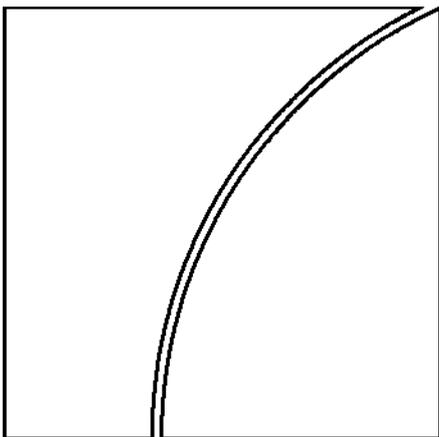
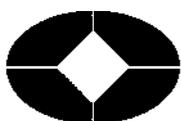


Basel Committee
on Banking Supervision



**Operational Risk –
Supervisory Guidelines for
the Advanced
Measurement Approaches**

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Operational Risk—Supervisory Guidelines for the Advanced Measurement Approaches

Introduction

1. The Basel Committee's Standards Implementation Group, through its Operational Risk Subgroup (SIGOR), has focused on the practical challenges associated with the development, implementation and maintenance of an operational risk (OR) management and measurement framework that meets the requirements of Basel II,¹ particularly as they relate to the Advanced Measurement Approaches (AMA). The SIGOR's mandate includes identifying and participating in resolving the practical challenges associated with the successful development, implementation and maintenance of an AMA framework.
2. Consistent with this mandate, this paper identifies supervisory guidelines associated with the development and maintenance of key internal governance, data and modelling frameworks underlying an AMA. Because operational risk is an evolving discipline, this paper is intended to be an evergreen document, and as further issues are identified and expectations for convergence towards a narrower range of appropriate practices are developed, these too will be added to this document.
3. This paper does not reduce or supersede the discretion of national supervisors to act in a manner that is consistent with their particular regulatory approaches. Nevertheless, the publication of this paper is intended to facilitate a convergence of practice by banks as well as national supervisors.

Background

4. In the development of the Basel II Framework, the fundamental objective of the Basel Committee on Banking Supervision was to develop a framework that would further strengthen the soundness and stability of the international banking system while maintaining sufficient consistency so that capital adequacy regulation would not be a significant source of competitive inequality among internationally active banks. The capital regulation was also designed to take into account changes in banking and risk management practices while at the same time preserving the benefits of a framework that can be applied as uniformly as possible at the international level.
5. In recognition of the evolutionary nature of operational risk management as a developing risk management discipline, the Committee provided significant flexibility to banks in the development of an operational risk measurement and management system. This flexibility was, and continues to be, a critical feature of the AMA. These features, however, require substantial efforts by national authorities to ensure sufficient consistency in application.
6. Flexibility in the development of an AMA, however, does not suggest that supervisors are prepared to accept any practice or process that a bank adopts in implementing its AMA frameworks. On the contrary, supervisors are concerned with

¹ "Basel II Framework" and "Basel II", used interchangeably in this report, refer to the Basel Committee's *International Convergence of Capital Measurement and Capital Standards: A Revised Framework* (June 2006).

identifying and encouraging bank operational risk practices that achieve robust and effective operational risk management and measurement systems that are consistent with safety, soundness and level playing field objectives.

General observations

7. The Basel II Framework envisages that, over time, the operational risk discipline will mature and converge towards 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 efforts to establish consistent supervisory expectations. Through the analysis of existing practices, and the publication of this paper, the Committee expects the maturation of operational risk practices and supports supervisors in developing more consistent regulatory expectations. As part of this process, the Committee has identified practices that fall outside the range of effective and sound operational risk practices.

8. Irrespective of the risk management and risk measurement practices adopted, a bank's operational risk strategy should reflect the nature and source of the bank's operational risks for all Operational Risk Measurement System (ORMS) elements, including regular review of predictive elements against experience. The operational risk strategy should be current and reflect material changes to the internal and external environment. Risk reporting should provide a clear understanding of the key operational risks, the related drivers and the effectiveness of the internal controls. The internal reporting framework should include regular reporting of relevant information at all levels of the bank, be transparent, responsive to changes, appropriate and support the proactive management of operational risk.

Industry trends and practices

9. In July 2009, the Committee published two papers providing current information on the operational risk data and practices of institutions implementing Basel II, *The 2008 Loss Data Collection Exercise (LDCE Paper)* and the *Observed range of practice in key elements of the Advanced Measurement Approaches (AMA) (Range of Practice Paper)*.² These papers were designed to advance SIGOR's goal of promoting consistency in implementation of the Basel II Framework by furthering the understanding of both supervisors and participating banking institutions regarding outstanding operational risk implementation issues, as well as to foster consistency in addressing these issues across regions.

10. The LDCE was the first international loss data collection effort to collect information on all four data elements that are used in the AMA. The main findings of the LDCE Paper were:

- (a) Overall, banks have made considerable progress in the collection and use of internal loss data since the previous international LDCE, conducted in 2002;
- (b) The frequency of internal losses of €20,000 or more varies significantly across regions when the data are scaled by various exposure indicators;
- (d) Despite the regional variation in loss frequency noted above, there is some consistency in the severity distribution of operational losses across regions;

² These papers are available at www.bis.org/publ/bcbs160.htm.

- (e) Most banks' scenario data extends the tail of the loss distribution beyond the point at which they have experienced internal losses. At many banks, the number of large scenarios greater than €10 million is approximately 20 times larger than the number of internal losses that are greater than this amount;
- (f) Although the number of large scenarios significantly exceeds the number of large internal losses, the frequency of large losses implied by scenarios and internal data are broadly consistent among AMA banks;
- (g) AMA banks have a higher frequency of internal losses greater than €100,000 than non-AMA banks, even when the data are scaled by exposure indicators. Some of this difference may be explained by the fact that AMA banks are generally larger and more complex, with more mature processes for collecting loss data; and
- (h) Operational risk capital for non-AMA banks is higher than for AMA banks, regardless of the exposure indicator used for scaling. For the typical AMA bank, the ratio of operational risk capital to gross income (10.8%) is significantly below the alpha for the Basic Indicator Approach (BIA) (15%) and also below the range of betas for the Standardised Approach (TSA) (12-18%). Also, the amount of capital relative to the frequency of large losses is generally higher at non-AMA banks than at AMA banks.

11. The second paper, the Range of Practice Paper, updates a 2006 report of the same name. The July 2009 Range of Practice Paper describes industry practices for some key areas of the governance, data and modelling components of an AMA framework. It identifies both emerging effective practices as well as practices that are inconsistent with supervisory expectations. The findings from the Range of Practice paper include:

- (a) 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;
- (b) There was a broad range of practice in the use of loss amount as the AMA input. Most of the 42 participating AMA banks (43%) used “gross loss after all recoveries” (except insurance). “Gross loss before any recoveries” was used by 29%. Other loss amounts used by participating banks include “net loss” (14%) and “other definition” (12%);
- (d) Data collection thresholds vary widely across institutions and types of activity. A bank should be aware of the impact that its choice of thresholds has on operational risk capital computations;
- (e) There is 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;
- (f) 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;
- (g) While it is common for banks to use the Poisson distribution for estimating frequency, there are significant differences in the way banks model severity, including the choice of severity distribution; and
- (h) 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 both within and across jurisdictions.

12. This paper addresses issues identified in the Range of Practice paper and includes below brief summaries of the papers produced as a result. Complete versions of the papers can be found in the subsequent pages.

Governance

13. Although operational risk management is an evolving risk discipline, a variety of practices have developed in several areas of internal governance, particularly in the governance structure used to manage operational risk.³ A bank's risk governance structure should be appropriate for its size and business complexity. The governance structure adopted by many banks relies on three lines of defence – business line management, independent corporate operational risk function, and independent review. The implementation of these three lines of defence varies depending on a bank's risk management approach and the flexibility provided by national supervisors.

Verification and validation

14. Independent validation and verification are components of the third line of defence in the governance structure used to manage operational risk, and serve as a challenge function to the other two lines of defence. The effectiveness of both the Corporate Operational Risk Management Function (CORF) and operational risk measurement system (ORMS) should be reviewed by appropriately qualified independent internal or external auditors, qualified external and/or other independent parties. The purpose of these activities is to ensure that a bank's operational risk management framework (ORMF) is functioning as intended and that it remains appropriate for the bank's risk profile. The existence of such an independent challenge process is central to the establishment and implementation of an effective overall ORMF. Verification and validation activities should encompass all of the components of the bank's ORMF and ORMS. The depth and extent of the validation and verification efforts should be consistent with the materiality and complexity of the risk being managed.

15. Validation ensures that the ORMS used by the bank is sufficiently robust and provides assurance of the integrity of inputs, assumptions, process and outputs. Specifically, the independent validation process should provide enhanced assurance that the risk measurement methodology results in a credible estimate of operational risk capital that reflects the operational risk profile of the bank. The work of internal validation is not limited to quantitative aspects; it covers validation of data inputs, methodology and use of outputs of operational risk models.

16. Verification of the ORMF is performed on a periodic basis and is typically conducted by the bank's internal and/or external audit, but may involve other suitably qualified independent parties from external sources. Verification activities test the effectiveness of the overall ORMF, consistent with policies approved by the board of directors, and also test ORMS validation processes to ensure they are independent and are implemented in a manner consistent with established bank policies.

³ See the Committee's *Principles for enhancing corporate governance* (October 2010), which is available at www.bis.org/publ/bcbs176.htm.

Use test and experience

17. A bank may use various approaches to articulate and demonstrate the integrated use of its ORMF. The integrated framework should be updated regularly and evolve as the bank gains more experience in the management and quantification of operational risk. The level to which the broader ORMF processes and practices have been embedded at all organisational levels across a bank is referred to as “embeddedness”. In addition to the initial period required by supervisors as part of their use and embeddedness AMA assessment, the requirement is ongoing and banks will need to ensure that their ability to demonstrate embeddedness is not adversely impacted over time by change.

18. A bank should have sustainable and embedded ORMFs and policies that are used in its risk management decision-making practices, with clear evidence of the integration and linkage between the measurement and management processes of the ORMF through the entire institution. The ORMF should be updated on a regular basis and become more embedded as the operational risk discipline further evolves. First, the strategic and business planning processes should consider a bank’s operational risk profile, including the outputs of the ORMS. Second, a bank’s board should endorse a clear statement of appetite and tolerance for operational risk and the bank should have adequate processes in place to monitor identified controls, ensuring that they are appropriate to mitigate the identified risks to the desired residual level and operating effectively. Next, business entity/unit management must be able to clearly demonstrate how the ORMF is implemented within the business entity/unit, including how specific procedures and processes have been used to facilitate implementation, validation and verification of the ORMF elements, and integration into the decision-making processes. In addition, a bank’s operational risk profile should reflect both the internal and external environment. Risk reporting should provide a clear understanding of the key operational risks, the related drivers, and the effectiveness of risk management. The internal reporting framework should include regular reporting of relevant information at all levels of the bank. The internal reporting framework should be transparent, responsive to changes, appropriate, and support the proactive management of operational risk. Finally, performance management criteria in relation to ORMS elements and outputs should be established.

Data

19. 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 should 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.

20. AMA operational risk data can be grouped into the following four categories: (1) internal loss data, (2) external data, (3) scenario data and data related to a bank’s business environment and (4) internal controls. 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. To maintain consistency, a bank should develop data policies and procedures that include, for example, guidelines around perimeter of application, minimum observation period, reference date, de minimis modelling thresholds, and data treatment.

Gross loss definition

21. An operational risk loss can only arise from an operational risk event. The scope of operational risk loss refers to the type of events, whether or not having an impact on the financial statement, to be included in the operational risk database, and the purposes for which they are included (eg for management and/or measurement purposes).

22. A gross loss is a loss before recoveries of any type. Net loss is defined as the loss after taking into account the impact of recovery. A recovery is an independent occurrence, related to the original loss event, separate in time, in which funds or outflows of economic benefits are received from a third party. For an operational risk event, a bank should be able to identify gross loss, recoveries and any insurance recoveries.

Gross versus net internal loss amounts

23. A broad range of practice in the use of gross or net internal loss amount as input for AMA models was identified in the July 2009 Range of Practice paper. A more consistent practice with regard to this topic can reduce differences in the capital requirement for similar events. An AMA bank should have robust processes to collect operational risk losses based on clear and consistent definitions of “gross loss” and “recoveries”.

24. A bank may use “gross loss amount” or “gross loss amount after all recoveries (except insurance)” as input for its AMA models. The bank should demonstrate to its relevant supervisors that its choice is appropriate and should not use losses net of insurance recoveries as an input for AMA models. There are particular concerns regarding the difficulties this choice could introduce in the calculation of the potential maximum 20% capital reduction allowed for insurance mitigation according to the Basel II framework.

Loss data thresholds

25. The internal loss data threshold is a supervisory requirement that may influence both the management and measurement of operational risk. The Range of Practice paper indicated considerable variation in data collection thresholds vary across banks. Ideally, internal loss collection thresholds are based on statistical evidence showing that losses below the threshold have an immaterial impact on capital calculations. In any case, a bank should be aware of the impact of its thresholds on capital.

26. A bank is responsible for defining and justifying appropriate thresholds for each operational risk class (both for data collection and modelling) and may use different thresholds for data collection and modelling. Thresholds should be reasonable and should not omit operational loss event data that are material for operational risk exposure and for effective risk management. The choice of threshold for modelling should not adversely impact the credibility and accuracy of the operational risk measures.

Date of internal losses

27. Banks generally have several reference dates that can be captured for any individual operational loss, including date of occurrence, date of discovery, date of contingent liability, date of accounting (first financial impact), and date of settlement. The collection of numerous dates does not represent an issue from an operational risk management perspective, as each reference date potentially offers different information on the characteristics of each loss. However, supervisors are concerned that AMA banks could select a reference date for quantification that results in the omission of large internal losses, which can have a significant impact on the bank’s operational risk capital charge at a given

point in time, and over time. Because of the potential for material differences in capital requirement levels for similar risk exposures, supervisors are encouraging convergence of practice in how losses are treated and recorded as operational risk loss events.

28. An AMA bank may use any of the reference dates (occurrence date, discovery date, contingent liability date or accounting date) for building its calculation dataset, and for meeting minimum observation period requirements, as long as material loss data is not omitted.

29. When collecting data, banks typically gather information from at least three reference dates: occurrence date, discovery date and accounting date. The discovery date or accounting date are the most prudent choices for developing a bank's dataset for the quantification of the operational risk capital requirements related to that event. However, institutions may use occurrence date for building the calculation dataset if the institution has not constrained or limited the observation period (ie five years).

