures is still relatively new and a common view of appropriate severity distributional assumptions is yet to emerge. The severity of operational risk loss data tends to be heavy-tailed and methodologies for modelling operational risk must be able to capture this attribute. However, a bank's choice of distribution will have a significant impact on operational risk capital, as will the statistical method used for fitting that distribution. Similarly, a bank's choice of data threshold may significantly impact the appropriateness of the chosen distributions and/or its estimation method, and consequently the bank's operational risk capital.

2006 Observed Range of Practice

The basis of all banks' operational risk models is a distribution of operational risk losses. However, there exists significant divergence in the processes for generating that distribution. The distributional assumptions made, the modelling techniques used and the data elements on which the distribution is based are all key sources of variation in approach.

The range of distributions assumed for modelling the severity of operational risk losses is diverse, with some of the more granular modelling approaches assuming more than one distributional form aligned to the characteristics of a particular business line or loss type. Distributions used include the generalised Pareto distributions of extreme value theory, empirical distributions, lognormal distributions, heavy-tailed distributions and light-tailed distributions.

There is much less diversity across banks in the range of distributions assumed in estimating the frequency of operational risk losses. The most commonly used distribution for frequency is the Poisson distribution. A much smaller number of banks assume a negative binomial distribution.

With respect to thresholds for loss data collection, some banks decide not to establish a collection threshold and instead aim to collect the full range of operational risk losses for modelling purposes. Other banks define a threshold above which they aim to collect all losses, along with information about those losses (eg business line and causal type), but below which they collect limited or no data (limited data could mean, for example, that loss amounts are collected without any descriptive information about individual losses). Some banks that collect limited or no data below a threshold use statistical techniques designed for situations involving truncated data to estimate their model despite the limited availability or absence of data below the threshold.

2008 Range of Practice Results

(a) Distributions (Tables 16A, 16B, 16C, 16D)

The vast majority of banks model the severity and frequency distributions separately.

For estimating severity distributions, there appears to be a wide range of practice. AMA banks use more than one approach to estimate severity of the body, tail and entire distribution. Only 31% of AMA banks apply a single distribution model to all data, with the lognormal (33%) and Weibull (17%) most widely used. Nearly 30% of AMA banks use two distributions (for body and tail). In these cases, lognormal (19%) and empirical (26%) are the leading approaches for estimating the body, and lognormal (14%) and generalised Pareto (31%) are the most frequently used to estimate the tail. (Tables 16A, 16B, 16C)

ROP Table 16A

Approach Adopted by Banks for Estimating Severity Distribution

Number and percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Applying one single distribution model for all the data	13	31%	3	60%	4	20%	3	43%	3	30%
Applying one single model based on two separate distribution models for the body and tail	12	29%	0	0%	8	40%	3	43%	1	10%
Applying two separate distribution models for high frequency/low severity and low frequency/high severity losses	8	19%	2	40%	2	10%	0	0%	4	40%
Other	9	21%	0	0%	6	30%	1	14%	2	20%

ROP Table 16B

Severity Distributions Used: Separate Distributions Applied to the Body and Tail

Number and percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA banks	42		5		20		7		10	
Used for the Body	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Lognormal	8	19%	0	0%	5	25%	2	29%	1	10%
Gamma	2	5%	0	0%	2	10%	0	0%	0	0%
Generalised Pareto	1	2%	0	0%	0	0%	0	0%	1	10%
Weibull	4	10%	0	0%	3	15%	0	0%	1	10%
g and h	0	0%	0	0%	0	0%	0	0%	0	0%
Generalised beta	3	7%	0	0%	3	15%	0	0%	0	0%
Mixture of Lognormal-Gamma	0	0%	0	0%	0	0%	0	0%	0	0%
Mixture of Lognormal	0	0%	0	0%	0	0%	0	0%	0	0%
Empirical distribution	11	26%	1	20%	6	30%	1	14%	3	30%
Others	1	2%	0	0%	1	5%	0	0%	0	0%
Used for the Tail	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Lognormal	6	14%	0	0%	3	15%	1	14%	2	20%
Gamma	3	7%	0	0%	3	15%	0	0%	0	0%
Generalised Pareto	13	31%	1	20%	8	40%	3	43%	1	10%
Weibull	3	7%	0	0%	2	10%	0	0%	1	10%
g and h	0	0%	0	0%	0	0%	0	0%	0	0%
Generalised beta	0	0%	0	0%	0	0%	0	0%	0	0%
Mixture of Lognormal-Gamma	0	0%	0	0%	0	0%	0	0%	0	0%
Mixture of Lognormal	1	2%	0	0%	1	5%	0	0%	0	0%
Empirical distribution	1	2%	0	0%	0	0%	0	0%	1	10%
Others	7	17%	0	0%	4	20%	0	0%	3	30%

Note: Banks were able to select more than one answer per question regarding the type of frequency and severity distributions used.

ROP Table 16C

Severity Distributions Applied to the Entire Distribution

Number and percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA banks	42		5		20		7		10	
Lognormal	14	33%	2	40%	8	40%	1	14%	3	30%
Gamma	3	7%	1	20%	2	10%	0	0%	0	0%
Generalised Pareto	2	5%	1	20%	0	0%	0	0%	1	10%
Weibull	7	17%	2	40%	4	20%	0	0%	1	10%
g and h	1	2%	0	0%	0	0%	0	0%	1	10%
Generalised beta	0	0%	0	0%	0	0%	0	0%	0	0%
Mixture of Lognormal-Gamma	2	5%	0	0%	1	5%	0	0%	1	10%
Mixture of Lognormal	3	7%	1	20%	1	5%	0	0%	1	10%
Empirical distribution	6	14%	1	20%	4	20%	1	14%	0	0%
Others	6	14%	1	20%	3	15%	1	14%	1	10%

Note: Banks were able to select more than one answer per question regarding the type of frequency and severity distributions used.

ROP Table 16D

Frequency Distributions Applied to the Entire Distribution

Number and percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA banks	42		5		20		7		10	
Poisson	39	93%	4	80%	18	90%	7	100%	10	100%
Negative Binomial	8	19%	2	40%	4	20%	2	29%	0	0%
Others	3	7%	1	20%	2	10%	0	0%	0	0%

Note: Banks were able to select more than one answer per question regarding the type of frequency and severity distributions used.

There is a greater convergence in approach for frequency estimation. Overall, the Poisson distribution is by far the most widely used (93%), followed by the negative binomial distribution (19%). This result is similar in all regions except in North America, where all banks report using the Poisson distribution. (Table 16D)

Supervisory Observations

As with granularity and dependence, the choice of modelling techniques can have a significant impact on measured operational risk capital levels.

The basis of all operational risk models is a distribution of operational risk losses,[33] with most banks modelling the severity and frequency distributions separately. These approaches tend to assume that operational risk losses are identically distributed, or in other words, that potential operational risk losses are generated from the same statistical distribution. These approaches also assume that operational risk losses are independent. Banks should analyse the extent to which their data fulfil these underlying assumptions in order to understand the "model risk" being assumed, especially at high percentiles. Conservatism in establishing assumptions should be added when necessary.

The results of the 2008 LDCE mirror those of 2006. There is convergence in the range of distributions assumed to estimate the frequency of operational risk losses. The most commonly used distribution for frequency is the Poisson distribution, followed by the negative binomial. The range of practice in estimating frequency distributions is broadly aligned with supervisory expectations.

Given that some distributional assumptions are idiosyncratic to particular business lines or types of banks, there are a variety of approaches for estimating severity currently being used. Consequently, broad convergence regarding the types of distributions used for modelling operational risk severity may not be achievable or desirable. Nevertheless, it is possible to identify principles for determining whether the chosen distributional assumptions are inconsistent with the underlying data. As such, banks should be able to demonstrate the validity of their assumptions in the context of their business activities and choice of model.

The process of selecting the probability distribution must be well-documented and validated. When choosing a probability distribution, banks should take into consideration the following:

- Exploratory analysis of each ORC that enables better understanding of each data set and may be helpful in selecting the most appropriate distribution.
- Appropriate techniques for the estimation of the distributional parameters.
- Appropriate tools for evaluating the quality of the fit of the distributions to the data, giving preference to the ones that are more sensitive to the tail, considering the asymmetric nature of OR.

Other appropriate and sound methods when the previous techniques do not lead to a clear choice.

