UNIVERSIDADE TÉCNICA DE LISBOA

INSTITUTO SUPERIOR DE ECONOMIA E GESTÃO

MASTER IN FINANCE

Diagnosis of implementation and impact study of Operational Risk under Basel II

Author: Rita Isabel Quintas Gouveia de Carvalho

Supervisor: Professor Doutor António Saragga Seabra

Examining Board

Chair - Doutora Maria de Nazaré Barroso

Member of the Jury - Doutor Carlos Gonçalves

Member of the Jury - Doutor António Saragga Seabra

January, 2007

GLOSSARY

ABA – American Banks Association

AMA – Advance Measurement Approach

ASA – Alternative Standardized Approach

BFI – Bank Financial Institutions

BIA – Basic Indicator Approach

BIS – Bank for International Settlements

EL – Expected Loss

ET – Event Type

EU – European Union

EVT – Extreme Value Theory

IT – Information Technology

KRI – Key Risk Indicators

LDA – Loss Distribution Approach

ORX - Operational Risk Data Exchange Association

QIS – Quantitative Impact Study

RMA – Risk Management Association

SOX – Sarbanes-Oxley

TSA – Standardized Approach

UL – Unexpected Loss

US – United States

VAR – Value at Risk

Diagnosis of implementation and impact study of Operational Risk under Basel II

Rita Isabel Quintas Gouveia de Carvalho
Master in: Finance
Coordinator: Professor Doutor António Saragga Seabra
Project concluded in: 29th January 2007

ABSTRACT

The purpose of this document is to discuss some of the most controversial aspects of Basel II specifically relating to Operational Risk requirements in terms of Capital adequacy. The author presents an overview of the Basel II framework in terms of foundation, fundamentals and challenges, and specifically operational risk requirements under Pillar I, before going on to discuss some of its most controversial aspects. Against our initial expectations, several interviews conducted with Operational Risk Officers as well as with Risk experts, consolidated by the analysis of databases and international surveys, show evidence to conclude that banks are still quite reluctant and struggling to understand the specific requirements of the Advanced Measurement Approach (AMA). This, together with the Key Risk Indicators component, remains the major challenge to the financial institutions, both still in a very early completion stage. The author also discusses practices and methodologies in terms of operational risk modeling, presenting an alternative development approach for a possible future update of the Basel requirements, as relates to aggregated event type differentiated treatment, for operational risk modeling, and thus capital calculation, in the scope of the soundness criteria defined under AMA, in view of its practical value towards its feasibility and the advantages of a larger implementation of such an approach. The author therefore demands, for the benefit of the overall Financial System, greater adhesion by Banks to more operational risk sensitive approaches, namely AMA. This prepares the ground for a proposal towards the development of a regulatory incentive framework on capital calculation, to be applied within the implementation stage to AMA, to motivate banks to move, and as early as possible, to implementing more risk-sensitive bottom-up operational risk models and management practices.

KEY WORDS: Basel II, Operational Risk, Operational Risk Modeling, AMA, KRI

Diagnóstico de Implementação e Impacto em termos de Risco Operacional no Âmbito do Acordo de Basileia II

Rita Isabel Quintas Gouveia de Carvalho
Mestrado em: Finanças
Orientador: Professor Doutor António Saragga Seabra
Provas concluídas em: 29 de Janeiro de 2007