Grouped losses

30. Banks sometimes group a number of losses and treat the group as a single loss for recording, management or modelling purposes. Depending on the reasons for grouping losses, the following different guidelines apply:

- (a) Losses caused by a common operational loss event should be grouped and entered into the loss calculation dataset as a single loss, unless a bank chooses to model causality or dependence among those losses in a different manner. A bank's internal loss data policy should establish guidelines for deciding the circumstances, types of data and methodology for grouping data as appropriate for their business, risk management and capital modelling needs. A bank should also clarify and document its individual judgments in applying these guidelines. The bank's policy regarding the threshold and dates for single losses should also be applied to grouped losses;
- (b) A bank that groups small losses with no causal relations for data collection and registration purposes should generally exclude them from their calculation dataset. When they do include them in their calculation dataset, they should demonstrate that the use of this type of grouped losses does not materially distort the capital calculation.

Modelling

31. The flexibility provided in the AMA reflects both the evolving nature 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 by 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.

32. 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.

Granularity

33. Due to the nature and diversity of operational risk across an institution, a bank should define its operational risk categories (ORC). A bank's risk measurement system and capital charge calculation is greatly influenced by the number of ORCs used within the model. There is currently a great variation both in the choice and the number of ORCs used by banks. While it is important that a bank's ORCs reflect the unique nature of its business models and risk profiles, the Committee also aims to ensure that banks use comparable standards when selecting ORCs for modelling operational risk.

Distributional assumptions

34. Distributional assumptions underpin most, if not all, operational risk modelling approaches and are generally made for both the frequency and severity 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.

35. A bank should have a policy that identifies when a loss or an event recorded in the internal (or external) loss event database is also to be included in the calculation dataset. Exceptions to the policy should be limited. In addition, the bank should follow a well specified, documented and traceable process for the selection, update and review of probability distributions and the estimate of its parameters. This process should lead to consistent and clear choices and be mainly finalised to properly capture the risk profile in the tail. Finally the techniques to determine the aggregated loss distributions should ensure adequate levels of precision and stability of the risk measures. The risk measures should be monotonic, reasonable and be supplemented with information on their level of accuracy.

36. Although the technicalities of AMA models predominantly based on scenario analysis (Scenario Based Approaches, or SBA) differ from those of AMA models predominantly based on loss data (loss distribution approach, or LDA), a few supervisory expectations and points of attention can be raised in order to make the identification of distributions in the SBA and LDA processes more consistent with each other. Many observed SBA models do not apply statistical inference to raw scenario data; very often the curves are predetermined and the scenario data are used only to estimate the parameters of those distributions.⁴ Under such a process, the scenario data risks being distorted by an inappropriate choice of distribution. A bank should thus ensure that the loss distribution(s) chosen to model scenario analysis estimates adequately represent(s) its risk profile.⁵

Correlation and dependence

37. Dependence modelling for operational risk is an evolving area, with banks pursuing various approaches for incorporating dependence effects. At the same time, the choice of

⁴ In fact, many banks use the same curve for modelling the severity of the scenario data across all ORCs, regardless of its business, size and complexity. The selection of a single curve across ORCs implies the only admissible driver of variation in the operational risk exposure lies in the scenario driven parameter estimates of the chosen distribution.

⁵ In doing so, banks should also consider the potential differences with an LDA in terms of level of granularity and dependence across the ORCs.

dependence approach can have a significant impact on the capital requirements generated by the model. The results of the LDCE and Range of Practice Papers indicate significant differences in banks' approaches to modelling dependence.

38. Dependence assumptions should be supported to the greatest extent possible by an appropriate combination of empirical data analysis and expert judgment. Assumptions regarding dependence should be conservative given the uncertainties surrounding dependence modelling for operational risk. The degree of conservatism should increase as the rigor of the dependence model and the reliability of the resulting capital requirements estimates decrease.

39. Dependence should not be inappropriately affected by the choice of granularity. Moreover, a bank should perform sensitivity analyses and stress testing (eg different parameter values, different correlation models) on the effect of alternative dependence assumptions on its operational risk capital charge estimate.

Use of the four data elements

40. An AMA for calculating the operational risk capital charge of a bank requires the use of four data elements which are: (1) internal loss data (ILD); (2) external data (ED); (3) scenario analysis (SBA) and (4) business environment and internal control factors (BEICFs). The Basel II Framework anticipated that there would be a need for different "combinations" of the data elements depending on the behaviour of the loss generating process. It places the onus on a bank to illustrate that the combination of the four data elements is sufficient for the purpose of estimating high percentiles.

41. The Committee therefore recognises that there will be jurisdictional differences in the use of the four data elements because of the quantity and relevance of the available loss data and different emphasis in the regulatory assessment of quantitative methodologies. Nevertheless, a number of key issues have been identified that are crucial to the successful implementation of an AMA:

- (a) Internal Loss Data (ILD) - The Committee expects that the inputs to the AMA model are based on data that represent or reflect the bank's business risk profile and risk management practices. It expects ILD to be used in the ORMS to assist in the estimation of loss frequencies, to inform the severity distribution(s) to the extent possible and to serve as an input into scenario analysis.
- (b) External Data (ED) - The Committee expects ED to be used in the estimation of loss severity as such data contain valuable information to inform the tail of the loss distribution(s). ED is also an essential input into scenario analysis. Banks may choose to source ED from a public database, from a consortium where members submit their loss information, or from other means such as collecting relevant ED themselves.
- (c) Scenario Analysis – A robust scenario analysis framework is an important part of the ORMF in order to produce reliable scenario outputs which form part of the input into the AMA model. The Committee acknowledges that the scenario process is qualitative and that the output from a scenario process necessarily contains significant uncertainties. This uncertainty, together with the uncertainty from the other elements, should be reflected in the output of the model producing a range for the capital estimate. The Committee recognises that quantifying the uncertainty arising from scenario biases poses significant challenge and is an area requiring further research.

- (d) BEICFS – Incorporating BEICFs directly into the capital model poses challenges given the subjectivity and structure of BEICF tools. The Committee has observed that BEICFs are widely used as an indirect input into the quantification framework and as an *ex post* adjustment to model output.

42. There are a variety of ways that an AMA model can be constructed to use the four data elements. A bank should carefully consider how the data elements are combined and used to ensure that the bank's level of operational risk capital is commensurate with the level of risk to which it is exposed. A bank should provide a clearly articulated rationale for its modelling choices and assumptions and conduct sufficient research and analysis that support these decisions. The Committee recognises that operational risk modelling continues to evolve and encourages further investigation into the combination of the four data elements within AMA models.

Governance

Verification and validation

43. The Basel Committee has actively promoted the adoption and implementation of sound corporate governance practices by banks. The effective management of operational risk has always been a fundamental element of banks' risk management programmes. However, the Basel II Framework 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.

44. The governance structure commonly adopted by banks for their operational risk discipline relies on three lines of defence: business line management, an independent corporate operational risk management function and independent review. The implementation of these three lines of defence varies depending on a bank's risk management approach and the flexibility provided by national supervisors.

45. Independent validation and verification are components of the third line of defence in the governance structure used to manage operational risk, and serve as a challenge function to the other two lines of defence. This section provides additional supervisory guidelines associated with the verification and validation of an AMA framework. While this issue is highly relevant to an AMA bank, information about verification and validation activities is beneficial to banks using the Basic Indicator Approach and The Standardised Approaches as they enhance their operational risk management processes.

Background

46. The Basel II Framework requires banks to develop an *operational risk management framework*. The ORMF consists of a bank's:

- (a) risk organisational and governance structure;
- (b) policies, procedures and processes;
- (c) systems used by a bank in identifying, measuring, monitoring, controlling and mitigating operational risk; and
- (d) operational risk measurement system.

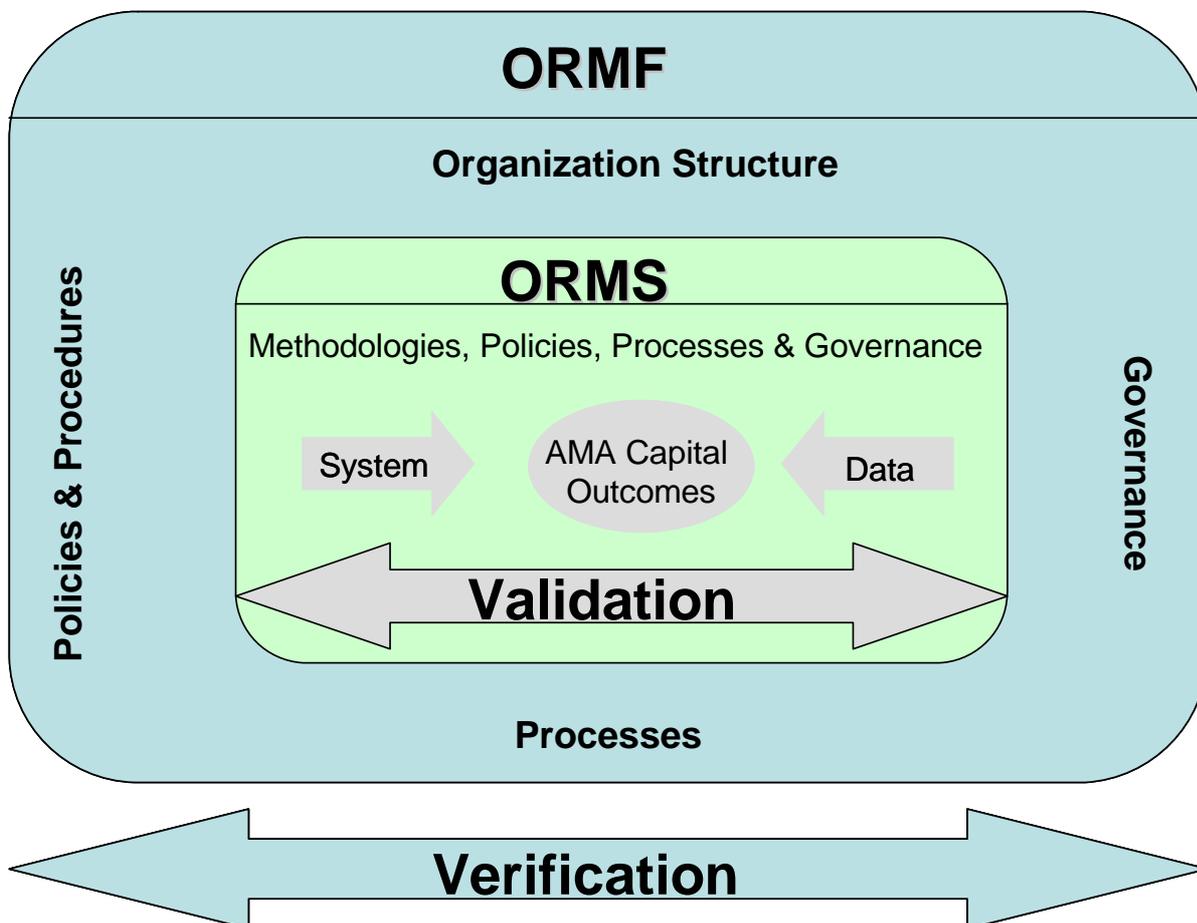
47. A bank's ORMS consists of the systems and data used to measure operational risk in order to estimate the operational risk capital charge. The ORMS must be closely integrated into the day-to-day risk management processes of the bank.

48. Figure 1 below illustrates the relationship between an ORMF and an ORMS.

49. Validation and verification activities comprise the bank's challenge processes that provide independent assessments of ORMF and ORMS effectiveness, and should incorporate both qualitative and quantitative approaches. The effectiveness of the ORMF and ORMS should be reviewed by independent internal or external auditors and/or other independent parties. The purpose of these activities is to ensure that a bank's ORMF is functioning as intended and that it remains appropriate for the bank's risk profile. An independent challenge process is central to the establishment of an effective overall ORMF. Verification and validation activities should encompass all components of the bank's ORMF.

The depth and extent of validation and verification efforts should be consistent with the materiality and complexity of the risk being managed.

Figure 1: Relationship between an ORMF and an ORMS



50. Paragraph 666 (f) of the Basel II Framework broadly addresses the subtle differences between sound verification and validation activities. Verification activities, such as credible and effective challenge functions, ensure that the ORMF, including the ORMS, is well-designed, effectively implemented, operating in a satisfactory manner, consistent with bank policies and procedures, and meets regulatory requirements. Validation activities tend to be more explicit and quantitative, consisting of activities that ensure processes and data flows associated with the ORMS are credible, transparent, well-documented and verifiable (paragraph 669 (f)).

- (a) **Verification** of the ORMF is done on a periodic basis and is typically conducted by the bank's internal and/or external audit, but may involve other suitably qualified independent parties from external sources. Verification activities test the effectiveness of the overall ORMF, consistent with policies approved by the board of directors, and also test ORMS validation processes to ensure they are independent and implemented in a manner consistent with established bank policies.
- (b) **Validation** ensures that the ORMS used by the bank is sufficiently robust and provides assurance of the integrity of inputs, assumptions, processes and outputs. Specifically, the independent validation process should provide enhanced assurance that the risk measurement methodology results in an operational risk capital charge

that credibly reflects the operational risk profile of the bank. In addition to the quantitative aspects of internal validation, the validation of data inputs, methodology and outputs of operational risk models is important to the overall process.

General observations

51. Verification and validation are fundamental components of the AMA. Their activities are both qualitative and quantitative in nature, and consist of inspection, observation, inquiry and confirmation (testing), computation and analytical exercises. Effective verification and validation activities serve as credible and effective challenge functions to ensure the reliability of the overall ORMF and identify where the framework can be improved. The requirement to estimate the operational risk capital charge in AMA models highlights the importance of an effective validation process. The validation process of the ORMS should provide enhanced assurance that the measurement methodology results in an operational risk capital charge that credibly reflects the operational risk profile of the bank. Furthermore, the AMA model should provide the bank's board of directors and senior management with necessary information to understand and effectively manage operational risk exposures as well as the overall ORMF.

52. For these reasons, the bank should establish validation and verification processes to ensure its model and ORMF operate as intended. These activities should enhance the degree of confidence of stakeholders in the bank's AMA framework.

53. Sound validation and verification activities present banks with important challenges:

- (a) A bank must develop and maintain rigorous procedures for independent validation and verification of the ORMS and ORMF. Individuals performing the assessments should be competent and appropriately trained. They should be independent, meaning they cannot influence the development, implementation and operation of the AMA framework. In addition, they may not be part of the corporate operational risk management function. Banks face challenges finding skilled independent staff that meet these criteria to perform validation and verification activities.
- (b) Conventional validation schemes and procedures may be inadequate for the validation of AMA models, thereby requiring a bank to develop new procedures. This challenge may arise from the limited scope of the definition of validation, fragmented or overlapping responsibilities for development and deployment of AMA models and lack of actual independence.
- (c) The scarcity of operational loss data and the ongoing development of AMA models continues to be a challenge for banks

Supervisory guidelines

54. A bank should establish clear and measurable objectives for its verification and validation activities. Verification and validation activities should consider, on an ongoing basis, whether the ORMF and ORMS are appropriate. Verification and validation activities should also provide an effective challenge that questions existing processes and information, while conducting specific testing of procedures and processes, consistent with the unique aspects of the bank's ORMF, ORMS and risk profile. There is no single method that is universally accepted by supervisors.