Some banks apply different distributions for the body and tail. This is because operational risk losses driven by high-frequency/low-severity events (the body of the data) are usually different in nature and statistical behavior from those driven by low-frequency/high-severity

[33] The term losses in this section refers not only to internal loss data but also to constructed data, which may include scenarios and external data.

events (the tail of the data). In these cases, banks should carefully consider the choice of the modelling threshold, as it usually has a significant impact on measured operational risk capital. Banks also should employ sound methods to connect body and tail.

Some banks have made a unique choice of a severity distribution to cover all ORCs. This has the advantage of being simple and easily understood. However, when this approach doesn't fulfill the above mentioned principles, supervisors would expect banks to develop more risk sensitive approaches that over time will better align with the operational risk profile of each bank. More specifically, when the empirical distribution, is chosen to model all ORCs, banks are expected to demonstrate that their modeling approach does not underestimate the probability of tail events.

In general, an over-arching principle when choosing distributions should be the internal consistency of the model. In addition to a good fit, Dutta and Perry (2007) have proposed other criteria which are useful in assessing the suitability of a model to describe the distribution of losses. Their criteria as follows:

- Realistic - If a method fits well in a statistical sense, does it generate a loss distribution with a realistic capital estimate?
- Well specified - Are the characteristics of the fitted data similar to the loss data and logically consistent?
- Flexible - How well is the method able to reasonably accommodate a wide variety of empirical loss data?
- Simple - Is the method easy to apply in practice, and is it easy to generate random numbers for the purposes of loss simulation?[34]

(iv) Use and Combination of elements

- ***Combination of the four elements***

One of the major distinguishing features of operational risk models is how the models combine internal loss data, external data, scenario analysis and business environment and internal control factors (BEICFs).

Basel text

"Any operational risk measurement system must have certain key features to meet the supervisory soundness standard set out in this section. These elements must include the use of internal loss data, relevant external data, scenario analysis and factors reflecting the business environment and internal control systems." (paragraph 669(e))

"A bank needs to have a credible, transparent, well-documented and verifiable approach for weighting these fundamental elements in its overall operational risk measurement system. For example, there may be cases where estimates of the 99.9th percentile confidence interval based primarily on internal and external loss event data would be unreliable for business lines with a heavy-tailed loss distribution and a small number of observed losses. In such cases, scenario analysis, and business environment and control factors, may play a more dominant role in the risk measurement system. Conversely, operational risk loss event data may play a more dominant role in the risk measurement system for business lines where

[34] *A Tale of Tails: An Empirical Analysis of Loss Distribution Models for Estimating Operational Risk Capital*, Kabir Dutta and Jason Perry, 2007, Federal Reserve Bank of Boston Working Paper No 06-13.

estimates of the 99.9th percentile confidence interval based primarily on such data are deemed reliable. In all cases, the bank's approach for weighting the four fundamental elements should be internally consistent and avoid the double counting of qualitative assessments or risk mitigants already recognised in other elements of the framework." (paragraph 669(f))

Issues/background

Under the AMA, internal loss data, relevant external loss data, scenario analysis and BEICFs must be incorporated into a bank's operational risk measurement system. Banks have flexibility in the specific methods used for incorporating the elements. Consistent with the flexibility of the AMA, a bank may place different emphasis on each AMA element in order to more closely reflect its specific loss history and risk profile.

However, the different emphasis on individual elements can complicate comparisons across banks. The elements must be combined in a way that allows the bank to meet the supervisory standards and ensure that the computation of operational risk capital reflects its risk profile. Banks need to demonstrate that their chosen approach for weighting the elements is credible, transparent, well-documented and verifiable.

2006 Observed Range of Practice

The combination and weighting of individual elements varies widely across banks. Some banks base their operational risk capital estimate largely – or even solely – on scenario analysis, and incorporate internal and external data only indirectly as inputs to the scenario elicitation process. Other banks rely heavily on internal loss data, using external data and scenario analysis only where there are gaps in their own loss experience. Others use internal loss data to model the frequency of operational risk losses and external data to model loss severity, especially in the tail. Most banks, however, incorporate more than one element directly in their AMA model, and some incorporate all four, albeit with varying weights.

No bank uses BEICFs as the primary determinant of its operational risk calculation. As noted above, banks have tended to focus much less on BEICFs than on the collection of historical data or development of scenarios. As a consequence, incorporation of BEICFS into the risk measurement model is still very much in its formative stages. Use of BEICFs tends towards the area of capital allocation rather than as a direct statistical input or adjustment within the operational risk modelling approach.

Many banks have not established how to avoid double counting the effects of data elements when the modelling approach combines elements.

2008 Range of Practice Results

(a) Operational risk capital contribution (Table 17A, 17B)

For many AMA banks, scenario analysis is the most significant direct[35] contributor of the four data elements to their operational risk capital. Scenarios have a median contribution toward

[35] *Direct effects* are inputs that directly inform the computational methodology (ie using external loss data as data points in the model used to quantify operational risk capital). When the element is not used directly to inform the capital calculation (ie using external data just to inform scenarios), a zero weight has been assigned.

capital of 55%, followed by external data (37%), internal loss data (31%) and BEICFs (11%).[36]

ROP Table 17A

Elements with Direct Effect to Operational Risk Capital

Number of Banks by Region
Percentage Contribution to Capital: Cross-Bank Medians and Interquartile Ranges

	All Participating AMA Banks	Australia	Europe	Japan	North America
Number of AMA banks	42	5	20	7	10
Internal Loss Data					
# of Banks Using ILD in their Calculation	32	4	12	7	9
% Contribution to Capital					
Median	31	16	36	15	50
25th Percentile	15	8	13	15	30
75th Percentile	50	36	46	16	83
External Loss Data					
# of Banks Using ELD in their Calculation	17	3	9	0	5
% Contribution to Capital					
Median	37	27	38	.	37
25th Percentile	25	25	25	.	25
75th Percentile	45	45	48	.	40

Notes: Missing values are shown when there are not enough observations to compute quartiles.
Excludes six AMA banks with no values for any direct effect to Operational Risk Capital elements, and 2 banks that did not include data regarding the direct effect of internal loss data.
For banks that provided estimated direct effect ranges, the mean was used as the corresponding direct effect percentage.

Missing direct effect elements were set to zero, if any direct effect values were provided by a bank.
Zero values are excluded from the calculation of quartiles.

There is some variation in the range of practice across regions. In North America, internal loss data has the largest direct effect on operational risk capital in AMA banks. Scenario analysis is the majority contributor to AMA capital in Japan (84%), Europe (64%), and Australia (50%). Direct use of BEICFs in AMA models is concentrated in Europe and North America.

[36] Results from the 2008 LDCE were reported as cross bank medians. The inter-quartile range, which describes the range of values containing half the banks, was also provided to give an indication of the variability of the data.

ROP Table 17B

Elements with Direct Effect to Operational Risk Capital

Number of Banks by Region
Percentage Contribution to Capital: Cross-Bank Medians and Interquartile Ranges

	All Participating AMA Banks	Australia	Europe	Japan	North America
Number of AMA banks	42	5	20	7	10
Scenario Analysis					
# of Banks Using SA in their Calculation	31	5	15	5	6
% Contribution to Capital					
Median	55	50	64	84	33
25th Percentile	33	40	33	75	15
75th Percentile	84	93	75	85	38
BEICFs					
# of Banks using BEICFs in their Calculation	10	1	4	1	4
% Contribution to Capital					
Median	11	.	19	.	8
25th Percentile	5	.	11	.	5
75th Percentile	18	.	60	.	11

Notes: Missing values are shown when there are not enough observations to compute quartiles.
Excludes six AMA banks with no values for any direct effect to Operational Risk Capital elements.

For banks that provided estimated direct effect ranges, the mean was used as the corresponding direct effect percentage.

Missing direct effect elements were set to zero, if any direct effect values were provided by a bank.
Zero values are excluded from the calculation of quartiles.