RESUMO

O objectivo deste trabalho assenta na discussão de alguns dos aspectos mais controversos relacionados com os requisitos de Capital regulatório oriundos do Risco Operacional no âmbito do Acordo de Basileia II. É efectuado um enquadramento do Basileia II e dos maiores desafios específicos para tratamento do Risco Operacional. Foi desenvolvido um trabalho de diagnóstico e pesquisa baseado em entrevistas a Responsáveis de Risco Operacional de Bancos Nacionais, Internacionais e a reputados investigadores internacionais desta área, alicerçado pela análise de algumas bases de dados e de vários questionários efectuados ao nível internacional. Contrariando as expectativas iniciais, muitos Bancos mantêm-se actualmente ainda reluctantes face à implementação de métodos mais avançados (AMA), existindo uma propensão ainda muito significativa pelos métodos menos avançados, i.e. o método Básico ou Standardizado. As maiores dificuldades prendem-se com os requisitos específicos delineados para o método mais avançado (AMA) e com a identificação e tratamento dos Indicadores Chave de Risco (KRI), ainda numa fase muito primária em termos de implementação. É igualmente discutido prácticas e metodologias, em termos de modelos de risco operacional, no âmbito do AMA. O presente trabalho desenvolve a teoria de que é fundamental uma maior adesão dos bancos à implementação do AMA. É, nestes termos, efectuada uma proposta para efeitos de futuros desenvolvimentos alternativos que possibilitem uma adesão mais generalizada à implementação do AMA. A proposta assenta no tratamento diferenciado em termos de modelação específica de risco operacional por segmentos agregados de tipologia de eventos de perda, para cálculo de capital regulatório, e por último, no desenvolvimento e aplicação regulatória de um enquadramento de incentivo, em fase de implementação para o AMA, para motivar os Bancos a promoverem rapidamente a implementação de modelos de gestão de risco operacional mais sofisticados e sensitivos, com as vantagens inerentes para a estabilidade e eficiência de todo o Sistema Financeiro.

PALAVRAS CHAVE: Basileia II, Risco Operacional, Modelos de risco operational, AMA, KRI

INDEX

INDEX TABLES   PAGE

INDEX FIGURES

Instituto Superior de Economia e Gestão
UNIVERSIDADE TÉCNICA DE LISBOA

ACKNOWLEDGMENT

CHAPTER 1 – INTRODUCTION

This work is focused on operational risk, exploring some of its insights and the major challenges which banks are facing nowadays with the pace of the introduction and implementation of the Basel II guidelines. Operational risk emerges nowadays as one of the major and most impacting risks, as it was not considered until now a capital charge obligation and therefore no specific capital hedging was hitherto defined.

Despite its intrinsic and significant limitations both in terms of its definition and quantitative treatment, and due also to the scarcity and unavailability of data, it is widely accepted that operational risk in the banking industry is a fast moving and extremely exciting field of research.

The increasing interest of regulators and the banking industry in Operational Risk in recent years has been largely driven by the increasing complexity of business processes, from large scale mergers and acquisitions to the use of highly sophisticated technology and integrated systems underlying the banking processes internal to e-business activities. Looking at today's rather complex banking business models and interdependencies, for instance in e-banking consortia, also creates a danger of linked operational breakdown in the service supply chain.

Banks have also been aware for a long time of hazards and uncertainties arising from Information Technology (IT) infrastructure, human error, human motivation and fraud, legal liability and many other issues. Operational risk is not a new risk; the innovative concept brought by the Basel Accord relates to defining operational risk as a quantifiable regulatory category and as such a capital charge, which repositions and gives an entirely new sense of urgency to this risk management discipline within the credit institutions and investment companies subject to the Basel directives.

From a residual category, Operational Risk has become a new key component of the global banking regulation framework for the Bank Financial Institutions, starting in 2004 with the Basel I and II requirements, running parallel until 2006 when Basel I is phased out.

In the scope of Basel II guidelines, the more risk-sensitive approach that presumes a capital charge specifically tailored to the bank profile, the Advance Measurement Approach (AMA), is based on a number of qualitative and quantitative assumptions that banks are finding quite difficult to understand, and furthermore to implement.

In view of the work I have developed, based on numerous studies, interviews and research analysis, I find that Banks are still struggling enormously to understand the AMA requirements. Furthermore, most remain very skeptical in terms of its implementation cost-benefit analysis, and are still quite focused on credit and market risk. The issue is clearly a significant delay and reticence towards implementing more widely the most sensitive bottom-up operational risk approaches, with the inherent negative consequences these can have on the overall Financial System.