55. Verification of the ORMF includes testing whether all material aspects of the ORMF have been implemented effectively, remain appropriate, and are performing as intended. Activities⁶ should ensure that:

- (a) Policies, processes, procedures and systems that comprise the bank's ORMF, including the ORMS, are conceptually sound, transparent and documented;
- (b) Business unit activities, the independent corporate operational risk management function and operational risk management governance committees and structures are effective and appropriate;
- (c) ORMF inputs and outputs are accurate, complete, credible, relevant, authorised and accessible;
- (d) Risk monitoring and management of the accuracy and soundness of all significant processes and systems are effective;
- (e) Appropriate remediation is undertaken if deficiencies are identified;
- (f) Outcome analysis is incorporated into bank processes, as appropriate, and is effective (outcome analysis includes comparisons of data elements such as a comparison of BEICFs with actual loss experience, or a comparison of scenario results with internal loss data and external data);
- (g) Validation processes are satisfactory. The verification function should ensure that validation of AMA models is completed in accordance with the bank's model validation policy;
- (h) Tests of operational risk management controls determine whether they are designed to prevent or detect and correct material deviations from or non-compliance with the policies, procedures and processes and operate effectively throughout the period being reviewed;
- (i) Every significant activity and division, subsidiary or other component of the bank is included; and
- (j) There is a periodic independent review of the AMA framework.

56. The validation activity is designed to provide a reasoned and well-informed opinion of whether AMA models work as predicted, and whether their results (capital requirement estimates and other information produced by the ORMS) are suitable for their various internal and supervisory purposes. Validation activities should:

- (a) Have a broad scope, evaluating all relevant items of the ORMS, such as:
 - Distributional assumptions;
 - Correlation assumptions;
 - Documentation;
 - The four elements of the AMA
 - Qualitative aspects (including the internal controls, use test, reporting, role of senior management and organisational aspects);

⁶ Supervisory expectations for the internal audit activities are more broadly identified in the Basel papers *A Framework for Internal Control Systems in Banking Organisations* (BCBS, September 1998) and *Internal audit in banks and the supervisor's relationship with auditors* (BCBS, August 2001). The enumeration here identifies supervisory expectations specifically for the AMA context.

- Technological environment relating to the computational processes; and
 - Procedures for the approval and use of new and modified estimation models or methodologies (such procedures should seek explicit opinion from the validation function in the approval process);
- (b) Evaluate the bank's processes for escalating issues identified during validation reviews to ensure that:
- Escalation processes are sufficiently comprehensive;
 - All significant ORMS concerns are appropriately considered and acted upon by senior management; and
 - All significant ORMS concerns are escalated to appropriate governance committees;
- (c) Evaluate the conceptual soundness – including benchmarking and outcome analysis – of the ORMS and of the modelling output;
- (d) Reflect policies and procedures to ensure that model validation efforts are consistent with board and senior management expectations.
- (e) Assess whether policies and procedures are sufficiently comprehensive to address critical elements of the validation process. These include independent review; clearly defined responsibilities for model development and validation; model documentation; validation procedures and frequency; and audit oversight; and
- (f) Confirm that the relationship between the model's inputs and outputs are stable and that the techniques underlying the model are transparent and intuitive.

Organisational aspects

57. The organisational structure of the verification process will vary depending on the size, complexity and operational risk profile of the bank. Verification activities may be carried out by qualified external parties and/or internal or external audit, if independent of the process or system being reviewed.

58. The validation function should generally be carried out internally by qualified validation resources. However, supervisors recognise that this may present a challenge for some banks.

59. While the outsourcing of verification and validation work is acceptable, the board and senior management are accountable for ensuring that outsourced functions are completed in a manner consistent with the bank's overall verification and validation plan.

Essential elements

60. **Independence:** The bank's verification and validation functions should provide independent assessments and opinions, while avoiding improper influence from those units being reviewed. Personnel conducting verification and validation work should not be involved in the development, implementation or operation of the ORMF or ORMS processes or systems being reviewed, or be subordinate to the units under review. Bank staff performing the verification and validation should be impartial and prepared to challenge management's views and conclusions regarding any aspect of the AMA framework.

61. **Capacity:** Verification and validation functions should be adequately staffed and have reasonable access of resources to perform their duties. The board and senior management are responsible for ensuring that these functions are adequately staffed.

62. **Professional Competence and Due Care:** Bank staff performing verification and validation work should be technically competent, appropriately trained and possess the appropriate skills.

63. **Critical Analysis:** Verification and validation functions should critically analyse all relevant information by questioning the work of the units involved in the design of the ORMF and ORMS.

Work plan

64. A bank should have a broad strategic plan that governs the verification and validation of its ORMF and ORMS. The plan should be approved by the appropriate audit or operational risk committee and should incorporate all relevant business units. The plans should ensure that the bank's ORMF and ORMS are independently reviewed. In addition, the bank should develop more detailed annual plans which state the purpose and tasks to be carried out during upcoming years.

65. The nature, timing and extent of work performed each year should provide a sufficient indication as to whether the bank's ORMF and ORMS: (i) function appropriately, (ii) are consistent with bank policies and (iii) are free of material weaknesses. The frequency with which policies, processes and systems within the bank's AMA framework is reviewed should be based on risk and significance.

66. Independent review plans, including procedures that will be used to test the ORMS and ORMF, should provide for the following expectations:

- (a) Independent review with respect to development, implementation and operation;
- (b) Explicit documentation requirements for major processes and systems;
- (c) Unlimited access to information;
- (d) The nature, timing and extent of planned assessment procedures;
- (e) Follow up on outstanding items from previous reviews;
- (f) Frequency of the independent review; and
- (g) Audit involvement or oversight over independent review work performed by third parties.

Verification and validation work plans should cover, at a minimum, the areas outlined above.

Reporting

67. Results from verification and validation work should be documented and distributed to appropriate business line management, internal audit, the corporate operational risk management function and appropriate risk committees. Bank staff ultimately responsible for the validated units should have access to, and an understanding of, these results.

68. Reporting should include underlying processes to resolve deficiencies and weaknesses, ensuring that corrective actions are implemented in a timely manner. Internal audit should evaluate management's response to significant findings.

69. **Board Reporting:** Results of verification and validation reviews (including senior management's attestation) should be summarised and reported annually (or periodically, as appropriate) to the bank's board of directors, or a committee thereof, for approval. Attestation by senior management entails review and approval of the effectiveness of the bank's ORMF and states that the ORMF, including the ORMS, is working appropriately.

70. **Monitoring/Periodic Reporting:** The verification and validation reporting should:

- (a) Summarise the verification and validation work done, indicate any limitations in the scope of work performed and detail the deviations from the plan;
- (b) Contain the assessment of the verification or validation teams on the essential elements of the area or model being reviewed (validation reports should assess the suitability of the model for internal use);
- (c) Identify weaknesses and their potential consequences, including deviation from or non-compliance with objective criteria, policy, procedures and Basel II Framework requirements;
- (d) Establish a corrective action plan and specific timeline for remediation as appropriate for significant deficiencies and weaknesses;
- (e) Establish a procedure to resolve disagreements between the verification and validation units and among the areas and units being reviewed; and
- (f) Be distributed, at the minimum, to the senior management, the board of directors and the individuals in charge of the relevant organisational units.

Use test and experience

71. Banks use various approaches in an attempt to clearly articulate and demonstrate the integrated use of their ORMF. This is especially the case with the use of the ORMS within their day-to-day decision-making practices. This section outlines the Committee's expectations as to how a bank's articulation and demonstration of its ORMF is embedded into decision-making practices, for the initial AMA assessment and on an on-going business-as-usual basis. Such a demonstration should answer the questions of whether and how a bank uses the ORMF. The key elements of an ORMF have been described in the Introduction to these Supervisory Guidelines.

Background

72. A bank should continue to enhance the integrated use of its ORMF in accordance with paragraph 666 (b) of the Basel II Framework, *"the bank's internal operational risk measurement system should be closely integrated into the day-to-day risk management processes of the bank"*. The parallel run required by certain jurisdictions at the initial AMA review is expected to form part of the supervisory assessment. The ORMF must be updated regularly and evolve as improvements in the management and quantification of operational risk are realised.

General observations

73. "Embeddedness" is defined as the level to which ORMF processes and practices have been embedded across a bank's organisational levels. The supervisory review of

embeddedness entails an assessment of managerial judgment and decision making and is broader than a “point-in-time” assessment. Use of the ORMF in decision making over a sustained period provides an indication of a bank’s degree of embeddedness. The requirement that the bank’s internal operational risk measurement system should be closely integrated into the day-to-day risk management processes of the bank is ongoing and banks will need to ensure that their ability to demonstrate embeddedness is not adversely impacted over time by change.

Supervisory guidelines

74. The bank should have a sustainable and embedded ORMF in its overall risk management decision-making processes that clearly indicates the level of integration between the measurement and management processes of the ORMF throughout the entire institution. The ORMF, including the ORMS, should be updated on a regular basis and become more embedded as the operational risk discipline further evolves.

75. The bank should incorporate the following guidelines in its assessment of an AMA’s use and embeddedness:

- (a) The purpose and use of an AMA should not be solely for regulatory compliance purposes;
- (b) As the bank gains experience, an AMA should reflect evolving risk management techniques;
- (c) An AMA should support and enhance the bank’s operational risk management policies and practices; and
- (d) An AMA should benefit a bank in the management and control or mitigation of operational risk.

Strategic and operational business planning process

76. A bank’s strategic and business planning processes should consider its operational risk profile, including outputs from the ORMS. Potential material changes to the operational risk profile resulting from strategic and business planning change should be appropriately reviewed, considered, reported and monitored.

Operational risk appetite and tolerance⁷

77. A bank’s board of directors should approve and review a clear statement of operational risk appetite and tolerance. Risk appetite and tolerance statements should: account for all relevant risks, including the bank’s current financial situation and strategic direction; encapsulate various risk tolerance and/or threshold levels; and detail how the board of directors will monitor and manage adherence to the risk appetite and tolerance statement. The board of directors and senior management performance assessment should

⁷ “Risk appetite” is a high level determination of how much risk a firm is willing to accept taking into account the risk/return attributes; it is often taken as a forward looking view of risk acceptance. “Risk tolerance” is a more specific determination of the level of variation a bank is willing to accept around business objectives that is often considered to be the amount of risk a bank is prepared to accept. In this document the terms are used synonymously.

reflect and measure adherence to the risk appetite and tolerance statement and be applied and monitored across all business entities.

Control effectiveness

78. The bank should have adequate processes in place to monitor the identified controls and ensure they are appropriate to mitigate the identified risks to the desired residual level. The processes should include the identification, review, escalation and remediation of the issues identified.

79. The ORMS elements should provide a key input into the assessment and ongoing monitoring of the control's effectiveness in relation to the risk appetite and tolerance statement. For example, during the stressing of the control environment in a scenario workshop (as a result of a loss event or from monitoring of indicators), weaknesses within the control environment may be detected. Additionally, the results from the ORMS elements should reflect the control environment. For example, a material deficiency in the control environment should result in a review of the relevant elements of the ORMS and the operational risk capital charge estimates.

Data

Gross loss definition

Background

80. Paragraph 673 of the Basel II Framework states that, “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.”

General observations

81. The Basel II Framework does not provide specific definitions for “gross loss” and “recoveries” which has resulted in significant industry variation in loss data collection practices. While industry consortiums have provided standard definitions, the Range of Practice Paper identified that quantification practices for similar events among AMA banks remains too broad. The disparity is particularly broad in the use of gross or net loss amount which may be one of the causes of the significant differences in banks’ respective capital charge calculations. Additionally, the use of loss net of insurance and other risk mitigation techniques poses challenges to banks and supervisors in determining the percentage of insurance and other risk-mitigating offsets that are embedded in the operational risk capital charge calculation.⁸

Supervisory guidelines

82. The following guidance sets forth standards for “gross loss” and “recoveries”, including specific items for inclusion and/or exclusion. The guidance generally parallels consortia practices. Common definitions will bring more consistency to loss data collection and treatment for purposes of quantification.

83. An operational risk loss can arise only from an actual operational risk event. Some operational risk events may have an impact on the financial statements of the firm while others are only detectable from other sources.⁹ Regardless of its impact on the financial statements, the scope of operational risk loss refers to the type of events, included in the operational risk database as well as the reasons for which they are included (eg for management and /or measurement purposes).

Items included in or excluded from the gross loss computation

84. A gross loss is a loss before recoveries of any type. Net loss is defined as the loss after taking into account the impact of recovery. A recovery is an independent occurrence, related to the original loss event, separate in time, in which funds or inflows of economic

⁸ Refer to the Committee’s *Recognising the risk-mitigating impact of insurance in operational risk modeling*, October 2010.

⁹ For example, managerial archives or incidents dataset.

benefits are received from a third party.¹⁰ For an operational risk event, a bank should be able to discretely identify the gross loss amount as well as any recoveries and insurance recoveries.

85. The following specific items should be *included* in gross loss computation.

- (a) Direct charges (including impairments) to the statement on comprehensive income and write-downs due to operational risk events.
- (b) Costs incurred as a consequence of the event that should include external expenses¹¹ with a direct link to the operational risk event (eg legal expenses directly related to the event and fees paid to advisors, attorneys or suppliers) and costs of repair or replacement, to restore the position that was prevailing before the operational risk event.
- (c) Provisions (“reserves”); the potential operational loss impact is reflected in the comprehensive income statement and should be taken into account in the gross loss amount.
- (d) Pending losses stem from operational risk events with a definitive financial impact, which are temporarily booked in transitory and/or suspense accounts and are not yet reflected in the statement of comprehensive income. For instance, in some countries, the impact of some events (eg legal events, damage to physical assets) may be known and clearly identifiable before these events are recognised through the establishment of a reserve. Moreover, the way this reserve is established (eg the date of recognition) can vary across institutions or countries. “Pending losses”, that are recognised to have a relevant impact, should be included in the scope of operational risk loss within a time period commensurate to the size and age of the pending item; this can be done through the recognition of their actual amount in the loss database or pertinent scenario analysis.

86. The following specific items should be *excluded* from the gross loss computation. It should not be considered to be an exhaustive list:

- (a) Costs of general maintenance contracts on property, plant or equipment;
- (b) Internal or external expenditures to enhance the business after the operational risk event: upgrades, improvements, risk assessment initiatives and enhancements ;
- (c) Insurance premiums.