(b) Use of the elements (Tables 18A, 18B, 18C)

There is a broad range of practice in the approach AMA banks use to incorporate the four individual elements into their AMA frameworks. Internal loss data is primarily used (76%) as a direct input into AMA models of reporting banks (*Table 18A*). In Europe the use of internal loss data as a direct input into AMA models is somewhat less, at 60%. The primary uses of internal loss data are to estimate the frequency and severity parameters for the entire distribution and for high frequency/low severity events. We see broadly similar results at the regional level. Scenario and external data are used primarily for severity estimation of low frequency/high severity events (please see the following sections for additional information and *Table 18B, 18C*)

ROP Table 18A

Primary Uses for Data in the Operational Risk Capital Model: Internal Loss Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Use of Internal Loss Data	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
As direct input into model	32	76%	4	80%	12	60%	7	100%	9	90%
As severity for high frequency / low severity events	23	55%	2	40%	13	65%	2	29%	6	60%
As severity for low frequency / high severity events	10	24%	1	20%	7	35%	0	0%	2	20%
As severity for the entire distribution	18	43%	2	40%	7	35%	5	71%	4	40%
As frequency for the high frequency / low severity events	14	33%	2	40%	9	45%	1	14%	2	20%
As frequency for the low frequency/ high severity events	10	24%	2	40%	6	30%	0	0%	2	20%
As frequency for the entire distribution	24	57%	2	40%	9	45%	6	86%	7	70%

Note: Banks were able to select more than one answer per question.

BEICFs are very widely used as an indirect input into the quantification framework (69%), and as an ex-post adjustment to AMA capital (24%) (*Table 6*). The use of BEICFs has evolved since the first SIGOR review of the observed range of practice in 2006, where the findings suggested that the banks pursuing an AMA tended to focus much less on this element for quantification. Currently, nearly a third of AMA banks are now using BEICFs as part of the direct modelling process. The use of BEICFs is aligning closer with supervisory expectations as AMA frameworks mature. There are some differences in the use of BEICFs between regions; all Japanese and Australian banks use BEICFs as an indirect input into AMA models. North American banks (50%) typically use BEICFs for ex-post adjustments to AMA Capital allocated to business lines.

ROP Table 18B

Primary Uses for Data in the Operational Risk Capital Model: External Loss Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Use of External Loss Data	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
As severity for high frequency / low severity events	1	2%	0	0%	1	5%	0	0%	0	0%
As severity for low frequency / high severity events	19	45%	2	40%	11	55%	0	0%	6	60%
As severity for the entire distribution	4	10%	1	20%	1	5%	0	0%	2	20%
As frequency for the high frequency / low severity events	0	0%	0	0%	0	0%	0	0%	0	0%
As frequency for the low frequency/ high severity events	7	17%	1	20%	4	20%	0	0%	2	20%
As frequency for the entire distribution	2	5%	0	0%	2	10%	0	0%	0	0%

Note: Banks were able to select more than one answer per question.

Supervisory Observations

The use of all four data elements in AMA capital modelling is a significant issue for many banks. Given the multiple and broad range of possible combination techniques for the four elements in the AMA and taking into account the material impact they may have on operational risk capital, banks must understand the impact that every element has on capital. This evaluation can be done in several ways, including producing separate calculations with each data element or evaluating the effect of gradually introducing different elements. Such an evaluation provides banks and bank supervisors a better understanding of the actual impact on capital of each of the key elements of the AMA, and its role in the AMA measurement framework.

Scenarios and external data are used by most banks to supplement low frequency/high severity events information. It would be expected that the inclusion of these sources of data will provide for a higher capital charge than that calculated based only on internal loss data.

ROP Table 18C

Primary Uses for Data in the Operational Risk Capital Model: Scenario Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Use of Scenario Data	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
As severity for high frequency / low severity events	4	10%	0	0%	4	20%	0	0%	0	0%
As severity for low frequency / high severity events	27	64%	3	60%	15	75%	2	29%	7	70%
As severity for the entire distribution	12	29%	2	40%	5	25%	5	71%	0	0%
As frequency for the high frequency / low severity events	4	10%	0	0%	4	20%	0	0%	0	0%
As frequency for the low frequency/ high severity events	14	33%	1	20%	10	50%	1	14%	2	20%
As frequency for the entire distribution	11	26%	1	20%	5	25%	5	71%	0	0%

Note: Banks were able to select more than one answer per question.

Further, supervisors have noticed some banks have imposed a limit on the size of internal data, external data and/or scenarios used in the quantification of their banks' operational risk capital. As these practices significantly impact the amount of operational risk capital, banks should assess and document why the imposition of loss caps is acceptable for its AMA framework.

Given that the use of BEICFs is the least developed area of quantification, supervisors will continue their work to determine an acceptable range of practice for incorporating BEICFs into banks' AMA models.

- ***Use of scenarios in the measurement framework***

Scenario analysis is a process by which banks consider the impact of extreme, but nonetheless plausible events, on their operations. As such, it can provide a prospective method for capturing tail events that may not have occurred in the bank's loss history. Different scenarios can also provide a means of stress testing the capital model. Scenarios

can be tailored to the business environment of the bank and capture changes in a banks internal or external situation.

Basel text

"A bank must use scenario analysis of expert opinion in conjunction with external data to evaluate its exposure to high-severity events. This approach draws on the knowledge of experienced business managers and risk management experts to derive reasoned assessments of plausible severe losses. For instance, these expert assessments could be expressed as parameters of an assumed statistical loss distribution. In addition, scenario analysis should be used to assess the impact of deviations from the correlation assumptions embedded in the bank's operational risk measurement framework, in particular, to evaluate potential losses arising from multiple simultaneous operational risk loss events. Over time, such assessments need to be validated and re-assessed through comparison to actual loss experience to ensure their reasonableness." (paragraph 675)

Issues/background

Scenario analysis is an important component in the estimation of a bank's operational risk exposure. Scenario analysis can be helpful in modelling high-severity events. It also allows a bank to consider possible tail events taking into account their specific risk exposures and effectiveness of controls. Scenario analysis is also helpful because it offers a forward-looking perspective that is not available when using internal loss data alone.

The incorporation of scenario analysis in a bank's operational risk modelling framework can vary in many respects, including the rigour with which scenarios are developed, the comprehensiveness and number of scenarios used, the severity of losses reflected in the scenarios, the choice of distribution used to fit the scenarios, and the way scenarios are combined with other data elements. Each of these factors can have a significant impact on a bank's operational risk exposure estimate.

2006 Observed Range of Practice

Banks' use of scenario analysis in calculating operational risk exposure varies widely. Some banks do not use scenario analysis to generate direct inputs to their operational risk capital calculation, while others base their operational risk capital calculation primarily on scenario analysis.

2008 Observed Range of Practice (Table 19)

Results regarding incorporation of scenario data into the AMA framework are evenly distributed between separate calculations for scenarios and internal (external) data (29%) and supplementing internal loss data directly with individual scenario data points in the capital calculation (29%). Only 4 banks base their model solely on scenarios. Regionally, most Japanese banks (86%) use scenarios to generate data points used directly in the modelling process. North America banks do not typically use scenario analysis as simulated data (10%).

ROP Table 19

Incorporation of Elements into the AMA Framework - Scenario Analysis

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
ONLY for risk management purposes	18	43%	5	100%	3	15%	6	86%	4	40%
Separate capital calculations for scenarios and for internal loss data (external loss data if applicable)	12	29%	1	20%	7	35%	1	14%	3	30%
Individual scenario data points are directly used as a supplement to internal and external loss data points in the capital calculation	12	29%	1	20%	4	20%	6	86%	1	10%
Simulated data from a scenario-generated distribution are included as a supplement to internal and external loss data points in the capital calculation	8	19%	1	20%	5	25%	1	14%	1	10%
Applied scenarios only as qualitative adjustments to model outputs	0	0%	0	0%	0	0%	0	0%	0	0%
Model based only on scenarios	4	10%	1	20%	3	15%	0	0%	0	0%
Other	17	40%	1	20%	9	45%	0	0%	7	70%

Note: Banks were able to select more than one answer per question.

Scenario data is used primarily for severity estimation of low frequency/high severity events and not surprisingly to a lesser extent for frequency estimation for low frequency/high severity events. Broadly similar results are seen at the regional level. (*Table 18C)*

Supervisory Observations

Given that the use of scenario analysis for operational risk modelling is still developing, banks face a challenge in assessing and benchmarking individual scenarios. There are currently various ways to generate scenarios,[37] such as individual scenarios, scenarios based in intervals and scenarios based in percentiles. These different methods have different management and measurement implications. Nevertheless, banks should demonstrate that their scenarios can appropriately capture potentially severe 'tail' loss events.

Also, the range of practice for using scenarios in the risk measurement process appears to be particularly wide and, therefore, not easily comparable. Some of the methods that are currently used to incorporate scenarios include: individual "scenario" data points used in the capital calculation to supplement internal (and/or external) loss data, as an ex post adjustment to the capital estimate generated by the AMA model, more indirectly as a means of assessing the reasonableness of model outputs, and/or separate calculations for internal (external) data.