I strongly believe that Basel requirements as relates to AMA should be urgently reviewed and worked out in order to motivate banks to implicate themselves more proactively in focusing on developing and implementing their own operational risk sensitive model as soon as possible. I therefore propose that an alternative development approach to the AMA be designed, allowing banks easier and feasible implementation of more risk-sensitive criteria, tailored to their own specific risk profiles. In my opinion it is also necessary to create an incentive framework to motivate banks to engage in this process as quickly as possible. The more sophisticated and forward looking risk sensitive models the banks are willing to develop and implement, the more efficiently will Operational Risk be mitigated and managed, greatly improving the whole environment of research and knowledge within this field. It is widely accepted that better management practices, governance and accountability as relates to operational risk assessment will certainly contribute positively to the greater financial stability of the Global Financial System.

CHAPTER 2 – AN OVERVIEW OF BASEL II

To better contextualize the discussion points developed below I shall open with an overview of Basel II foundations and fundamentals before discussing the operational risk approaches proposed.

2.1. - BASEL II FOUNDATIONS

In 1974, after the collapse of Bankhaus Herstatt, the governors of the Group of Ten[1] established the Standing Committee on Banking Regulations and Supervisory Practices comprised of representatives of the supervisory authorities and central banks of the Group of Ten, plus Luxembourg and subsequently also Spain. The official name of the committee was later shortened to "The Basel Committee on Banking Supervision", commonly referred to as the Basel Committee. See Herring and Litan (1995) for a more extensive discussion of the Basel Committee and the process that led to the Accord.

The 1988 Accord on Capital Adequacy, which became known as the Basel Accord, established a framework for capital regulation of internationally active banks. The Basel Committee did not attempt to harmonize accounting conventions, nor require the use of market values in measuring capital. Instead, it took as given the accounting practices in the Group of Ten Countries and focused on: (1) how to define regulatory capital; (2) how to measure risk-weighted assets including off-balance sheet exposures; and (3) the minimum acceptable ratios for regulatory capital to risk-weighted assets.

The Basel Capital Accord or Basel I (1988), which set minimum capital standards for internationally active banks, was really the first international accord of its kind. It succeeded in raising capital levels at a time when they were quite low. Aside from defining what types of capital were eligible, Basel I set a capital ratio at 8% of risk-adjusted assets. It was the risk-adjustment of the assets which became the focus of concern and current regulatory reform resulting in the New Basel Capital Accord or Basel II.

---

[1] Consisting of senior representatives of bank supervisory authorities and central banks from Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States.

Figure 1 – Breakdown of Economic Capital by Risk type
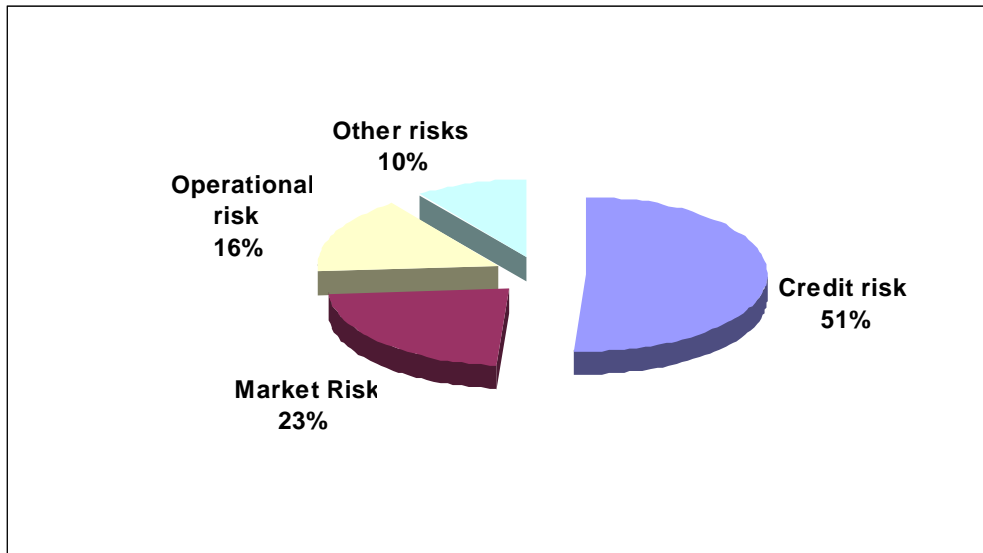
Source: QIS 2