87. The inclusion or exclusion of the following items depends on their nature and materiality.

- (a) **Timing losses** are defined as the negative economic impacts booked in an accounting period, due to operational risk events impacting the cash flows or financial statements of previous accounting periods. Timing impacts typically relate to the occurrence of operational risk events that result in the temporary distortion of

¹⁰ Examples of third parties are insurers providing a settlement or other parties (for instance when there is a recovery of fraud loss from a perpetrator or a recovery of a misdirected transfer from the wrong beneficiary).

¹¹ Capture and analysis of internal costs, while not required for capital estimation, can be useful for understanding the risk profile and managing risk, and is encouraged. In some cases, certain expenses that do not represent usual or customary costs of business should be considered for inclusion in loss amounts for capital estimation, for example excessive bonus payments resulting from internal fraudulent or unapproved trading activities.

an institution's financial accounts (eg revenue overstatement, accounting errors and mark-to-market errors). While these events do not represent a true financial impact on the institution (net impact over time is zero), if the error continues across two or more accounting periods, it may represent a material misrepresentation of the institution's financial statements. Material "timing losses" due to operational risk events that span two or more accounting periods should be included, ie full amount that includes make-up payments as well as penalties and interest, in the scope of operational risk loss when they give rise to legal events.

- (b) **Rapidly recovered loss events** are operational risk events that lead to losses recognised in financial statements that are recovered over a short period. For instance, a large internal loss is rapidly recovered when a bank transfers money to a wrong party but recovers all or part of the loss soon thereafter. A bank may consider this to be a gross loss and a recovery. However, when the recovery is made rapidly, the bank may consider that only the loss net of the rapid recovery constitutes an actual loss. When the rapid recovery is full, the event is considered to be a "near miss".

Measures of the gross loss amount

88. There are different ways to measure the gross loss amount:

- (a) **Mark-to-market:** the economic impact of an operational risk loss is usually the same as the accounting impact when an operational risk loss affects assets or accounts treated on a mark-to-market basis. In such cases, the gross loss amount is the loss or adjustment as recognised in the comprehensive statement of income.
- (b) **Replacement cost:** the economic impact of an operational risk loss usually differs from the accounting impact when losses affect assets or accounts that are not maintained on a mark-to-market basis such as property, plant, equipment or intangible assets. The gross loss amount is the replacement cost of the item.¹² Replacement cost means the cost to replace an item or to restore it to its pre-loss condition.^{13,14}

Other cases

89. Some items are important for risk management although they may be beyond the scope required for quantification. In particular, the items below can be useful for promptly detecting failures and errors in processes or internal control systems. These items may also be useful inputs for scenario analysis.

- (a) **"Near-miss events":** operational risk events that do not lead to a loss. For example, an IT disruption in the trading room just outside trading hours.
- (b) **"Operational risk gain events":** operational risk events that generate a gain.

¹² It is estimated before taking into account recoveries (such as insurance coverage, legal judgments/settlements or other recoveries).

¹³ By coherence with item 2 related to excluded items: enhancements or upgrades should not be taken into account.

¹⁴ For example, when a fully depreciated or amortised building is destroyed, the gross loss amount would be the replacement cost of restoring the building to its original condition at the time of the loss.

- (c) **“Opportunity costs/lost revenues”**: operational risk events that prevent undetermined future business from being conducted (eg unbudgeted staff costs, forgone revenue and project costs related to improving processes).

Gross versus net internal loss amounts

90. A broad range of practice in the use of gross or net internal loss amount as input for AMA models was identified in the Range of Practice Paper. A more consistent practice in this issue can reduce differences in the capital requirement for similar events.

Background

91. The Basel II Framework does not provide definitions for “gross loss” and “recoveries,” nor does it clarify whether the AMA input should be “gross loss” or “net loss”. Paragraph 673, states: *“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.”*

92. The “collection of gross versus net internal loss amount” is described in the Range of Practice Paper. The timing of a recovery often comprises elements of the criteria banks use to determine whether the gross loss amount recorded in their internal loss database and/or used for risk measurement purposes should be net of the amount recovered. Some losses that are fully-recovered rapidly and, according to banks’ netting criteria, would not be recorded as a loss event. The nature of the underlying transaction and/or the counterparty may also be considered in these cases.

93. Different practices among banks can result in significant differences in the “gross loss” amount recorded for similar events.

94. The Range of Practice Paper indicated a clear supervisory concern related to the use of loss net of insurance recoveries as an input for AMA quantification.

General observations

95. According to the Range of Practice Paper, there was a broad range of practice in the use of loss amount as the AMA input. Many of the 42 participating AMA banks (43%) used “gross loss after all recoveries (except insurance)”. “Gross loss before any recoveries” was used by 29%. Other loss amounts used by participating banks include “net loss” (14%) and “other definition” (12%). Regionally, there were some differences as well.

96. The Basel II Framework and the Committee’s document *Recognising the risk-mitigating impact of insurance in operational risk modelling* outline specific requirements for AMA banks using insurance risk mitigation.

Supervisory guidelines

97. Considering the progress of AMA implementation, a bank should have strong processes to collect operational risk losses based on clear and consistent definitions of “gross loss” and “recoveries”. Supervisory expectations on gross loss definition and recoveries are treated in another section of this paper.

98. Banks should follow the guidelines below on the use of internal loss amount to enhance consistency and harmonisation in the implementation of AMA models across jurisdictions.

99. A bank may use “gross loss amount” or “gross loss amount after all recoveries (except insurance)” as an input for its AMA models and should demonstrate to its supervisor the rationale for this choice. Additionally, a bank should collect gross losses and recoveries separately and use the information for risk management purposes.

100. A bank should not use loss net of insurance recoveries as an input for its AMA models. An approach using loss net of recoveries and insurance recoveries may prove especially difficult in the calculation of the maximum 20% capital requirements reduction permitted for insurance mitigation in the Basel II Framework and discussed in *Recognising the risk-mitigating impact of insurance in operational risk modelling*.

101. A bank should use conservative data as an input for the AMA capital requirements. There are specific limitations and requirements for the use of risk mitigation from insurance in the operational risk capital charge estimation.

102. Conservatism should be considered, for example, following a significant loss event, where a bank receives recoveries after a considerable delay. During this timing lag “gross loss” may represent a material impact on the statement of comprehensive income. The prevalent practice of “gross loss amount after all recoveries (except insurance)” as a model input should be rigorously challenged in these circumstances. For this kind of loss event, it may be more appropriate to use the “gross loss amount” even when those losses are fully recovered.

103. The recognition of insurance in operational risk capital models is in an early stage of development. A bank should calculate the total operational risk capital charge gross of insurance recovery in order to determine the 20% limit and isolate the bank’s methodology for modelling insurance mitigation.¹⁵

¹⁵ Refer to the Committee’s *Recognising the risk-mitigating impact of insurance in operational risk modelling*, October 2010.

Internal loss data thresholds

Background

104. The Basel II Framework states in paragraph 673, that an AMA 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. However, particular thresholds should be broadly consistent with those used by peer banks.”

General observations

105. The internal loss data threshold is a supervisory requirement that may influence both the management and measurement of operational risk. The Range of Practice Paper showed that data collection thresholds vary widely across banks and types of activity. Some banks apply high thresholds to avoid cluttering their databases with events that are judged to be immaterial, while others choose lower thresholds in order to obtain more information on their loss events.

106. Ideally, internal loss data collection thresholds are based on statistical evidence indicating that losses below the threshold have an immaterial impact on the calculation of the capital charge. 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, a bank should be aware of the impact thresholds have on the capital charge.

Supervisory guidelines

107. A bank is responsible for defining and justifying appropriate thresholds for each operational risk class, both for data collection and modelling.

108. A bank may use different thresholds for data collection and modelling. A lower threshold may be desirable for risk management (eg to examine credit card fraud) and expected loss calculation.

109. A bank should examine the following points when justifying its decision:

- (a) Sufficiency of data for statistical modelling;
- (b) Ability to reconcile between accounting and loss data or demonstrate assurance of data quality (an elevated threshold could lead to significant gaps between the sum of losses in the database and the actual loss without being able to explain them);
- (c) Ability to calculate expected losses for each risk class;
- (d) Capacity to make management decisions to avoid, mitigate, transfer or take operational risk; and
- (e) Whether thresholds account for the inherent risk and complexity of the class and the related business (a lower threshold could be chosen for retail business due to the high frequency of losses).

110. It should be noted that the threshold for internal loss collection processes corresponds to the gross loss amount.

111. Thresholds for data collection and risk management should be reasonable and should not omit operational loss event data that are material for operational risk exposure and for effective risk management.

112. A bank should be aware of the effect of loss data collection thresholds on the management of operational risk. This is especially important for a bank with high thresholds for data collection.

113. The choice of threshold may greatly affect the manner in which operational risk is managed. A bank should ensure that its choice of thresholds provides a clear understanding of realised as well as potential operational losses.

114. Data collection thresholds should capture all material losses in terms of their value. A bank should verify, on a regular basis, that its choice of thresholds includes all material operational risk losses for risk management purposes. For example, a bank may attempt to collect all below-threshold items for a given period and then reconcile them with accounting data to examine the effect of including these losses in management action.

115. In the case of very high frequency losses with no causal relationships (but with common features¹⁶) that are below the threshold, a bank may individually collect these losses or group them in order to collect their aggregated amount and features for risk management purposes.¹⁷

116. It is important to note that the €10,000 threshold mentioned in paragraph 673 of the Basel II Framework is merely an example of a threshold. Implementing this threshold, without further analysis, would not be acceptable by supervisors.

117. The choice of threshold for modelling should not adversely impact the credibility and accuracy of the operational risk measures.

118. A bank may establish a de minimis “modelling threshold” for an ORC so that the frequency and severity distributions in each ORC are fitted to the data only above the threshold.

119. Use of de minimis modelling thresholds that are much higher than the data collection thresholds should be limited and properly justified by sensitivity analysis at various thresholds. Moreover, changes in the de minimis modelling thresholds, when not embedded in the model engine and driven by specific reasons (eg discount rates), should be limited in number and duly motivated by the need to better capture the risk profile of the ORC.

120. All operational losses above the set de minimis modelling threshold should be included in the calculation dataset and used, whatever their amounts, for generating the regulatory measures.¹⁸

¹⁶ For instance, amounts below the threshold related to external frauds on payment cards.

¹⁷ See also specific recommendations in the group losses section regarding the use of this type of grouped losses in quantification.

¹⁸ See the section on distributional assumptions for exceptions to this rule.

Date of internal losses

121. The Range of Practice Paper identified a broad range of approaches in the recognition and use of internal losses as an input for AMA modelling. While banks' practices in this area tend to be heavily influenced by accounting or provisioning practices, there remains significant industry divergence in institutional practice that could generate results that are inconsistent with a bank's actual operational risk profile. A more consistent industry practice should reduce differences in capital requirements for similar exposures.

Background

122. Internal loss data must link a bank's risk estimate to actual loss experience. Paragraph 673 of the Basel II Framework states that "*internal loss data must...capture all material activities and exposures ...*" and that "*a bank should collect [descriptive] information about the date of the event... [that is] commensurate with the [loss's] size*". The Basel II Framework provides no guidance, however, on the appropriate reference date to include losses (including litigation-related exposures) in its dataset for quantifying operational risk capital requirements.

123. Banks generally have several reference dates that can be captured for any individual operational loss, including date of occurrence, date of discovery, date of contingent liability (IAS 37), date of accounting (first financial impact) and date of settlement.

124. By definition, litigation-related losses are considered internal operational risk losses; however, they differ from most internal losses because often the amounts are not entirely quantified and do not affect a bank until months or years after the event. In legal cases the sequence of dates is similar to other operational risk losses except that the date of accounting is sometimes considered the date when a legal reserve is established for the probable estimated loss in profit and loss accounts. The ultimate loss is then recorded in its totality on the date of settlement or agreement.

125. The Range of Practice Paper demonstrated that banks have varying practices regarding which of these dates is used for recording legal losses in their databases and which are used for quantifying the operational risk capital charge. The divergence exists for the following reasons: (1) initial amounts claimed in lawsuits can differ significantly from the actual amount paid; (2) final settlement amounts can differ significantly from reserve estimates or initial legal judgments; or (3) institution concerns that early public recognition, or private disclosure to opposing legal counter-parties of internal estimates of potential settlements, could increase the likelihood and size of legal losses.

General observations

126. Banks currently capture several dates for an operational risk event. Because of the multiple dates that relate to any single event, a bank may use (one) reference date(s) for risk management and reporting purposes and another reference date for quantification purposes. The date used for quantification is critical as it is used to fulfil the minimum observation period envisaged by the Basel II Framework. When losses are litigation-related, the added reference date (ie date of settlement) can lead to further divergence. This deviation in practice was identified in the Range of Practice Paper, indicating that just over one-quarter of AMA banks use the date of establishing a legal reserve in the AMA capital charge calculation. Other dates used include settlement date (12%), accounting date (10%), date of discovery (17%), or date when first confirmed or validated (7%).

Supervisory guidelines

127. The collection of numerous dates does not represent a concern from an operational risk management perspective, as each reference date offers potentially different information on the characteristics of each loss. A bank should not select a reference date for quantification that results in the omission of large internal losses as this can have a significant impact on the bank's operational risk capital charge. Due to the potential for material differences in capital requirement levels for similar risk exposures, supervisors are encouraging convergence of practice in the way losses are treated and recorded as operational risk loss events. This issue is particularly relevant for institutions that use the occurrence date to build their calculation dataset, and in regions where legal losses represent a material amount of all losses.

128. These guidelines are designed to encourage more consistency to AMA models and more harmony to AMA implementation in different jurisdictions for building a calculation dataset.

129. A bank may use any of the reference dates (occurrence date, discovery date, contingent liability date or accounting date) for building its calculation dataset, and for meeting minimum observation period requirements as long as material loss data is not omitted. No other dates are acceptable for building a calculation dataset.

130. The building of a proper calculation dataset from available internal/external data is critical to the quantification of a bank's operational risk capital charge and for accurately representing its operational risk profile. To maintain consistency, a bank should develop policies and procedures that include guidelines around the perimeter of application, minimum observation period, reference date, de minimis modelling thresholds and data treatment.¹⁹

131. A bank should select the appropriate reference date in order to extract data from the internal/external database, thereby ensuring that the Basel II Framework minimum observation period is fulfilled. When collecting data, banks usually gather information from three reference dates: occurrence date, discovery date and accounting date. The discovery date and accounting date are the most prudent choices for developing a bank's dataset for the quantification of the operational risk capital requirements related to that event. However, a bank may use the occurrence date for building the calculation dataset if the bank has not constrained or limited the observation period. Because there is often a time lag between the actual occurrence and discovery of an operational risk event,²⁰ material losses could be excluded if the occurrence date falls outside of the time series used for the capital charge estimation. For this reason, a bank should carefully consider the time series used for the frequency and severity estimation and should incorporate an observation period that avoids the omission of any material loss data.