In any case, scenarios (and/or external data) would be expected to add to the base level of AMA capital, which would be calculated by using internal loss data only by capturing potential low frequency/high severity events which may have not occurred, but to which the bank is exposed.

- ***Use of external data in the measurement framework***

External loss data comprises operational risk losses experienced by third parties.[38] Banks can use information about external data losses to assess the relevance of a particular loss to their circumstances. External data can offset the paucity of internal operational risk loss data in areas where a bank has a potential risk, but has not experienced significant losses.

Basel text

"A bank's operational risk measurement system must use relevant external data (either public data and/or pooled industry data), especially when there is reason to believe that the bank is exposed to infrequent, yet potentially severe, losses. These external data should include data on actual loss amounts, information on the scale of business operations where the event occurred, information on the causes and circumstances of the loss events, or other information that would help in assessing the relevance of the loss event for other banks. A bank must have a systematic process for determining the situations for which external data must be used and the methodologies used to incorporate the data (eg scaling, qualitative adjustments or informing the development of improved scenario analysis). The conditions and practices for external data use must be regularly reviewed, documented, and subject to periodic independent review." (paragraph 674)

The March 2006 Basel Committee Newsletter No. 8, *Use of Vendor Products in the Basel II IRB Framework*, states that banks should develop and implement strategies designed to verify the accuracy and consistency of any external data used. Conceptually, this statement is also relevant in the context of the AMA, although the focus of an AMA bank is more likely to be on the relevance of any external data acquired from consortia or third-party vendors.

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[37] For more details, please see the 2008 LDCE report.

[38] It may be appropriate for one ORC to use data from another ORC within the bank if the losses are relevant and are appropriately filtered and scaled.

Issues/background

External data are another important component in the estimation of a bank's operational risk exposure and is available from various sources. External data must be assessed for its relevance and may need to be adjusted depending on how it is used in an operational risk measurement system. Similar to scenario analysis, it can be helpful in modelling high-severity events particularly in instances where internal loss data is limited. External data can also be used to offer a forward-looking perspective, as it contains events that may not have historically been experienced by a bank. However, external data alone is unlikely to cover the full scope of operational risk events to which a bank is exposed.

The way in which external data is incorporated into the estimation of the operational risk exposure (directly into the modelling methodology, or as inputs for scenarios) can vary. The use of external data in modelling depends upon the qualitative assumptions the bank makes regarding which external loss events are considered relevant and the degree to which the data are scaled. Additionally, the availability of external data that is comparable to a bank's own loss experience can result in external data being utilised differently across banks and jurisdictions. Regardless of how external data might be used, AMA banks' internal governance processes should include appropriate validation and verification processes to determine the appropriate situations and methodologies for how external data will be incorporated into their AMA frameworks (see internal governance above).

2006 Observed Range of Practice

Most banks factor external loss data into their operational risk capital estimates, but the method for which data incorporation varies. For example, some banks use external data as a direct statistical input to their operational risk quantification models. Others use external data to inform their scenario process and/or for risk management purposes such as validation. Most banks 'filter' external data to select only those observations that are deemed relevant, and have developed specific criteria for determining the relevance of individual events. While many banks recognise the potential importance of scaling external data to account for bank size and other relevant factors, none have derived a workable scaling methodology.

Banks gather external loss data by one or more of the following means: (i) building and maintaining an in-house database by gathering relevant information from public sources such as newspapers, magazines and trade journals, (ii) participating in industry data consortia and/or, (iii) purchasing external data from vendors. Consortium data appear to cover a wider range of events than vendor data.

While many banks have access to vendor or consortium data that include data from their respective countries, this is not universally the case. As a result, some banks may have to gather external data themselves, if it is considered of sufficient importance.

2008 Range of Practice Results

(a) Sources of External Data (Table 20)

As expected from the 2006 results, external loss data are mainly sourced from vendors (71%) and from participation in industry consortia (48%). These sources are supplemented to a lesser extent (33%) from in-house databases of public sources, including newspapers and journals.

These results are generally consistent across regions, although industry consortia participation is more evident in Europe and North America.

(b) Uses of external data (Tables 21, 18B)

External loss data are primarily used (*Table 21) are* as input to scenario analysis (86%), as an aid for risk management purposes (71%), and to a lesser extent as a direct input into the AMA model (29%). No bank solely relies on external data for its AMA calculation.

ROP Table 20

Sources of External Loss Data used within the AMA Framework

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
In-house database from public sources such as newspapers, magazines, and trade journals	14	33%	1	20%	6	30%	4	57%	3	30%
Industry consortia	20	48%	1	20%	13	65%	2	29%	4	40%
Vendors	30	71%	5	100%	11	55%	4	57%	10	100%
Other	2	5%	0	0%	1	5%	0	0%	1	10%

Note: Banks were able to select more than one answer per question.

All Japanese, Australian and North American banks use external data as input to scenario analysis (100%). No Japanese bank uses external data as a supplement to internal loss data in AMA models. The use of external data as a supplement to internal loss data varies from one bank in Australia (20%) to almost half in North America (40%).

When used in AMA models (*Table 18B)*, many banks (45%) use external loss data primarily to estimate the severity of tail events (low frequency/high severity). External data is used less widely (22%) to estimate parameters of the frequency distribution, but when used to estimate frequency, it is typically used (17%) to estimate tail frequency parameters.

ROP Table 21

Incorporation of Elements into the AMA Framework - External Loss Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
Use of External Loss Data	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Separate calculations are run for internal loss and external loss data in the AMA calculation	7	17%	2	40%	3	15%	0	0%	2	20%
External loss data points are directly included as a supplement to internal loss data in the AMA calculation	12	29%	1	20%	7	35%	0	0%	4	40%
The AMA calculation is based only on external loss data	0	0%	0	0%	0	0%	0	0%	0	0%
As an input into scenario analysis	36	86%	5	100%	14	70%	7	100%	10	100%
As an input into BEICF tools	11	26%	1	20%	6	30%	1	14%	3	30%
For risk management purposes	30	71%	5	100%	13	65%	4	57%	8	80%

Note: Banks were able to select more than one answer per question.

(c) Filtering and Scaling (Tables 22A, 22B)

The current range of practice (*Table 22B)* indicates that most AMA banks (88%) make a selection[39] of the external data to be used in the quantification model. The selection criterion is primarily based on geography (57%), loss thresholds (26%) which ranges from under €100M to over €1MM; or other selection criteria (26%).

[39] Selection and filtering are used as synonyms in this section. It refers to the mechanisms of selecting some data from the overall external data set that the bank has for management purposes (for example: selecting the data for a certain region or above a certain threshold from all the data the consortium provides).

Issues identified in 2006 included the technical challenges of scaling and other adjustments to external data. These issues are yet to be resolved. The current range of practice indicates that only a few AMA banks (21%) are able to scale external data, with the remaining banks using unscaled external loss data in their AMA models. *(Table 22A*)

AMA banks which scale external data generally use a scalar based on revenues or assets (21% of total participating AMA banks, or 64% that scale), or use other unspecified techniques (21%). These aggregate results are generally consistent across regions.

ROP Table 22A

Incorporation of External Loss Data into the AMA Framework: Processes Banks use for Scaling External Data

Number and Percentage of Banks by Region

	All Participating AMA Banks		**Australia**		**Europe**		**Japan**		**North America**	
Number of AMA Banks	42		5		20		7		10	
Number of AMA banks that scale external data	14		2		9		1		2	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Adjustment for size (eg, assets, revenues)	9	21%	2	40%	6	30%	0	0%	1	10%
Scaling not performed	29	69%	3	60%	11	55%	7	100%	8	80%

* Other selections written in included *BEICFs* (2 banks), *Other* (9 banks).

Note: Banks were able to select more than one answer per question.

(d) Supervisory Observations

External loss data is an important component in the estimation of a bank's operational risk capital. However, none of the external data sources are sufficiently comprehensive or relevant to be used as the sole source of information for modelling operational risk. Further, consortia data does not include the large tail events experienced by non-member banks.

There seems to be a wide range of practice in the qualitative assumptions made by banks when determining the relevance of external loss data (filtering or selecting), the degree to which the data are scaled or otherwise adjusted, and the way these data are introduced in the AMA model.