Following the publication of the Committee's first round of proposals for revising the capital adequacy framework in June 1999, an extensive consultative process was set in motion in all member countries and the proposals were also circulated to supervisory authorities worldwide. The Committee subsequently released additional proposals for consultation in January 2001 and April 2003, and conducted three quantitative impact studies related to its proposals.

In accordance with the second Quantitative Impact Study (QIS 2)[2] carried out by the Basel Committee, Operational Risk according to the weights then used constituted 16% of the economic capital identified by risk type, i.e. a fundamental part of the risk profile as shown in Figure 1.

As an outcome of all this previous work, discussion and analysis, the Basel Committee released in 2004 a revised agreement know as Basel II, aiming at introducing a much broader and deeper framework, differentiating risks into credit, operational and market as well as economic and regulatory capital, foreseeing the development of far more complex new techniques, systems and procedures to better analyze and classify the banking system effective risk profile.

Having a key-impact on the banking system,[3] as Basel II attempts to eliminate incentives for regulatory capital arbitrage and align capital regulation with best practices in risk

---

[2] Quantitative Impact Study 2, published in September 2001
[3] See David Bieri (2004) and Richard J. Herring (2004) for an in-depth discussion of the impact of Basel II.

management, it is unquestionably one of the major challenges that banks face nowadays. I will focus on one of its most controversial aspects – the Operational Risk requirements guidelines under Basel II.

2.2. - BASEL II FUNDAMENTALS

The revised framework of the International Convergence of Capital Measurement and Capital Standards - A Revised Framework (2004) is the outcome of the Basel Committee on Banking Supervision's work over recent years to secure international convergence on revisions to supervisory regulations governing the capital adequacy of internationally active banks, referred to as Basel II.

It was developed with the aim of further strengthening the soundness and stability of the international banking system while maintaining sufficient consistency such that capital adequacy regulation would not be a significant source of competitive inequality among internationally active banks.

The new framework relies on three "pillars": capital adequacy requirements, supervisory review, and market discipline. This document has been circulated to supervisory authorities worldwide with a view to encouraging them to consider adopting the revised Framework at such time as they believe is consistent with their broader supervisory priorities. While it was designed to provide options for banks and banking systems worldwide, the Committee acknowledged that moving towards its adoption in the near future may not be a top priority for all non-G10 supervisory authorities. Where this is the case, each national supervisor should carefully consider the benefits of the revised Framework in the context of its domestic banking system when developing a timetable and approach to implementation.