132. Consistent with other operational risk losses, a bank should use a date no later than the date of reserve for including legal related losses/exposures as an input in its AMA model.

133. Differences as to when legal losses are recognised may impact the measurement of operational risk exposure for similar events. Consequently a bank should follow the principle of conservatism when considering the inputs in its AMA model. Given the time lag between the legal proceeding and its conclusion, a date that is no later than the date for establishment

¹⁹ The latter two areas are discussed in the section on distributional assumptions of this paper.

²⁰ Litigation-related losses result in further delay.

of a legal reserve provides consistency and conservatism and more effectively reflects the bank's operational risk profile.

134. Because a legal exposure can change over time, a bank should consider alternative methods for the inclusion of legal events in the interim (eg through scenario analysis). That is, from discovery date until the date of accounting of the legal reserve, these events are recognised potential exposures that may potentially impact the bank's operational risk profile. A bank should also implement a robust process for updating legal event exposures between the reserve date and settlement date.

135. Consider the following example to illustrate:

Bank X is named in an investor lawsuit claiming inadequate and misleading disclosure of mortgage-related losses on 4 May 2006 (discovery date). The suit asks for monetary damages for investment losses in the amount €5 billion. At the discovery date, when the bank was served with a potential exposure of €5 billion, legal counsel indicated that the suit had no merit, and that the likelihood of loss is remote. On 15 November 2008, following a review of internal documents/discovery the bank's legal counsel recommends that the "least cost" would be to settle the case for €1 billion. As a result, the bank takes a reserve for that amount. The case is settled two years later (settlement date) for €2 billion.

At the reserve date, the exposure of €1 billion is reasonably probable and it has been reasonably estimated. Supervisors expect the reserve amount of €1 billion to be reflected as a direct input into the AMA model. However, between the discovery date and the reserve date, legal counsel updates the probability that some settlement would be paid. During that time period the bank should consider reflecting this exposure in the capital calculation, for instance by a scenario analysis.

Between the reserve date and settlement date, the exposure may increase or decrease based on the outcome of settlement negotiations. In this example, the settlement amount increased to €2 billion, so during the period between the reserve date and settlement date that bank should reflect the increased exposure in its' AMA capital requirement estimation process. Alternatively, if the exposure declined to €500 million, the bank should reflect the decreased exposure in its' AMA capital requirement estimation process. However, if the bank paid a settlement as a provisional execution following a court decision, only to have the decision/settlement overturned or reduced, the bank should reflect the paid amount as its' gross loss with any reduction reflected as a recovery.

136. The diverse use of dates for quantification purposes raises questions as to whether a bank's operational risk profile quantification properly reflects all known operational risk exposures. The example above clearly illustrates that a bank that uses settlement date rather than accounting date may in fact omit a material exposure for an extended time period.

137. Date of reserve is a sensible option for improving industry convergence because the loss exposure is reasonably estimated and it can be reconciled to the general ledger. Convergence would likely ensure that similar legal exposures across banks do not materially differ in the determination of a bank's calculation dataset.

138. Supervisors understand industry concerns that including legal events in the loss database prior to settlement may lead to an increase in the frequency and severity of legal settlements. Several banks continue to raise this matter contending that the loss data and accompanying descriptive information could be revealed through the discovery process in a legal proceeding, thereby increasing the likelihood and magnitude of an adverse outcome. However, this concern lacks credibility, as many banks have developed processes to provide

information on legal events that support their AMA modelling methodology without disclosing confidential data. As a result, a bank should capture all known legal-related exposures in its operational risk measurement and management systems.

Grouped losses

Background

139. Banks sometimes group a number of losses and treat the group as a single loss for recording, management or modelling purposes.

140. Paragraph 673 of the Basel II Framework states that “A bank must develop specific criteria for assigning loss data arising from related events over time,” but provides no further details. This section clarifies the treatment of grouped losses in models, including their dates and thresholds.

General observations

141. Banks group their losses for the following two reasons.

- (a) **Situation 1:** Losses caused by a common operational risk event, which may materialise over a period of time, are grouped together and entered into the model as a single loss.

Example 1: A natural disaster causes losses in multiple locations and/or across an extended time period.

Example 2: A breach of a bank’s information security results in the disclosure of confidential customer information. As a result, multiple customers incur fraud-related losses that the bank must reimburse. This is sometimes accompanied by remediation expenses such as credit card re-issue or credit history monitoring services.

- (b) **Situation 2:** Small losses with no causal relationship but with some common features are recorded in the database and reported to the management as one group.

Example 1: Credit card fraud-related losses discovered during a given period are grouped together and recorded in the loss database (total number and total amount of losses are recorded).

Example 2: Losses smaller than €100 that occur in a particular business line are grouped together and recorded in the loss database, while losses over €100 are treated as single events.

142. Situation 1 refers to multiple losses that are treated as a single loss for modelling purposes. Banks typically group losses with similar underlying causes and treat them as a single loss in their modelling. However, the losses differ depending on varying interpretations of causality. Some banks use the date of the underlying cause, often assigning the date of the first loss in the group. Other banks (have a policy of limiting the use of internal loss data by age) use the latest date among the series of losses to ensure the grouped loss is not prematurely discarded (eg using only the internal loss data that occurred within the past seven years).

143. Situation 2 refers to practices in which several losses are treated as a single loss for the purpose of loss database entries. Some banks wish to be informed of these small losses for risk management purposes, but they doubt cost of individually recognising and registering those small losses is justified. Such banks often enter these grouped losses into their models directly, thereby entering the grouped losses as a single loss. Some banks ungroup the bundled data/losses and input individual losses (eg inputting the number of grouped losses with their average loss amount).

Supervisory guidelines

144. Different guidelines apply for Situation 1 and Situation 2.

Losses caused by a common operational loss event

145. Losses caused by a common operational loss event should be grouped and entered into the calculation dataset as a single loss, unless the bank chooses to model causality or dependence among those losses in a different manner.

146. A bank's internal loss data policy should establish guidelines²¹ for deciding the circumstances, types of data and methodology for grouping data as appropriate for their business, risk management and capital charge modelling needs. They should also clarify and document their individual judgments in applying these guidelines.

147. The bank's policy about the threshold and dates for single losses should also be applied to grouped losses.

148. Since the losses in this case should be treated as a single loss modelling purposes, the threshold should be applied to the grouped loss comprised of ostensibly single losses. As such, a bank should ensure its threshold is not circumvented or compromised because of failure to collect some of the losses that could comprise the group.

149. An unacceptable example:

Bank X sets its threshold for its modelling at €10,000 and it neither collects nor enters losses smaller than that amount in its internal loss database. It also has a policy of grouping losses together that are caused by the same underlying event.

A natural disaster hits its three branches over a week and damages each of them, resulting in an €8,000 loss for each. However, each branch did not report its loss because its damage was below the €10,000 threshold. As a result, the loss that would have amounted to €24,000 in sum was not used in their risk calculation, although the bank has the policy of using all the losses that are greater than €10,000.

150. To prevent such cases from occurring, internal loss data collection procedures and internal controls should be sufficiently robust to ensure information capture and data

²¹ Examples of guidelines:

Example 1: Several causal damages due to one typhoon that were incurred within 72 hours are treated as a single loss.

Example 2: Several losses from internal frauds in the same business line by the same person are treated as a single loss.

grouping consistent with the firm's policy. Oversight, communication and assurance processes should ensure firm-wide understanding of the policy, information sharing regarding events that may have related or delayed impacts, and review processes to test the grouping of data for conformance with policy. The independent review function also should review data grouping as part of its verification activities.

151. A bank should be consistent in dating these grouped losses for modelling purposes; that is, it should apply the same policy to single losses as it does to grouped losses.

152. For a bank that limits the use of internal loss data by age (eg using only the internal data that occurred within the past seven years), special consideration should be taken to ensure that grouped losses are not discarded too early.

153. If a significant time lag exists between an incident's discovery date and the dates of the related grouped losses, the more recent discovered losses may not be included in the calculation dataset if their reference date falls outside of the bank-determined observation period. A more prudent practice would consider the date of the last discovered/accounted loss as the reference date for all the related loss events and include the related losses in the calculation dataset as a single loss with the severities of the individual losses added together.

Losses without causal relations

154. A bank that groups small losses above the threshold for modelling²² with no causal relations for data collection and registration purposes generally should not include them in its calculation dataset. If a bank chooses to include these losses in its calculation dataset, it should demonstrate that the use of this type of grouped losses does not materially distort the capital requirements calculation.

155. When banks group losses in this way (ie grouping losses with no causal relations) and decide to enter them into their models, some banks input them as bundles of data points/losses. Other banks may decide to ungroup the losses that comprise the groups and input them individually, instead of inputting the bundles. A bank should not input bundles of data points that have no causal relationship as it distorts reality and lacks theoretical grounding. A bank that wishes to apply this grouping method should demonstrate that it does not materially distort the capital requirements calculation and that the model output is independent of the grouping methods.

156. Ungrouping bundled losses may provide a bank with a dataset that more accurately reflects its risk profile than bundled losses. However, in most cases, a bank does not have information about individual losses (eg loss amounts and dates for individual losses) as the purpose of grouping losses is to simplify the data collection process. In these cases, the bank should approximate individual losses (eg inputting the number of grouped losses with an average loss amount assigned to each) and ensure that the effect of this approximation is immaterial to the calculation results.

157. A bank should not circumvent or infringe its threshold by grouping losses. One such unacceptable example:

²² This means that the sum of the group of losses is above the threshold, while individual losses are below the threshold.

Bank Z implements a €1,000 threshold for modelling purposes. The bank groups "cases of minor damage to physical assets which can easily be replaced from inventory" that occurred during a given year and enters them as a single entry into its database for management purposes. This year, the losses were reported as an estimation of 1000 events with a total estimated amount of €50,000. Consequently, the bank decided that there were no losses above the modelling threshold of €1,000, since the average amount of losses was €50. However, the reality (not known to the bank) was that there were 999 cases of theft or damages with a €49 loss and a single €1,049 theft, which was ignored. The bank should have identified this major loss and ensured that it was reflected in its models.

158. Similar to the first example, strong governance on data collection procedures is essential to preventing such cases. In the example above, Bank Z's corporate operational risk management function should have monitored possible events that needed grouping and ensured that the branches collected necessary losses.

159. In both Scenario 1 and Scenario 2, special consideration of issues related to data grouping is required in the case of a merger. For example, when quantifying the operational risk of a merged bank, all the relevant losses, including those that occurred before the merger, with a common underlying cause should be grouped together before being input into the model. When this is not feasible, a bank should ensure that the effect of not doing so is insignificant to the quantification result.

Modelling

Most AMA models are currently based on either the loss distribution approach (LDA) or on the scenario-based approach (SBA).²³ While some of the criteria and examples under this section are more applicable to one approach than another, the underlying principles are meant to be generally valid; therefore they should be applicable to any AMA method. This in particular holds for the “Building of the calculation dataset” and “Determination of aggregated loss distributions and risk measures” Sections, which are elaborated having the LDA as reference, but that should be applied to the maximum extent to other approaches such as the SBA.

Granularity

Background

160. In accordance with paragraph 669(c) of the Basel II Framework, an AMA 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”.

General observations

161. Due to the nature and diversity of operational risk, banks define operational risk categories (ORC) along which they measure their operational risks. A bank’s risk measurement system and capital charge calculation is greatly influenced by the number of ORCs used within the model. There is currently considerable variation both in the choice and the number of ORCs used by banks. While it is important that a bank’s ORCs reflect the unique nature of its business models and risk profiles, the Committee also aims to ensure that banks use comparable standards when selecting ORCs for modelling operational risk.

Supervisory guidelines

162. When choosing their operational risk categories, a bank should take into account the nature and complexity of business activities and the operational risks to which they are exposed.

163. When modelling operational risks, a bank should ensure that the model takes into account the bank’s idiosyncrasies. These may include the business profile, risk profile, history of operational losses, business environment and other factors. A bank should characterise operational risks along these factors. For modelling purposes, it is important that risks sharing common factors are grouped together.

²³ The SBA and LDA terminology referred to in this Section is used only for simplicity and does not want to categorise AMA models between the extremes of those based on loss data and those based on scenario analysis. Instead it is a well recognised fact that there is a variety of AMA models, which use all of the four elements (internal loss data, external data, scenario analysis, BEICFs) in different ways and with different emphasis.

164. When a major change in the organisational or the risk profile of an institution occurs, the bank should ensure the choice of granularity remains valid.

165. A bank should determine the optimum balance between granularity of the classes and volume of historical data for each class. Using one or only a few ORCs can lead to increased heterogeneity for the events in each category. A high number of ORCs can cause the number of losses in each category to fall below a model's data threshold. As such an outcome is more likely for business lines where the underlying risk exposure is immaterial, the materiality of a business line may in effect be one of the factors determining the level of granularity. Supervisors should be wary when an institution uses either a very low or very high number of ORCs, especially when used in conjunction with a loss distribution approach (LDA).

166. A bank should provide evidence to supervisory authorities that its choice of operational risk categories is reasonable and does not adversely impact other factors of the operational risk model, such as diversification assumptions, correlations and capital allocation.

167. A bank should support its choice of granularity by qualitative and quantitative means.²⁴ It should be particularly aware of the impact its choice of granularity has on the capital charge and provide evidence that the choice is reasonable.

168. A high number of ORCs may lead to an unrealistically high capital charge when no correlations are modelled and capital charges for all ORCs are summed together. On the other hand, a bank modelling correlations that use a high number of ORCs might have difficulty finding statistical means to validate correlation assumptions due to minimal loss data for each ORC.

169. Capital allocation to internal business lines should be a factor when choosing ORCs, as these ORCs may be used as part of the capital allocation process.²⁵ When using an allocation method that is very different in nature from the choice of ORCs, the bank should ensure that its choice of ORCs and allocation method was reasonable in the first place. Note that changes in the ORCs need not always correspond with changes in the capital allocation method. For example, banks often take continuous management actions leading to changes in their business units that may not lead to major changes in their business processes or risk profile. Such changes may not justify changing the ORCs used for capital modelling, even though they must be incorporated in the capital allocation process.