ROP Table 22B

Selection Process for External Loss Data used within the AMA Framework

Number and Percentage of Banks by Region

	All Participating AMA Banks		Australia		Europe		Japan		North America	
Number of AMA Banks	42		5		20		7		10	
	#	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Selection by industry, business line or institution size	37	88%	4	80%	17	85%	7	100%	9	90%
Selection by geography	24	57%	4	80%	13	65%	2	29%	5	50%
Selection by threshold:	11	26%	3	60%	5	25%	3	43%	0	0%
<100,000 €	3	7%	1	20%	2	10%	0	0%	0	0%
100,000 € - 500,000 €	0	0%	0	0%	0	0%	0	0%	0	0%
500,001 € - 1,000,000 €	2	5%	0	0%	1	5%	1	14%	0	0%
>1,000,000 €	5	12%	2	40%	1	5%	2	29%	0	0%
Threshold selected but level missing	1	2%	0	0%	1	5%	0	0%	0	0%
Other	11	26%	3	60%	4	20%	2	29%	2	20%

Note: Banks were able to select more than one answer per question.

Filtering techniques currently used by banks are mainly based on objective and unilateral decisions. As the models mature, it is expected that empirical analysis will be used to demonstrate that the relationship used for filtering are observable in the data.

Scaling techniques remain rudimentary, though some progress has been made in developing more rigorous methodologies. As tools improve, there may be reason for supervisors to provide additional guidance on how external data are properly scaled and incorporated into the AMA, including a way to ensure that the information appropriately captures potentially severe ‘tail’ loss events.

The range of practice for sourcing external data is neither surprising nor significant, given the increased membership in consortia and enhanced marketing by vendors. Sourcing of external data is in broad alignment with the expectations of the Basel II framework.

The current range of practice of using external data is still evolving, as banks attempt to integrate external data into the operational risk management and measurement framework. Although the Basel II framework envisioned that banks would be able to scale external loss

data, it is proving to be more difficult to implement in real world situations. The SIGOR continues to encourage industry efforts to strengthen banks approaches for using external data in AMA frameworks.

(v) Insurance as a risk mitigant

Basel text

"Under the AMA, a bank will be allowed to recognise the risk mitigating impact of insurance in the measures of operational risk used for regulatory minimum capital requirements. The recognition of insurance mitigation will be limited to 20% of the total operational risk capital charge calculated under the AMA." (paragraph 677)

Issues/background

Banks may be able to incorporate the mitigating impact of insurance in their operational risk capital estimate. In recognising the use of insurance, it is important for banks to account for factors such as the probability of coverage, the probability of timely payout, deductibles, insurer default, policy limits for certain events, and the remaining term on the policy. An important issue is the rigour with which banks are be expected to calculate the impact of insurance. For example, for a given aggregate exposure, the impact of insurance may vary depending upon the interplay between individual operational risk losses and the insurance policies that are in place. Thus, it can be argued that calculation of the mitigating impact of insurance should be embedded within the model at the event level rather than being applied as an *ex post* adjustment.

2006 Range of practice

Banks are at various stages of incorporating insurance as a risk mitigant into their operational risk capital models. Many do not incorporate insurance within their current operational risk capital calculation; of the banks that do, many calculate the impact in a very simple manner. For example, some base the calculation on a number of large losses for which insurance recoveries have been significant, while others seem to have interpreted the regulatory language as indicating that a 20% offset can be taken without much justification. A few banks have embedded the impact of insurance within the model.

2008 Range of practice results (Table 23)

Only a small number of losses experienced by AMA banks had an associated insurance recovery. The median cross-bank value shows that 2.1% of all losses and 4.2% of losses of €20,000 or more were offset to some degree by an insurance recovery. The median recovery rate is 75% for all losses with insurance recoveries and 71% for losses of €20,000 or more with insurance recoveries. Only a small percent (3.1%) of the total value of losses is recovered through insurance (3% for losses of €20,000 or more).

Very few AMA banks have estimated the impact of including insurance in their capital calculation. For banks that are including insurance, the impact on the operational risk capital calculation is small. For European and North American banks, insurance offsets are approximately 5% of total operational risk capital at the 75th percentile level, with the median value being 0 – see *Table 24B*).

ROP Table 23

Insurance Recoveries

All Institutions Reporting Recoveries

	Percent of Losses with an Insurance Recovery [1]	Recovery Rate for Losses with Recoveries [2]	Amount Recovered as a Percent of Total Loss Amount [3]
All Losses			
Median	2.1%	74.6%	3.1%
(25th-75th)	(0.4% - 8.3%)	(59.3% - 89.9%)	(1.3% - 9.5%)
Losses ≥ €20,000			
Median	4.2%	70.5%	3.0%
(25th-75th)	(1.3% - 15.6%)	(53.2% - 87.1%)	(0.7% - 11.8%)

Table shows median, 25th and 75th percentiles across participants reporting at least one insurance recovery.

[1] Percent of Losses with an Insurance Recovery is calculated as the number of losses that had insurance recoveries divided by the total number of losses.

[2] Recovery Rate for Losses with Recoveries is calculated as the total amount of insurance recoveries divided by the amount lost on losses that had insurance recoveries. (Loss amounts refer to gross loss net of all non-insurance recoveries.)

[3] Amount Recovered as a Percent of Total Loss Amount is calculated as the total amount of insurance recoveries divided by the total amount lost to losses both with and without insurance recoveries. (Loss amounts refer to gross loss net of all non-insurance recoveries.)

Supervisory Observations

Banks that incorporate insurance in their capital calculation must provide supervisors with the information they need to assess the reasonableness of the results. This includes information about the nature of their insurance coverage, the methodology for incorporating insurance into their AMA, and the impact on the capital estimate. Banks need to establish appropriate criteria for ensuring that risk mitigants are mapped properly to operational risk exposures. Similarly, criteria should be developed for ensuring that an appropriate level of conservatism is used when incorporating insurance (eg that the probability of coverage and other factors relating to the policy are accounted for appropriately) into the AMA capital model. Supervisors must have a complete set of information to evaluate the appropriateness of how banks factor the impact of insurance into their operational risk capital estimates. Banks whose AMA models incorporate insurance mitigation are expected to be able to assess the potential impact on operational risk capital estimates that would result from changes to their insurance coverage and consider whether the estimate needs to be revised should the insurance coverage change.

(vi) Treatment of expected loss (EL)

Basel text

"Supervisors will require the bank to calculate its regulatory capital requirement as the sum of expected loss (EL) and unexpected loss (UL); unless the bank can demonstrate that it is

adequately capturing EL in its internal business practices. That is, to base the minimum regulatory capital requirement on UL alone, the bank must be able to demonstrate to the satisfaction of its national supervisor that it has measured and accounted for its EL exposure." (paragraph 669(b))

2006 Range of practice

Since banks did not have the opportunity to react to the November 2005 guidance[40] prior to the 2006 Range of Practice exercise, the range of practice on the treatment of EL was expected to change over time. Most banks using a loss distribution approach are able to calculate EL from their statistical model. In addition, two areas where banks have argued that losses are predictable and are likely to meet the criteria included in the guidance have been in credit card fraud and securities processing. In both instances, some banks have been able to show with historical data that operational risk losses are quite predictable and can provide an estimation process that would be consistent over time. Reserves for these two loss areas are not permitted in some jurisdictions, while in others banks can either reserve for them currently or are expected to be able to do so in the future.

2008 Range of practice results (Tables 24A, 24B, 24C)

The range of practice for expected losses has not changed significantly compared with 2006. Only European and North American AMA banks provided data on EL included in AMA regulatory operational risk capital (*Table 24A)*. European AMA banks include significantly more EL in their AMA capital estimates than do North American AMA banks. The median ratio of included EL to AMA capital was 14% in Europe and 8% in North America. Some of this difference may be explained by a higher frequency of small losses in European AMA banks, which increases the potential pool of losses that comprise EL.

Supervisory Observations

In November 2005, the SIGOR released guidance on the treatment of EL clarifying the conditions under which banks could be permitted to calculate operational risk capital based only on unexpected loss.

The use of the EL offset remains extremely limited. The cross-bank median of the ratio of the EL offset to AMA capital is 0%. Only a few European banks have calculated what their potential EL offset might be, and that amount is small relative to AMA capital. At least three quarters of North American Banks reported no EL offset.

[40] *The treatment of expected losses by banks using the AMA under the Basel II Framework*, Basel Committee Newsletter No.7 (November 2005).