²⁴ Where a bank uses the Basel II Event Types categorisation as ORCs, different drivers of risk may be identified even within a given Event Type. Usually these drivers are easy to recognise as in one case the losses are recurrent, occur in "business as usual" situations and their impacts is never or rarely large (for instance, thefts/robberies in the Event Type External Fraud); in another case they are less frequent, are due to specific and/or uncommon situations and their impact is from medium to large (for instance in the External Fraud category, large frauds due to misappropriation of assets such as pyramid or "Ponzi" schemes). In such cases, it is recommended that the ORC be split into pertinent subclasses in order to more correctly capture the different drivers of risk.

²⁵ For example, when using a very high or very low number of ORCs, the allocated capital charges may not have the desired impact on the management of operational risk.

Distributional assumptions

Background

170. Distributional assumptions underpin most, if not all, operational risk modelling approaches and are generally made for both the frequency and severity 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.

171. Paragraph 667 of the Basel II Framework states that *"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)."*

172. Paragraph 673 of the Basel II Framework states *"... 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 ..."*

General observations

173. The basis of all operational risk models is a distribution of operational risk losses. Most banks model the frequency and severity distributions separately. These distributions are fitted to the "calculation dataset", which represents the portion of gathered data, either actual or constructed, that fulfils the necessary conditions to serve as inputs into the AMA model. Such necessary conditions include perimeter of application (ie AMA compliant parts only, observation period, reference date, modelling threshold and data treatment).

174. The Range of Practice Paper shows broad convergence in the range of distributions assumed to estimate the frequency of operational risk losses, with the Poisson distribution the most commonly used, followed by the Negative Binomial.

175. Significant differences emerge, however, in the ways banks model the severity of operational risk losses. The wide set of selected distributions ranged from light- to heavy-tailed curves. Some banks assume that in each ORC, the operational risk losses follow either a similar or different path (ie a different path for High Frequency Low Impact events (HFLI) and Low Frequency High Impact events (LFHI)). There are also varied approaches around the choice and use of modelling thresholds and the methods adopted to estimate the distribution parameters. These varying assumptions highlight the key sources for variation in the banks' approaches and, subsequently, the calculation of their operational risk capital requirements.

176. Convergence regarding the types of approaches and distributions used for modelling operational risk losses may not be achievable or desirable because the severity is often idiosyncratic to particular business lines or types of banks. However, it is possible to identify principles for determining whether the chosen approaches are inconsistent with the underlying data or supervisory expectations.

177. The following section provides supervisory guidelines on identifying basic principles and pertinent criteria related to distributional assumptions. These guidelines take into account the current best practices in modelling operational risk. A bank should closely follow

the evolution and development of best practices and update and improve its measurement system as appropriate.

Supervisory guidelines

Building of the calculation dataset

178. A bank should have a policy that identifies when a loss or an event recorded in the internal (or external) loss event database is also to be included in the calculation dataset. This policy should provide a consistent treatment for loss data across the institution. Exceptions to the policy should be limited and, in any case, duly documented and properly addressed to prevent undue reduction of the capital charge.²⁶

179. The building of a proper calculation dataset from the available internal/external data requires that a bank develop policies and procedures to address its several features (ie perimeter of application, observation period, reference date, de minimis modelling thresholds and data treatment).

180. The definition of “gross loss” for the purpose of building the calculation dataset should include all the items mentioned in Paragraphs 85 and, when applicable, 87 of these Guidelines. The Basel II Framework requires banks to base their internally generated operational risk measures on a minimum historical observation period of five years (three years when an institution first moves to an AMA). For certain ORCs with low frequency of events, an observation period greater than five years may be necessary to collect sufficient data to generate reliable operational risk measures and ensure that all material losses are included in the calculation dataset. If very long data series are used, banks will need to consider the heterogeneity arising from changes in the risk profile through time. In such cases, time trends or other adjustments should be strongly preferred to discarding older data. Discarding older data should be undertaken only as last resort for ORCs where loss experience is sparse.

181. A bank may use one of the reference dates (occurrence date, discovery date, contingent liability date or accounting date) for building the calculation dataset, as long as material loss data are not omitted. No other dates are acceptable for building the calculation dataset.

182. The discovery date or accounting date are the most prudent choices for developing a bank’s dataset for the quantification of operational risk capital related to that event. However, a bank may use the occurrence date for building the calculation dataset if the bank has not constrained or limited the observation period.

183. A bank should use a date no later than date of reserve for including legal related losses/exposures in the calculation dataset.

184. A bank may establish a de minimis modelling threshold for an ORC, so that frequency and severity distributions in each ORC are fitted to the data only in excess of the threshold. The de minimis modelling threshold may differ across ORCs. The choice of threshold for modelling should not adversely impact the credibility and accuracy of the operational risk measures.

²⁶ This guideline reiterates the guidelines outlined in the data section, as far as they are relevant for building a proper calculation dataset.

185. On an exceptional basis, a bank may identify data points related to abandoned business lines within the calculation data. It may adopt specific techniques for the treatment of these data points to address an undesired effect on capital measures. However, a bank should justify and clearly document the identification and treatment of these data points and provide estimates of the capital requirements with and without this treatment.

186. Use of de minimis modelling thresholds that are much higher than the data collection thresholds should be limited and properly justified by sensitivity analysis at various thresholds. Moreover, changes in the de minimis modelling thresholds, when not embedded in the model engine and driven by specific reasons (eg discount rates), should be limited in number and duly motivated by the need to better capture the risk profile of the ORC.

187. All operational losses above the set de minimis modelling threshold should be included in the calculation dataset and used, whatever their amounts, for generating the regulatory measures.

188. Losses caused by a common operational loss event should be grouped and entered into the calculation dataset as a single loss, unless a bank chooses to model causality or dependence among those losses in a different manner. A bank's internal loss data policy should establish guidelines for deciding the circumstances, types of data and methodology for grouping data as appropriate for their business, risk management and capital charge modelling needs. They should also clarify and document their individual judgments in applying these guidelines. A bank's policy about the threshold and dates for single losses should also be applied to grouped losses.

189. A bank that groups small losses above the threshold for modelling with no causal relations for data collection and registration purposes generally should not include them in its calculation dataset.

190. A bank should consider applying appropriate adjustment rates on data when inflation or deflation effects are material. For example, when the observation period for a specific ORC is extensive (eg 15-20 years) due to the infrequent occurrence of loss events and the loss data series is not stationary, adjusting loss amounts due to discount effects could be the solution to recover stationarity.

191. A bank should not use loss net of insurance recoveries as an input for its AMA models. An approach using loss net of recoveries and insurance recoveries may prove especially difficult in the calculation of the maximum 20% capital requirements reduction permitted for insurance mitigation in the Basel II Framework and discussed in *Recognising the risk-mitigating impact of insurance in operational risk modelling*.

192. The recognition of insurance in operational risk capital models is in an early stage of development. A bank should calculate the total operational risk capital charge gross of insurance recovery in order to determine the 20% limit and isolate the bank's methodology for modelling insurance mitigation.

Identification of the probability distributions

193. A bank should follow a well specified, documented and traceable process for the selection, update and review of probability distributions and the estimate of their parameters.

This process should result in consistent and clear choices and be finalised to properly capture the risk profile in the tail.²⁷

194. Severity distributions play a crucial role in AMA models. That the models are often medium/heavy tailed implies that the final outcome is significantly impacted by the chosen distribution. The choice of frequency distributions has a lesser impact on the final outcome.

195. The selection of probability distributions should be consistent with all elements of the AMA model. In addition to statistical goodness of fit, Dutta and Perry (2007) have proposed the following criteria for assessing a model's suitability:²⁸

- realistic (eg it generates a loss distribution with a realistic capital requirements estimate, without the need to implement "corrective adjustments" such as caps),
- well specified (eg the characteristics of the fitted data are similar to the loss data and logically consistent),
- flexible (eg the method is able to reasonably accommodate a wide variety of empirical data) and
- simple (eg it is easy to implement and it is easy to generate random numbers for the purpose of loss simulation).

196. The process of selecting the probability distribution should be well-documented, verifiable and lead to a clear and consistent choice. To this end, a bank should generally adhere to the following:

- (a) Exploratory Data Analysis (EDA) for each ORC to better understand the statistical profile of the data and select the most appropriate distribution;
- (b) Appropriate techniques for the estimation of the distributional parameters; and
- (c) Appropriate diagnostic tools for evaluating the quality of the fit of the distributions to the data, giving preference to those most sensitive to the tail.

197. In order to examine the statistical properties of each ORC (ie homogeneity, independence, stationarity²⁹), a bank should make use of statistical tools which include, but are not limited to, scatter plots, time series autocorrelation plots, empirical distribution plots, histograms and regression analysis. Other tools, such as p-p plots, q-q plots and mean excess plots provide preliminary evidence on the type and shape of the probability distributions which better represent the data.

198. The Range of Practice Paper reveals a wide range of practices for the estimate of the severity distributions, with 31% of AMA banks applying a single distribution to all the data and nearly 50% using two separate distributions for the body (or HFLI region) and the tail (or LFHI region).

²⁷ The considerations in this principle and the following are broadly limited to the severity distribution. The frequency distribution doesn't usually constitute a relevant issue, especially in presence of medium or heavy tailed data.

²⁸ "A Tale of Tails: an empirical analysis of loss distribution models for estimating operational risk capital", K. Dutta, J. Perry, 2007, Federal Reserve of Boston Working papers, No 6-13

²⁹ An ORC is *homogeneous* when the data of the ORC are of the same or similar nature under the operational risk profile, *independent* when no form of dependence or correlation is identifiable across them, *stationary* when the characteristics of the data do not change when shifted in time or space.

199. The operational risk data from a severity perspective clearly illustrate positive skewness and medium-heavy tailedness (*leptokurtosis*). In statistical terms, this may mean that not all the statistical moments of the severity distribution exist; in many cases the 2nd moment (ie the standard deviation) and higher moments, although always empirically calculable, are often enormous due to the relevant dispersion of the data.

200. A bank should pay particular attention to the positive skewness and, above all, leptokurtosis of the data when selecting a severity distribution. In particular, when the data are medium/heavy tailed (therefore very dispersed in the tail), the use of empirical curves to estimate the tail region is an unacceptable practice due to the inability to extrapolate information beyond the last observable data point.³⁰

201. In such cases the use of so-called sub-exponential distributions³¹ is highly recommended. Subexponential distributions, which sometimes have a higher number of parameters than light tailed curves, can better represent the shape of the data in the tail (other than their skewness in the body) by allowing estimates of parameters that do not depend on the higher order statistical moments.

202. When separate distributions for the body and the tail are used, a bank should carefully consider the choice of the body-tail modelling threshold that distinguishes the two regions. The bank should provide documented statistical support, supplemented as appropriate by qualitative elements, for the selected threshold, as the threshold may significantly impact the capital requirements. Ideally the estimate of the body-tail modelling threshold should be made conjunctly with the parameters of the distribution; however for practical reasons banks tend to first identify the threshold and then estimate the parameters. EDA instruments like the hill plot and the mean excess function plot can be useful in the determination of the threshold. A bank should employ sound methods to connect the body and tail distributions. In particular, jumps in the probability mass function when attaching the body and tail of the distributions should be avoided, in order to guarantee that the LFHI and HFLI regions are mutually exclusive and are properly reflected in the aggregated distribution.³²

203. When estimating the parameters of the distribution, a bank should take into account the incompleteness of the calculation dataset in the model (eg due to the presence of de minimis modelling threshold(s) which may or may not coincide with the data collection threshold). The bank should provide evidence that an incomplete calculation dataset does not adversely impact the credibility and accuracy of the parameter estimates and capital requirements.

³⁰ In general the same principle should apply to AMA models based on scenario analysis (SBA). Just in limited cases, for example when the biggest data point is demonstrated to be larger or equal in amount to the event that occurs less than once in 1000 years, the use of empirical curves to estimate the tail may be accepted in SBA models. In any case this is acceptable only if the far tail is based on well constructed scenario data and the bank has strict standards for the use of the empirical tail distribution, for instance that the tail contains sufficient data points that are far outside the internal loss data.

³¹ Sub-exponential distributions are those distributions whose tail decays slower than the Exponential distribution. The class of Sub-exponential distributions includes the Lognormal, Lognormal-Gamma, Log-Gamma, Generalised Pareto, Burr, Weibull (with shape parameter < 1). The Weibull (with shape parameter > 1) and Gamma distributions do not belong to the class of Sub-exponential distributions.

³² Indeed, a jump of the probability at the threshold could assign to High Impact events a very different probability of occurrence than that suggested by their Low Frequency nature. This would determine an improper estimation of the tail of the aggregated distribution.

204. A bank should pay particular attention to the estimate of the kurtosis-related parameters, which describe the tail region of the losses. Because of data scarcity, the estimates can be highly unstable. The bank should put in place methodologies to reduce estimate variability and provide measures of the error around these estimates (eg confidence intervals, p-values).

205. Robust estimation methods (such as alternatives to classical methods as the Maximum Likelihood and the Probability Weighted Moments), proposed recently in operational risk literature,³³ are reasonably efficient under small deviations from the assumed model. These methods also highlight which observations or deviating substructures have the greatest influence on the statistic to be estimated. A bank may adopt alternatives to classic estimators, provided it can demonstrate that its use does not underestimate risk in the tail. These estimators may also be used as a diagnostic technique for evaluating the sensitivity of the capital charge to the chosen parameter estimation method.

206. A bank should assess the quality of fit between the data and the selected distribution. The tools typically adopted for this purpose are graphical methods (which visualise the difference between the empirical and theoretical functions) and quantitative methods, based on goodness-of-fit tests. In selecting these tools, a bank should give preference to graphical methods and goodness-of-fit tests that are more sensitive to the tail than to the body of the data (eg the Anderson Darling upper tail test).

207. While diagnostic tools provide information on the quality of fit between the data and each distribution, they do not always lead to a clear choice of the best-fitting distribution. Moreover, the results of the goodness-of-fit tests are usually sensitive to the sample size and the number of parameters estimated. In such cases, a bank should consider selection methods that use the relative performance of the distributions at different confidence levels. Examples of selection methods may include the Likelihood Ratio, the Schwarz Bayesian Criterion and the Violation Ratio.³⁴

208. A bank should have a regular cycle to verify assumptions underlying the probability distributions they have selected. These verifications may follow the criteria and tests a bank's use in the selection of the probability distribution. If assumptions are invalidated, alternative methods should be tested and implemented. However, any change should be properly justified. In particular, after suffering one or more significant losses in an ORC, a bank should not decide to replace the probability distributions used in that ORC with lighter-tailed curves.³⁵

³³ On the topic of robust estimators, see, among others: Dell'Aquila, R. and Embrechts, P.: "Extremes and robustness: a contradiction?" (Financial Markets and Portfolio Management, 2006); Dell'Aquila, R. and Ronchetti, E.: "Robust statistics and econometrics with economic and financial applications" (New York: Wiley 2006); McNeil, A., Frey, R. and Embrechts, P.: "Quantitative risk management: concepts, techniques and tools" (Princeton: Princeton University Press 2005). See also Chernobai, A. and Rachev, S.T.: "Applying Robust Methods to Operational Risk Modelling" (Journal of Operational Risk, 1(1), pp. 27-41, 2006) for the discussion on the topic and an overview of the literature on robust statistics.