ROP Table 24A

Expected Loss, Dependency and Risk Mitigant Offsets to Capital

AMA Banks

		All Participating AMA Banks	Australia	Europe	Japan	North America
Number of AMA Banks		42	5	20	7	10
Numerator: Expected Loss included in AMA Regulatory Operational Risk Capital						
Denominator:						
AMA Regulatory Operational Risk Capital (Without EL Offsets)	Median	10%	-	12%	-	8%
	25th %	5%	-	7%	-	4%
	75th %	19%	-	20%	-	16%
AMA Regulatory Operational Risk Capital	Median	11%	-	14%	-	8%
	25th %	6%	-	9%	-	4%
	75th %	19%	-	22%	-	16%
Annualised sum of losses ≥ €20,000	Median	129%	-	138%	-	41%
	25th %	60%	-	99%	-	27%
	75th %	281%	-	281%	-	74%
Numerator: Expected Loss Offset						
Denominator:						
AMA Regulatory Operational Risk Capital (Without EL Offsets)	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	1%	0%	3%	0%	0%
AMA Regulatory Operational Risk Capital	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	1%	0%	3%	0%	0%
Annualised sum of losses ≥ €20,000	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	10%	0%	41%	0%	0%

ROP Table 24B

Expected Loss, Dependency and Risk Mitigant Offsets to Capital

AMA Banks

		All Participating AMA Banks	Australia	Europe	Japan	North America
Number of AMA Banks		42	5	20	7	10
Numerator: Insurance Offset						
Denominator:						
AMA Regulatory Operational Risk Capital (without Insurance Offsets)	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	4%	0%	5%	0%	5%
Numerator: Other Risk Mitigants						
Denominator:						
AMA Regulatory Operational Risk Capital (without Other Risk Mitigant Offsets)	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	0%	0%	0%	0%	0%
Numerator: All Risk Mitigants						
Denominator:						
AMA Regulatory Operational Risk Capital	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	0%	0%	4%	0%	0%
AMA Regulatory Operational Risk Capital (without Other Risk Mitigant Offsets)	Median	0%	0%	0%	0%	0%
	25th %	0%	0%	0%	0%	0%
	75th %	0%	0%	4%	0%	0%
Numerator: Correlation Adjustment *						
Denominator:						
AMA Regulatory Operational Risk Capital	Median	-8%	-	-17%	0%	-9%
	25th %	-24%	-	-27%	0%	-22%
	75th %	-1%	-	-3%	0%	-3%
AMA Regulatory Operational Risk Capital (assuming full independence)	Median	-8%	-	-20%	0%	-10%
	25th %	-31%	-	-38%	0%	-29%
	75th %	-1%	-	-3%	0%	-3%

* Correlation adjustment is calculated as AMA Operational Risk Capital assuming full independence minus AMA Operational Risk Capital.

ROP Table 24C

Expected Loss, Dependency and Risk Mitigant Offsets to Capital

AMA Banks

		All Participating AMA Banks	Australia	Europe	Japan	North America
Number of AMA Banks		42	5	20	7	10
Numerator: AMA Regulatory Capital						
Denominator:						
AMA Regulatory Operational Risk Capital (Assuming full independence)	Median	108%	-	120%	-	110%
	25th %	101%	-	103%	-	103%
	75th%	131%	-	138%	-	129%
AMA Regulatory Operational Risk Capital (Sum of ORCs)	Median	78%	-	61%	100%	57%
	25th %	52%	-	37%	100%	54%
	75th %	100%	-	100%	100%	81%
Numerator: ORC Correlation Adjustment *						
Denominator:						
AMA Regulatory Operational Risk Capital	Median	29%	-	64%	0%	76%
	25th %	0%	-	0%	0%	24%
	75th %	93%	-	124%	0%	86%
AMA Regulatory Operational Risk Capital (Sum of ORCs)	Median	22%	-	39%	0%	43%
	25th %	0%	-	0%	0%	19%
	75th %	48%	-	55%	0%	46%
Numerator: Operational Risk Capital from partial use						
Denominator:						
Total Reported Regulatory Operational Risk Capital	Median	16%	-	19%	15%	-
	25th %	6%	-	7%	10%	-
	75th %	23%	-	35%	16%	-

* ORC Correlation Adjustment is calculated as AMA Operational Risk Capital calculated as the sum of capital from each of the ORCs minus AMA Operational Risk Capital.

Annex I

Members of the SIG Operational Risk Subgroup

Chairman: Kevin Bailey, Office of the Comptroller of the Currency, United States

Australian Prudential Regulation Authority	Harvey Crapp Michael Booth Sarah He Emily Watchhorn Shane Wilson
Banking, Finance and Insurance Commission, Belgium	Jos Meuleman
Banco Central do Brasil, Brazi	Kathleen Krause Wagner Almeida Ana Paula Carvalho
Office of the Superintendent of Financial Institutions, Canada	Abhilash Bhachech
French Banking Commission	Jean-Luc Quémard
Deutsche Bundesbank, Germany	Marcus Haas Karsten Stickelmann
Federal Financial Supervisory Authority (BaFin), Germany	Bernd Rummel
Reserve Bank of India	P R Ravi Mohan
Bank of Italy	Marco Moscadelli
Bank of Japan	Koichiro Kamada
Financial Services Agency, Japan	Tsuyoshi Nagafuji
Surveillance Commission for the Financial Sector, Luxembourg	Didier Bergamo
Netherlands Bank	Claudia Zapp
Polish Financial Supervision Authority	Grazyna Szwajokowska
Bank of Spain	María Ángeles Nieto
South African Reserve Bank	Jan van Zyl
Finansinspektionen, Sweden	Jan Hedqvist
Swiss Federal Banking Commission	Martin Sprenger
Financial Services Authority, United Kingdom	Khim Murphy Andrew Sheen
Board of Governors of the Federal Reserve System, United States	Adrienne Townes Haden
Federal Deposit Insurance Corporation, United States	Mark Schmidt Alfred Seivold

Federal Reserve Bank of Boston, United States	Patrick de Fontnouvelle Victoria Garrity Peggy Gilligan
Federal Reserve Bank of New York, United States	Ronald Stroz
Office of the Comptroller of the Currency, United States	Mark O'Dell Jennifer Eccles Steven Strasser
Office of Thrift Supervision, United States	Eric Hirschhorn
Financial Stability Institute	Juan Carlos Crisanto
Secretariat of the Basel Committee on Banking Supervision, Bank for International Settlements	Brad Shinn

Annex II

Loss Data Collection Exercise Range of Practice Questionnaire

BASEL COMMITTEE ON BANKING SUPERVISION

BANK FOR INTERNATIONAL SETTLEMENTS

Restricted

Accord Implementation Group
Operational Risk Working Group

Attachment A
Supplemental Internal Loss Data and Scenario Analysis Questionnaire

INPUT DOCUMENT

April 2008

Attachment A
Supplemental Internal Loss Data and Scenario Analysis Questionnaire

Institution Name: _____

Operational Risk Capital Estimates provided in Attachment B were calculated using the [ ] approach

Internal Loss Data

1. What loss data collection threshold(s) are used in your internal loss database?

Unit of Collection	*Threshold*	*Threshold Currency*

Note:

The ***unit of collection*** is the level at which the threshold is applicable. For example, group-wide, business line, event type, or business line/event type combination are units of collection.

The ***threshold*** is the gross loss amount above which loss data are collected.

Please use the three character currency abbreviations (ISO 4217 standard) found at http://www.xe.com/iso4217.php when filling out the ***Threshold Currency***.

2. If there are any internal losses in the database that are not directly used for modelling operational risk capital, please provide the following:

   (a) Losses below a threshold of _____ in currency _____ are not used for modelling operational risk capital. If multiple thresholds are used, provide only the value of the highest threshold.

   (b) Losses not used for modelling operational risk capital fall in the date range of _____ to _____. Please use *dd/mm/yyyy* format.

   (c) If other losses (from certain subsidiaries, business lines or countries) are not used for modelling operational risk capital, please explain.

3. Do the internal loss data submitted include any aggregate losses for very low impact events with high frequency?

   ○ Yes
   ○ No

   If Yes, please explain how these aggregate losses can be identified in the data (eg, via a special format of the reference number)

Note:

Aggregate losses for very low impact/high frequency events are losses that do not represent an individual loss, but the sum of many small losses. This definition does not refer to multiple losses associated with the same event.

4. If there are any gaps in the internal loss data provided, please select all of the types of data issues that are relevant:

   ☐ Excluded data for all or part of the following business lines (please select all that apply):

   ☐ Corporate Finance ☐ Commercial Banking ☐ Asset Management
   ☐ Trading and Sales ☐ Payment and Settlement ☐ Retail Brokerage
   ☐ Retail Banking ☐ Agency Services ☐ Other - Please specify:

   ☐ Excluded data for all or part of the following event types (please select all that apply):

   ☐ Internal Fraud ☐ Clients, Products & Business Practices ☐ Execution, Delivery & Process Management
   ☐ External Fraud ☐ Damage to Physical Assets ☐ Other - Please specify:
   ☐ Employment Practices & Workplace Safety ☐ Business Disruption & System Failures

   ☐ Time periods in which data collection was incomplete (please provide date range) _____ to _____. Please use *dd/mm/yyyy* format.

   ☐ Time periods that do not reflect ***merger and acquisition activity*** (please provide date range) _____ to _____. Please use *dd/mm/yyyy* format.

   ☐ Other - please specify:

Note:

Merger and acquisition activity may not be reflected in the loss data either because the acquired institution did not collect loss data for the same period as the reporting institution or the reporting institution had not yet added loss data from the acquired institution to its own loss database.

5. Internal Loss Data Capture of Legal Events:

5.1 Please select when legal events are first entered into the internal loss database (with or without loss amounts) provided for this exercise.

- ○ At discovery
- ○ Upon establishing a legal reserve
- ○ At settlement, or
- ○ Other - please specify:

5.2 Please select when ***loss amounts from legal events*** are first entered into the database provided for this exercise.

- ○ At discovery
- ○ Upon establishing a legal reserve
- ○ At settlement, or
- ○ Other - please specify:

Note:

Loss amounts from legal events, or settlements due to operational risk events, do not include "timing impacts." For the purpose of this exercise, a timing impact is a temporary distortion to the aggregate profit and loss statement of a banking organization in a particular reporting period that can be fully corrected when later discovered. It results in profit and/or loss being shifted from one period to another.

5.3 When are loss amounts from legal events used as a direct input to the AMA model?

- ○ At discovery
- ○ Upon establishing a legal reserve
- ○ At settlement, or
- ○ Other - please specify:

6. Please select the methodology used to allocate losses impacting multiple business lines:

- ○ Allocating the entire loss to the business line for which the impact is greatest
- ○ Allocating the loss on a pro-rata basis, or
- ○ Other allocation methodology - please specify:

- ○ ***No allocation method***

Note:

No allocation method means that losses are not assigned to specific business lines. If losses impacting multiple business lines are recorded in a category such as corporate centre, corporate operations, or 'other', then option (d) for "no allocation method" should be selected.

7. Indicate what any negative loss amounts represent in the submitted loss data. (select all that apply)

- ☐ Recoveries
- ☐ ***Misses*** that brought about profits
- ☐ Other - please specify:

Note:

Misses are operational risk events (eg, failed controls, potential system failures, etc.) occurring within the organization that did not result in a loss, but a net gain to the institution.

8. Please briefly identify any ***inconsistencies*** between the internal loss data submitted and the information requested in the exercise. Examples of inconsistencies include reporting dates in quarter-year format rather than in day-month-year format; using a full-text currency name rather than the three character currency codes; or reporting numeric variables in thousands rather than ones.

Note:

Inconsistencies would generally arise if an institution is submitting a copy of the dataset prepared for submission to a consortium.

Scenario Analysis

1. Please indicate which scenarios you have provided in the scenario template:

   ○ All operational risk scenarios that are currently in use within the organization
   ○ The **twenty largest scenarios**
   ○ Other - please specify:

Note:

The twenty largest scenarios refers to (i) at least the 20 highest-severity scenarios where at least 20 of these scenarios are expected to happen once or more every 1,000 years (ie with a mean annual frequency greater or equal to 0.001) and (ii)the five highest-severity scenarios for each of the seven Level I Basel II event types (if available).

2. The total number of scenarios (group-wide) that are currently in use within the operational risk framework: _____

   If your operational risk scenarios are mapped to Basel business lines, please provide the total number of scenarios by Basel business line:

_____	Corporate Finance	_____	Payment & Settlement
_____	Trading & Sales	_____	Agency Services
_____	Retail Banking	_____	Asset Management
_____	Commercial Banking	_____	Retail Brokerage

   If your operational risk scenarios are mapped to Basel event types, please provide the total number of scenarios by Basel event type:

_____	Internal Fraud	_____	Damage to Physical Assets
_____	External Fraud	_____	Business Disruption & System Failures
_____	Employment Practices & Workplace Safety	_____	Execution Delivery & Process Management
_____	Clients, Products & Business Practices		

3. Select the data sources that are used as inputs in the scenario development process (select all that apply):

   ☐ Internal loss data
   ☐ External loss data
   ☐ Financial indicators
   ☐ Other - please specify:

4. Select which method(s) are used to gather scenario data (select all that apply):
   - ☐ Workshops involving multiple employees/units
   - ☐ A series of individual meetings/interviews
   - ☐ Questionnaires
   - ☐ Voting
   - ☐ Other - please specify:

5. Which of the following types of scenarios are developed? (select all that apply)
   - ☐ Group-wide scenarios that may affect the entire organization
   - ☐ Scenarios that are specific to major internal business lines
   - ☐ Scenarios that are specific to subgroups of major internal business lines
   - ☐ Other - please specify:

6. Select all respondents' ***biases*** (under or over estimation) explicitly addressed as part of the scenario process:
   - ☐ Partition Dependence – the respondents' knowledge was distorted by discrete choices or buckets within which their responses had to be represented
   - ☐ Availability – overestimation of events the respondents had closer or more recent contact with
   - ☐ Anchoring – respondents' bias towards information presented in background material to the questions or within the questions themselves
   - ☐ Motivational – misrepresentation of information due to respondents' interests in conflict with the goals and consequences of the assessment
   - ☐ Overconfidence - underestimation of risk due to the number of observed events being small
   - ☐ Other - please specify:

7. Please briefly identify any ***inconsistencies*** between the scenario data requested and the scenario template submitted. Examples of inconsistencies include using a full-text currency name rather than the three character currency codes.

Note:

Inconsistencies would generally arise if an institution is submitting a copy of the dataset prepared for submission to a consortium.

Note: Page 8 of Attachment A is blank.

Accord Implementation Group
Operational Risk Working Group

Attachment C
Supplemental Range of Practice Questionnaire

INPUT DOCUMENT

April 2008

Attachment C
Supplemental Range of Practice Questionnaire

Institution Name: _____
Local Currency: _____
Completed by the institution or national supervisor? [ ]

Overall Framework:

1. Please provide the ***direct effect*** that each of the ***four elements*** has on the institution's final operational risk capital figure as of 31 December 2007, using a XX.X% format:

   (a) Internal loss data:
   Please indicate percentage _____ or, if estimating,
   please indicate a range from _____ to _____.

   (b) External loss data:
   Please indicate percentage _____ or, if estimating,
   please indicate a range from _____ to _____.

   (c) Scenario Analysis:
   Please indicate percentage _____ or, if estimating,
   please indicate a range from _____ to _____.

   (d) BEICF:
   Please indicate percentage _____ or, if estimating,
   please indicate a range from _____ to _____.

Note:

If available, each of the ***four element's*** effects should be reported as the marginal impact on capital added to the effect of the other elements. If readily available, please use the results of separate calculations for the percentage each element contributes to the amount of operational risk capital. If separate calculations are not available, please provide the best estimate of the element's direct effect.

Direct effects are inputs that directly inform the computational methodology (ie, using external loss data as data points in the model used to quantify operational risk capital). If the element is not used directly, a zero weight should be assigned. If an approximate figure is not available, please provide a range, for example less than 25%; from 25 to 50%; etc.

2. How many ***Operational Risk Categories*** (ORCs) are defined in the AMA model? Please specify the number in all applicable categories:

   (a) Identify the number of total ORCs _____. Please use an *integer* format.

   (b) Indicate the number of ORCs based only on business lines _____. Please use an *integer* format.

   (c) Indicate the number of ORCs based only on event types _____. Please use an *integer* format.

   (d) The number of ORCs based on a combination of business lines and event types _____. Please use an *integer* format.

   (e) The number of ORCs based on other criteria _____. Please use an *integer* format. Please list the criteria:

   Note:

   An ***Operational Risk Category*** is the level (for example, organizational unit, operational loss event type, risk category, etc.) at which the institution's quantification model generates a separate distribution for estimating potential operational losses.