³⁴ In particular, the Schwarz Bayesian Criterion adjusts each distribution test for sample size and the number of parameters, while the Violation Ratio measures the performance of the distributions at different confidence levels by comparing the estimated and expected number of violations.

³⁵ The occurrence of a very large loss indicates that the risk profile of the bank is increased or, in the most favourable situation, that this was a very rare, not repeatable, event. None of these cases would determine a reduction of the capital charge of the ORC. In such cases, it may be appropriate to replace the probability distributions with heavier-tailed curves.

Additional considerations for AMA models based on scenario analysis

209. Many observed SBA models do not apply statistical inference to raw scenario data. Very often the SBA-model curves are predetermined and the scenario data are used only to estimate the parameters of those distributions (usually by percentile matching).

210. While this approach is very common in practice, banks generally use the same curve (usually the Lognormal) for modelling the severity of the scenario data across all ORCs, regardless of its business, size and complexity. The selection of a single curve across ORCs implies that the only admissible driver of variation in the operational risk exposure lies in the scenario driven parameter estimates of the chosen distribution.

211. A bank should ensure that the loss distribution(s) chosen to model scenario analysis estimates adequately represents the risk profile of the ORCs. In doing so, banks should also consider the potential differences with an LDA in terms of level of granularity and dependence across the ORCs.³⁶

Determination of aggregated loss distributions and risk measures

212. The techniques to determine the aggregated loss distributions should ensure adequate levels of precision and stability of the risk measures. The risk measures should be monotonic, reasonable and supplemented with information on their level of accuracy.

213. Banks use several statistical techniques to generate the aggregated loss distributions from frequency and severity curves and parameter estimates. Given the type of distributions adopted in the context of operational risk, it is especially difficult to represent the aggregated loss distributions by closed form curves. As such, simulation, numerical or approximation methods are necessary to derive aggregated curves (eg Monte Carlo simulations, Fourier Transform-related methods, Panjer algorithm and Single Loss Approximations).

214. A bank should adopt criteria that mitigate sample and/or numerical related errors and provide a measure of the magnitude of these errors, regardless of the techniques used to aggregate frequency and severity distributions.

215. Where Monte Carlo simulations are used, the number of steps to be performed is an important variable. Good modelling practice suggests that the number should be consistent with the shape of the distributions and with the confidence level to be achieved. In particular, where the distribution of losses is heavy tailed and measured at a high confidence level, the number of steps should be sufficiently large to reduce sampling variability to an acceptable level. In order to do this, a bank can use either (i) a very large number of iterations or (ii) a dynamic number of iterations. The latter, which is typically more accurate, allows the

³⁶ For instance, let's suppose that in a LDA the ORCs coincide with the Basel Event Types and are supposed perfectly correlated. Moreover, let's suppose that a SBA has a higher granularity than the LDA (i.e. a number of ORCs coincident with all the organisational units) and that envisages independence across the ORCs. Even if each ORCs severity in the SBA were modelled by lighter distributions than those used in the LDA, the different level of granularity and the independence across the ORCs envisaged in the SBA makes it possible to produce bank's aggregated risk estimates which are comparable with those stemming from the LDA. This may happen because in the SBA the less conservative assumptions in terms of risk within and across the ORCs (i.e. the use of lighter severity distributions than those in the LDA and the hypothesis of independence across the ORCs) could be counterbalanced by the higher number of ORCs to which the model is applied (i.e. the level of granularity).

simulation process to stop when the marginal variation of the risk measure, or some other dispersion index, is close to zero.

216. If Fourier Transform or other numerical methods are used, a bank should pay attention to algorithm stability and error propagation issues.

217. The risk measure is a single statistic extracted from the aggregated loss distribution at the desired confidence level. The most common and, so far, most adopted measure in risk management, including operational risk, is the Value at Risk (VaR). However, in certain applications and fields, including risk management, Shortfall measures (eg Expected Shortfall, Median Shortfall) have also gained acceptance in representing the whole tail region and in providing a coherent risk estimate (under a sub-additivity perspective).

218. Whichever risk measure is adopted, a bank should ensure that the measure (and the overall AMA model) fulfils the monotonic principle of risk,³⁷ which can be seen in the generation of higher capital requirements when the underlying risk profile increases.

219. It is also crucial that the risk measures (while using conservative criteria and assumptions for prudential purposes) are realistic from a managerial and economical perspective. In specific cases, banks may adopt distributions that envisage the non existence of the first moment (ie the mean), as this would determine high capital requirements and would not be easily and clearly justifiable and applicable within the firm.

220. A bank should recognise that the estimated capital charge is inherently uncertain due to the heaviness and scarcity of operational risk losses in the tail region. As such, the bank should explicitly recognise this variability in their estimates and provide measures of the error around these estimates.

221. A bank should also gather information on the expected loss. Due to its high sensitivity to extreme losses, the arithmetic mean can cause an inaccurate picture for the expected losses. In light of this, the use of statistics that are less influenced by extreme losses (eg median, trimmed mean) is recommended, especially in the case of medium/heavy tailed datasets.

Correlation and dependence

Background

222. Paragraph 669(d) of the Basel II Framework states that, “*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.*”

³⁷ A measure of risk $\rho(x)$ is monotonic if $\rho(x) < \rho(y)$ for $x < y$.

223. Dependence in operational risk may arise from exposure to common process or structural factors (eg people, businesses processes, IT systems) or from environmental factors (eg a change in legal risk associated with certain business practices) that affect multiple areas of the firm. These factors can influence the observed frequency or severity of losses within a bank.

224. Dependence modelling for operational risk is an evolving area, with banks pursuing many different approaches for incorporating dependence effects. However, the choice of dependence approach can have a significant impact on the capital requirements generated by the model. It is thus important to ensure that cross-bank differences in dependence approach do not lead to spurious differences in exposure estimates.

General observations

225. The results of the LDCE and Range of Practice Paper indicate significant differences in banks' approaches to modelling dependence. Of the AMA banks surveyed, 29% do not model dependence or correlation estimates in their AMA. This percentage is higher in Australia (60%) and Japan (86%).

226. Expert judgment (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 region. No banks use external loss data to model dependence in Australia and Japan and only one bank in Europe.

227. Dependence is introduced into the modelling process mainly by use of copulas (43%). Of the banks using Copulas, most (83%) use a Gaussian copula. Less than one-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. Most of the respondents that use dependence/correlation estimates use the dependence as an input in the model through aggregate losses.

Supervisory guidelines

228. Dependence assumptions should be supported to the greatest extent possible by an appropriate combination of empirical data analysis and expert judgment. It is important to recognise that using internal and external data to model dependence presents challenges, as data limitations observed in the univariate context (modelling loss distributions for single ORCs) are likely to be more significant in the multivariate context (modelling multiple ORCs). Using judgment to model dependence presents its own challenges, as eliciting accurate but subjective estimates is more difficult in the multivariate context than in the univariate context. As such, the specification of dependence structures represents one of the most significant challenges in AMA modelling.

229. Assumptions regarding dependence should be conservative given the uncertainties surrounding dependence modelling for operational risk. Consequently, the dependence structures considered should not be limited to those based on Normal or Normal-like (eg T-Student distributions with many degrees of freedom) distributions, as normality may underestimate the amount of dependence between tail events.

230. The degree of conservatism should increase as the rigor of the dependence model and the reliability of the resulting capital requirements estimates decrease. Accordingly, models assuming statistical independence across all loss events would require a very high

degree of rigour. Such rigor may be difficult to attain given the evolving nature of dependence modelling for operational risk. It is important to note that the trade-off between rigor and conservatism will function only within certain bounds; supervisors would not accept a high degree of conservatism to compensate for an approach to dependence that suffered from fundamental deficiencies.

231. Losses within each ORC should be independent of each other.³⁸ If this is not the case, either within-ORC dependence should be modelled explicitly or the input data should be modified to achieve independence across individual losses.³⁹

232. Dependence should not be inappropriately affected by the choice of granularity. For example, many operational risk management frameworks assume statistical independence between losses within the same ORC. To the extent that a bank's framework has only a few ORCs, the impact of dependence may be inappropriately minimised. In such a situation, it may be preferable to simply add capital estimates across ORCs.

233. A bank should perform sensitivity analyses and stress testing (eg different parameter values and different correlation models) on the effect of alternative dependence assumptions on its operational risk capital charge estimate. A bank should have a rigorous process in place specifying the conditions under which the results based on alternative dependence assumptions would lead to a revision of the operational risk capital requirements estimate.

234. Given the evolving nature of dependence modelling for operational risk, it may be difficult to meaningfully differentiate the impact of dependence at one bank versus another. One would thus expect some degree of cross-bank consistency in the overall impact of dependence.

Use of the four data elements

235. The AMA of a bank requires the use of four data elements which are: internal loss data (ILD); external data (ED); scenario analysis (SA) and business environment and internal control factors (BEICFs). This section outlines the Committee's expectations with respect to the use of these four data elements to produce a credible and robust estimate of the operational risk capital charge.

Background

236. Paragraphs 667 and 669 of the Basel II Framework state the following with respect to the AMA framework:

- (a) "Any operational risk measurement system must have certain key features to meet the supervisory soundness standard set out in this section. These elements must

³⁸ Given that it could be challenging to prove statistically the independence of losses within an ORC, sound logical arguments may be used to evaluate the independence of such losses. For example, losses arising from the same root cause would not generally be considered independent.

³⁹ This can be achieved, for example, by integrating data which show strong cross dependence into a single data point.

include the use of internal data, relevant external data, scenario analysis and factors reflecting the business environment and internal control systems.”

- (b) “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...”
- (c) “A bank must be able to demonstrate that its approach captures potentially severe ‘tail’ loss events...”

237. The Basel II Framework clearly anticipated that there would be a need for different “combinations” of the data elements depending on the behaviour of the loss generating process.⁴⁰ The Basel II Framework envisions that the onus is on the bank to illustrate that the combination of the four data elements is sufficient for the purpose of estimating high percentiles.

238. Banks benefit from the flexibility to explore different options for combining the four data elements within a model to produce a reliable capital requirements estimate. However, the Basel Committee has indicated that there would be a review and refinement of the Basel II Framework as appropriate. As such this section provides some further guidance on the use of the four data elements within an AMA model based on the results of the Range of Practice and LDCE Papers and other supervisory observations.

General observations

239. Various aspects of the contribution to capital requirements and the use of the four data elements in modelling are addressed in Tables 17 A-B and 18 A-C of the Range of Practice Paper. The cross-bank median and inter-quartile range of the percentage contributions to the capital charge for the direct effect of each of the data elements have been consolidated in Table 1.

⁴⁰ “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 loss event data may play a more dominant role in the risk measurement system for business lines where 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...” (Basel II Accord - Paragraph 669(f)).

Table 1

Percentage direct contribution to capital charge of each data element - Cross-bank medians and inter-quartile ranges for the 2008 LDCE. The figures in brackets in the top row are the number of participating AMA banks for each region

| | All (42) | Australia (5) | Europe (20) | Japan (7) | North America (10) |
|--------|-----------------|----------------------|--------------------|------------------|---------------------------|
| SA | 55 (33 – 84) | 50 (40 – 93) | 64 (33 – 75) | 84 (75 – 85) | 33 (15 – 38) |
| ED | 37 (25 – 45) | 27 (25 – 45) | 38 (25 – 48) | - - | 37 (25 – 40) |
| ILD | 31 (15 – 50) | 16 (8 – 36) | 36 (13 – 46) | 15 (15 – 16) | 50 (30 – 83) |
| BEICFs | 11 (5 – 18) | - - | 19 (11 – 60) | - - | 8 (5 – 11) |

240. The proper interpretation of the results reported in Table 1 can be challenging as each element's direct contribution to the operational risk capital charge is difficult to estimate. The table nonetheless provides a broad overall picture of each element's influence within a bank's capital model. The results of Table 1 reveal distinct jurisdictional differences. Most noticeable is the higher direct impact ILD had on the capital charge of North American banks when compared to all other regions. For institutions in Australia and Japan, ILD had a much lower impact on capital requirements than it did for those at institutions in North America and Europe.⁴¹ SA had the most significant impact on the capital requirements of Japanese, European and Australian institutions. With the exception of Japanese banks, the direct use of ED appears to be reasonably consistent across regions.

241. A closer analysis of the data provided by AMA banks⁴² for the 2008 LDCE, as shown below in Table 2⁴³ and Figure 1, reveal that there are also significant differences in the loss experience of banks in different regions. Figure 1 presents the relative regional percentage of the average number of losses per bank for each severity range.⁴⁴ In particular, banks in Australia and Japan have experienced a much smaller percentage of losses per bank for all severity ranges compared to banks in Europe and North America. While the majority of losses across each of the severity ranges were experienced by banks in Europe

⁴¹ In the 2008 LDCE results, the South African data is included in the European region.

⁴² For the purposes of the 2008 LDCE, an "AMA bank refers to a bank that is targeting or has implemented the AMA approach in its implementation of Basel II".

⁴³ Table 2 presents some previously unpublished results from the 2008 LDCE. This table represents three years of loss data from the 'stable' dataset.

⁴⁴ For each severity range, the regional percentages are calculated as the average number of losses (ie the total number of losses for the region divided by the number of AMA banks in that region) as a percentage of the sum of the average number of losses across regions. Consequently, for each severity range, the percentages sum to 100%. The data for these calculations is taken from Table 2.