3. Choose the approach that is used to estimate the severity distribution:

   ○ Applying one single distribution model for all the data (based on a single distribution or a mixture of distributions)

   ○ Applying one single model based on two separate distribution models for the body and tail

   ○ Applying two separate distribution models for high frequency/low severity and low frequency/high severity losses

   ○ Others - please specify:

4. What severity distributions were used in the most recent capital calculation? Please indicate (b) for the body; (t) for the tail and (d) for all the entire distribution:

Severity Distribution	***Select b, t and/or d***
LogNormal	b☐ t☐ d☐
Gamma	b☐ t☐ d☐
Generalized pareto	b☐ t☐ d☐
Weibull	b☐ t☐ d☐
g and h	b☐ t☐ d☐
Generalized beta	b☐ t☐ d☐
Mixture of LogNormal-Gamma	b☐ t☐ d☐
Mixture of LogNormal	b☐ t☐ d☐
Empirical distribution	b☐ t☐ d☐
Others (please specify)	b☐ t☐ d☐

5. What frequency distributions were used in the most recent capital calculation? (select all that apply)
   - ☐ Poisson
   - ☐ Negative Binomial
   - ☐ Others - please specify:

6. For the dependence analytical model used:

   6.1 What data sources were used to estimate dependence? (select all that apply)
   - ☐ Dependence not modelled or estimated
   - ☐ Internal loss data
   - ☐ External loss data
   - ☐ Scenario data
   - ☐ Expert judgement
   - ☐ Other - please specify:

   6.2 What source of dependence was calculated and used as an input to the model? (select all that apply)
   - ☐ Frequency
   - ☐ Severity
   - ☐ Aggregate losses
   - ☐ Other - please specify:

7. Describe how correlations are introduced in the analytical model. (select all that apply)
   - ☐ Copula model - please specify type
   - ☐ ***Correlation matrix***
   - ☐ Others - please specify:

Note:

Correlation matrix should be selected if used in a different way than the copula model.

8. What are the primary uses for the following data items in the operational risk capital model? (select all that apply)

	Internal Loss Data	*Scenario Data*	*External Loss Data*
As severity for high frequency / low severity events	☐	☐	☐
As severity for low frequency / high severity events	☐	☐	☐
As severity for the entire distribution	☐	☐	☐
As frequency for high frequency / low severity events	☐	☐	☐
As frequency for low frequency / high severity events	☐	☐	☐
As frequency for the entire distribution	☐	☐	☐
Other (please specify)	☐	☐	☐

9. What loss amount is used as an input to the AMA model? (select all that apply)

☐ Gross loss before any recoveries
☐ Gross loss after all recoveries except insurance recoveries
☐ Net loss (gross loss net of all recoveries)
☐ Other - please specify:

10. What circumstances would trigger an update of scenarios or external loss data between review dates? (select all that apply)

Circumstance:	*Scenario Analysis*	*External Loss Data*
New business or new product	☐	☐
Major operational loss	☐	☐
Major change in computer systems	☐	☐
Major change in organization (includes reorganizations, mergers, and acquisitions)	☐	☐
Major change in operations	☐	☐
Outsourcing	☐	☐
Other (please specify)	☐	☐

11. Which applicable characteristics of the challenge function(s) (eg, internal audit, external audit, use of subject matter experts, etc.) are used to maintain the integrity of each data element? (select all that apply)

	Internal Loss Data	*Scenario Analysis*	*External Loss Data*	*BEICFs*
Review by a Risk Control Function	☐	☐	☐	☐
Review by Internal or External Audit	☐	☐	☐	☐
Review by Business peers	☐	☐	☐	☐
Comparison with other data element(s)	☐	☐	☐	☐
Comparison with experience or expertise	☐	☐	☐	☐
Not-defined	☐	☐	☐	☐
Other (please specify)				

12. How are scenario data incorporated into the AMA framework? (select all that apply)

- ☐ Scenarios are used only for risk management purposes
- ☐ Separate capital calculations are run for scenarios and for internal loss data (and external loss data if applicable)
- ☐ Single impact scenario estimates (ie, individual scenario data points) are directly included as a supplement to internal loss and external data points in the capital calculation
- ☐ Simulated data from a scenario-generated distribution are included as a supplement to internal loss and external loss data points in the capital calculation
- ☐ Scenarios are applied only as qualitative adjustments to model outputs
- ☐ The ***model is based only on scenarios***
- ☐ Other - please specify:

Note:
Models based on scenarios do not directly use internal loss or external loss data in the quantification process.

External Loss Data

1. How are external loss data incorporated into the AMA framework? (select all that apply)

- ☐ Separate calculations are run for internal loss and external loss data in the AMA calculation
- ☐ External loss data points are directly included as a supplement to internal loss data in the AMA calculation
- ☐ The AMA calculation is based only on external loss data
- ☐ As an input into scenario analysis
- ☐ As an input into business environment and internal control factor tools
- ☐ For risk management purposes

2. Select the sources of external loss data that are used in the AMA framework (select all that apply):

- ☐ In-house database from public sources such as newspapers, magazines and trade journals
- ☐ Industry consortia. Please provide names of consortia
  _____ ; _____ ; _____
- ☐ External loss data from vendors. Please provide vendors used
  _____ ; _____ ; _____
- ☐ Other - please specify:

3. What process is used to select external losses from the data source? (select all that apply):

- ☐ Selection by industry, business line or institution size (eg, asset, revenues)
- ☐ Selection by geography
- ☐ Selection by threshold (please specify threshold level _____)
- ☐ Other - please specify:

4. What process is used to scale external loss data? (select all that apply):

- ☐ Adjustment for size (eg, asset, revenues)
- ☐ Other - please specify
- ☐ Scaling not performed

BEICFs

1. How are BEICFs utilized at the institution? (select all that apply)

- ☐ Risk management purposes.
- ☐ Risk quantification – indirect input (eg, to inform scenario analysis).
- ☐ Risk quantification – direct input into model in parallel with other data elements (ie, prior to the calculation of any exposure estimates).
- ☐ Risk quantification – ex post adjustment to calculated exposure estimates at the consolidated level (eg, qualitative adjustment factors).
- ☐ Risk quantification – ex post adjustment to calculated exposure estimates at the business line level.
- ☐ Not used.
- ☐ Other - please specify:

2. Please indicate the ***potential*** impact that BEICF tools have on the institution's operational risk capital. (select all that apply)

☐ Indicate the largest possible increase in operational risk capital:
☐ _____ (in percent XX.X% format) or ☐ No limit

☐ Indicate the largest possible decrease in operational risk capital:
☐ _____ (in percent XX.X% format) or ☐ No limit

☐ Not used for quantification

3. How are the following BEICF tools used? (select all that apply)

	Used for Risk Management Purposes	***Used directly or indirectly for Risk Quantification***	***Not used***
Risk and Control Self Assessments	☐	☐	☐
KRI/KPIs	☐	☐	☐
Audit Scores/ Audit Findings	☐	☐	☐
Other (please specify)	☐	☐	☐

4. How often is each BEICF tool updated? (please check the appropriate boxes for each BEICF tool)

BEICF Tool	***Annually***	***Semi-annually to Annually***	***Quarterly to Semi-annually***	***Monthly to Quarterly***	***More frequently than Monthly***	***Reviewed when triggered***	***Not used***
Risk and Control Self Assessments	☐	☐	☐	☐	☐	☐	☐
KRI/KPIs	☐	☐	☐	☐	☐	☐	☐
Audit Scores/ Audit Findings	☐	☐	☐	☐	☐	☐	☐
Other (please specify)	☐	☐	☐	☐	☐	☐	☐

5. Please provide the names of up to three Key Risk/Key Process Indicators that are particularly useful for each of the following ***business lines*** and/or at the ***group level***:

Business Line	***KRI/KPI***	***KRI/KPI***	***KRI/KPI***
Corporate Finance			
Trading & Sales			
Retail Banking			
Commercial Banking			
Payment & Settlement			
Agency Services			
Asset Management			
Retail Brokerage			
Group level (if used)			

Note:
Please provide the KRI/KPI the institution uses that best match the ***business lines*** noted above.
Group level is defined as the highest management level of the organization.

Participating Institutions

Save preliminary work by using the menu option File | Save As ... Please include the name of the institution in the file name. When you have finished answering the Attachment's questions, please save the document (PDF) and send it to your national supervisor, using the procedures provided to your institution.

Participating National Supervisors

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