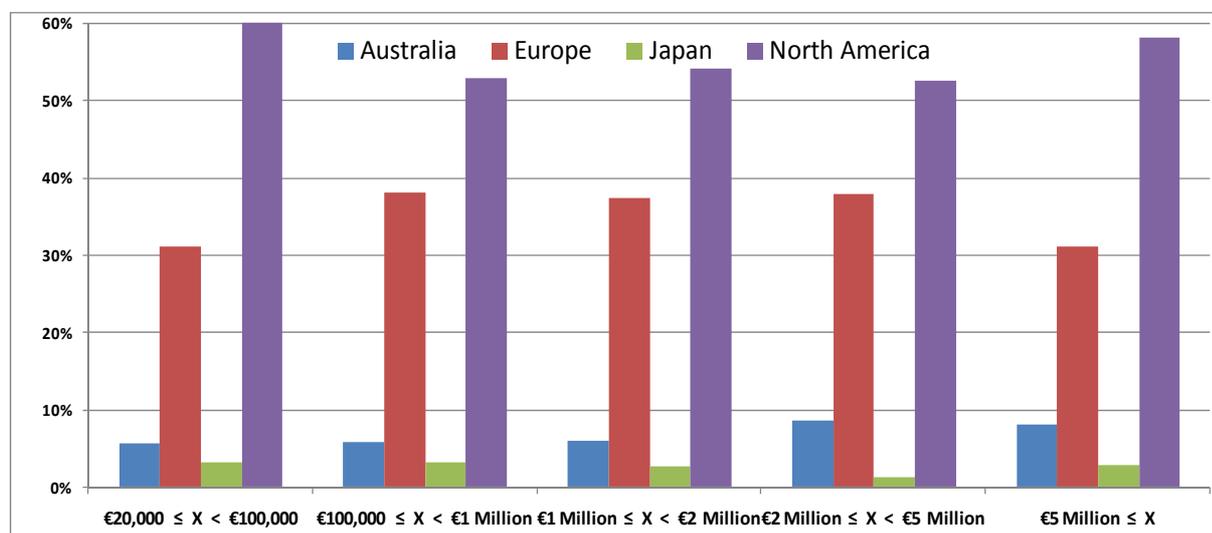
and North America, on average the typical North American bank experienced up to nearly twice the number of losses as their European counterparts across all severity ranges.

Table 2

Number of losses for AMA banks within each severity range for each region as reported in the 2008 LDCE. The figures in brackets in the top row are the number of AMA banks that submitted internal loss data for each region

| Severity Range (X) | All (41) | Australia (5) | Europe (20) | Japan (7) | North America (9) ⁴⁵ |
|-----------------------------|----------|---------------|-------------|-----------|---------------------------------|
| €20,000 ≤ X < €100,000 | 88,337 | 2,063 | 45,311 | 1,636 | 39,327 |
| €100,000 ≤ X < €1 Million | 23,541 | 528 | 13,910 | 410 | 8,693 |
| €1 Million ≤ X < €2 Million | 1,408 | 33 | 820 | 20 | 535 |
| €2 Million ≤ X < €5 Million | 935 | 31 | 553 | 6 | 345 |
| €5 Million ≤ X | 662 | 22 | 341 | 11 | 288 |

Figure 1: Relative regional percentage of the average losses per bank for each severity range.



242. In terms of more severe losses, there were less than 300 loss events between €10 million and €100 million, and less than 40 loss events greater than €100 million in the all

⁴⁵ Although 42 AMA participated in the LDCE (10 of which were from North America), one North American AMA institution did not submit internal loss data.

region dataset.⁴⁶ These results, combined with those of Table 2, highlight that the relatively few high severity loss events present challenges to modelling the tail of loss distributions using only ILD, particularly for the majority of institutions with a low frequency of large events. It is therefore necessary for banks to consider the impact of relevant external data and scenarios for producing meaningful estimates of the capital charge.

243. Considering the results of Tables 1 and 2 together reveals:

- (a) The relative contributions of ILD and SA for North American banks compared to other regions may in part reflect the relative availability of ILD in each region;
- (b) The direct influence of SA within the capital models of European banks is significantly higher than for North American banks, despite having a reasonably comparable amount of ILD in relative terms; and
- (c) The exceptionally small sample sizes of large internal losses, for both Australian and Japanese banks, necessitate greater reliance on the other data elements.

244. The 2008 Range of Practice Tables 18B and 18C confirm that scenario data and ED are used to quantify the severity of at least the low frequency and high severity events, which are influential in the determination of the final capital charge.⁴⁷

Supervisory guidelines

245. The Committee recognises that there will be jurisdictional differences in the use of the four data elements because of:

- (a) The quantity and relevance of the available loss data; and
- (b) Different emphasis in the regulatory assessment of quantitative methodologies (which may in part be a reflection or a cause of point a).

246. In light of these acknowledged differences, there are certain modelling approaches that have been developed which the Committee believes are within an acceptable range of practice with respect to the use of the four data elements.

Internal loss data

247. While the Basel II Framework provides flexibility in the way a bank combines and uses the four data elements in its operational risk management framework (ORMF), supervisors expect that the inputs to the AMA model are based on data that represent or the bank's business risk profile and risk management practices. ILD is the only component of the AMA model that records a bank's actual loss experience. Supervisors expect ILD to be used in the operational risk measurement system (ORMS) to assist in the estimation of loss frequencies; to inform the severity distribution(s) to the extent possible; and to serve as an input into scenario analysis as it provides a foundation for the bank's scenarios within its own risk profile. The Committee has observed that many banks have limited high severity internal

⁴⁶ The regional breakdown for the number of losses for higher severity ranges from the 2008 LDCE data have not been reported because of confidentiality concerns.

⁴⁷ Seven out of the ten North American banks report using scenarios for quantifying the severity of low frequency/high severity events, although this translates into a relatively small contribution to their overall capital.

loss events to inform the tail of the distribution(s) for their capital charge modelling. It is therefore necessary to consider the impact of relevant ED and/or scenarios for producing meaningful estimates of capital requirements.

External data

248. ED provides information on large actual losses that have not been experienced by the bank, and is thus a natural complement to ILD in modelling loss severity. Supervisors expect ED to be used in the estimation of loss severity as ED contains valuable information to inform the tail of the loss distribution(s). ED is also an essential input into scenario analysis as it provides information on the size of losses experienced in the industry. Note that ED may have additional uses beyond providing information on large losses for modelling purposes. For example, ED may be useful in assessing the riskiness of new business lines, in benchmarking analysis on recovery performance, and in estimating competitors' loss experience.

249. While the ED can be a useful input into the capital model, external losses may not fit a particular bank's risk profile due to reporting bias. Reporting bias is inherent in publicly-sourced ED and therefore focuses on larger, more remarkable losses. A bank should address these biases in their methodology to incorporate ED into the capital model.

250. As ED may not necessarily fit a particular bank's risk profile, a bank should have a defined process to assess relevancy and to scale the loss amounts as appropriate. A data filtering process involves the selection of relevant ED based on specific criteria and is necessary to ensure that the ED being used is relevant and consistent with the risk profile of the bank. To avoid bias in parameter estimates, the filtering process should result in consistent selection of data regardless of loss amount. If a bank permits exceptions to its selection process, the bank should have a policy providing criteria for exceptions and documentation supporting the rationale for any exceptions. A data scaling process involves the adjustment of loss amounts reported in external data to fit a bank's business activities and risk profile. Any scaling process should be systematic, statistically supported, and should provide output that is consistent with the bank's risk profile.

251. To the extent that little or no relevant ED exists for a bank, supervisors would expect the model to rely more heavily on the other data elements. Limitations in relevant ED most frequently arise for banks operating in distinct geographic regions or in specialised business lines.

Scenario analysis

252. A robust scenario analysis framework is an important element of the ORMF. This scenario process will necessarily be informed by relevant ILD, ED and suitable measures of BEICFs. While there are a variety of integrated scenario approaches, the level of influence of scenario data within these models differs significantly across banks.

253. The scenario process is qualitative by nature and therefore the outputs from a scenario process necessarily contain significant uncertainties. This uncertainty, together with the uncertainty from the other elements, should be reflected in the output of the model producing a range for the capital requirements estimate. Thus, scenario uncertainties provide a mechanism for estimating an appropriate level of conservatism in the choice of the final regulatory capital charge. Because quantifying the uncertainty arising from scenario biases continues to pose significant challenges, a bank should closely observe the integrity of the modelling process and engage closely with the relevant supervisor.

254. Scenario data provides a forward-looking view of potential operational risk exposures. A robust governance framework surrounding the scenario process is essential to ensure the integrity and consistency of the estimates produced. Supervisors will generally observe the following elements in an established scenario framework:

- (a) A clearly defined and repeatable process;
- (b) Good quality background preparation of the participants in the scenario generation process;
- (c) Qualified and experienced facilitators with consistency in the facilitation process;
- (d) The appropriate representatives of the business, subject matter experts and the corporate operational risk management function as participants involved in the process;
- (e) A structured process for the selection of data used in developing scenario estimates;
- (f) High quality documentation which provides clear reasoning and evidence supporting the scenario output;
- (g) A robust independent challenge process and oversight by the corporate operational risk management function to ensure the appropriateness of scenario estimates;
- (h) A process that is responsive to changes in both the internal and external environment; and
- (i) Mechanisms for mitigating biases inherent in scenario processes. Such biases include anchoring, availability and motivational biases.

BEICFs

255. BEICFs are operational risk management indicators that provide forward-looking assessments of business risk factors as well as a bank's internal control environment. However, incorporating BEICFs directly into the capital model poses challenges given the subjectivity and structure of BEICF tools. Banks continue to investigate and refine measures of BEICFs and explore methods for incorporating them into the capital model.

256. BEICFs are commonly used as an indirect input into the quantification framework and as an *ex-post* adjustment to model output. Ex-post adjustments serve as an important link between the risk management and risk measurement processes and may result in an increase or decrease in the AMA capital charge at the group-wide or business-line level. Given the subjective nature of BEICF adjustments, a bank should have clear policy guidelines that limit the magnitude of either positive or negative adjustments. It should also have a policy to handle situations where the adjustments actually exceed these limits based on the current BEICFs. BEICF adjustments should be well-supported and the level of supervisory scrutiny will increase with the size of the adjustment. Over time, the direction and magnitude of adjustments should be compared to ILD, conditions in the business environment and changes in the effectiveness of controls to ensure appropriateness. BEICFs should, at a minimum, be used as an input in the scenario analysis process.

Combining the elements

257. There are various ways that an AMA model can be constructed to effectively incorporate the four data elements. A bank should carefully consider how the data elements are combined and used to ensure that the bank's operational risk capital charge is commensurate with its level of risk exposure. A bank should provide a clearly articulated rationale for their modelling choices and assumptions and conduct sufficient research and

analysis to support their decisions. The approach adopted should also encourage ownership of the outcomes and be readily understood by the business. It is highly desirable that there is no disconnect between the measurement and the management of operational risk within the bank. The Committee recognises that operational risk modelling continues to evolve and encourages further investigation into the combination of the four data elements within AMA models.

Mixing of outcomes from AMA sub-models

258. The Range of Practice Paper recognises that “[t]here are numerous ways that the four data elements have been combined in AMA capital models and a bank should have a clear understanding of the influence of each of these elements in their capital model”. In some cases it may not be possible to:

- (a) Perform separate calculations for each data element; or
- (b) Precisely evaluate the effect of gradually introducing the different elements.

259. While in principle this may be a useful mathematical approach, certain approaches to modelling may not be amenable to this style of decomposition. However, regardless of the modelling approach, a bank should have a clear understanding of how each of the four data elements influences the capital charge.

260. A bank should avoid arbitrary decisions if they combine the results from different sub-models within an AMA model. For example, in a model where internal and external loss data are modelled separately and then combined, the blending of the output of the two models should be based on a logical and sound statistical methodology. There is no reason to expect that arbitrarily weighted partial capital requirement estimates would represent a bank’s requisite capital requirements commensurate with its operational risk profile. Any approach using weighted capital charge estimates needs to be defensible and supported, for example by thorough sensitivity analysis that considers the impact of different weighting schemes.

Combining data elements within the capital model

261. The combination of data elements within the capital model can provide the opportunity for the development of an integrated and self-consistent modelling framework. However, there are significant challenges that banks will need to address when combining data elements (eg combining scenario data or ED directly with ILD). The combination of data elements should be based on a sound statistical methodology. The Committee will continue to monitor progress in the development of robust techniques to combine data elements.

Appendix

Reference Material

International Convergence of Capital Measurement and Capital Standards: A Revised Framework – Comprehensive Version, BCBS, June 2006, available at <http://www.bis.org/publ/bcbs128.htm>

Results from the 2008 Loss Data Collection Exercise for operational risk, BCBS, July 2009, available at <http://www.bis.org/publ/bcbs160.htm>

Observed range of practice in key elements of Advanced Measurement Approaches (AMA), BCBS, July 2009, available at <http://www.bis.org/publ/bcbs160.htm>

Observed range of practice in key elements of Advanced Measurement Approaches (AMA), BCBS, October 2006, available at <http://www.bis.org/publ/bcbs131.htm>

Principles for enhancing corporate governance – final document, BCBS, October 2010, available at www.bis.org/publ/bcbs176.htm

Recognising the risk-mitigating impact of insurance in operational risk modelling, BCBS, October 2010, available at <http://www.bis.org/publ/bcbs181.htm>

Extremes and robustness: a contradiction?, Dell'Aquila, R. and Embrechts, P., *Financial Markets and Portfolio Management*, 2006

Robust statistics and econometrics with economic and financial applications, Dell'Aquila, R. and Ronchetti, E., New York: Wiley 2006

Quantitative risk management: concepts, techniques and tools, McNeil, A., Frey, R. and Embrechts, P., Princeton: Princeton University Press 2005

Applying Robust Methods to Operational Risk Modelling, Chernobai, A. and Rachev, S.T., *Journal of Operational Risk*, 1(1), pp. 27-41, 2006

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

A Framework for Internal Control Systems in Banking Organisations, BCBS, September 1998, available at <http://www.bis.org/publ/bcbs40.htm>

Internal audit in banks and the supervisor's relationship with auditors, BCBS, August 2001, available at <http://www.bis.org/publ/bcbs84.htm>

Glossary of terms

Basel II

“Basel II Framework” and “Basel II”, used interchangeably in this report, refer to the Basel Committee’s *International Convergence of Capital Measurement and Capital Standards: A Revised Framework* (June 2006).

Operational risk capital

Unless explicitly mentioned otherwise, this term refers to the capital requirements for the AMA under pillar 1 of Basel II, as stated in paragraph 655 of the Basel II Framework.

Operational Risk management function (CORF)

This term refers to the independent operational risk management function that is responsible for the design and implementation of the bank’s operational risk management framework, as mentioned in paragraph 666(a) of the Basel II Framework.

Operational Risk management framework (ORMF)

The ORMF consists of a bank’s:

- (a) risk organisational and governance structure;
- (b) policies, procedures and processes;
- (c) systems used by a bank in identifying, measuring, monitoring, controlling and mitigating operational risk; and
- (d) operational risk measurement system.

Operational Risk measurement system (ORMS)

A bank’s ORMS consists of the systems and data used to measure operational risk in order to estimate the operational risk capital charge. Figure 1 in the Governance section of this paper illustrates the relationship between an ORMF and an ORMS.

Operational Risk Category (ORC)

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.

Risk appetite and tolerance

“Risk appetite” is a high-level determination of how much risk a firm is willing to accept taking into account the risk/return attributes; it is often taken as a forward looking view of risk acceptance. “Risk tolerance” is a more specific determination of the level of variation a bank

is willing to accept around business objectives that is often considered to be the amount of risk a bank is prepared to accept. In this document the terms are used synonymously.