Figure 2 - Expected change in capital requirements per country
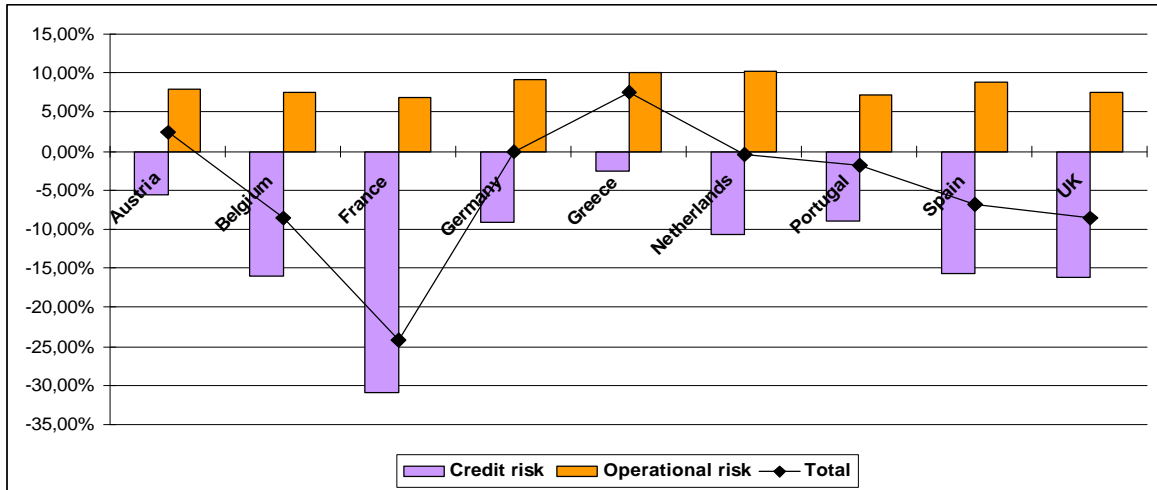
Source: QIS 3 country reports, EU Commission[4]

Figure 3 - Contribution of Operational Risk to the overall expected change in capital requirements per country
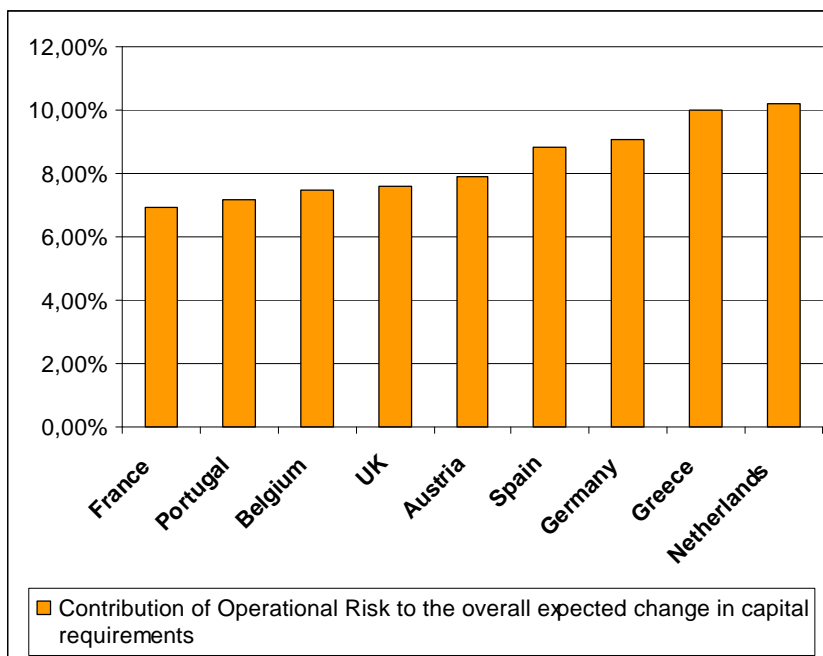
Source: QIS 3 country reports, EU Commission[5]

---

[4] No data was available for Ireland, Italy and Luxembourg. Data for Sweden was insufficient for the analysis. Data for Finland and Denmark was not displayed for reasons of confidentiality.

[5] No data was available for Ireland, Italy and Luxembourg. Data for Sweden was insufficient for the analysis. Data for Finland and Denmark was not displayed for reasons of confidentiality.

In developing the revised Framework, the Committee has sought to arrive at many more risk-sensitive capital requirements that are conceptually sound and at the same time pay due regard to particular features of the present supervisory and accounting systems in individual member countries. It believes that this objective has been achieved. Since the Framework is designed to establish minimum levels of capital for internationally active banks, supervisors should expect banks to operate above minimum regulatory capital levels, particularly in countries where risks in the local banking market are relatively high, where banks should be required to hold additional capital over and above the Basel minimum.

According to a study ordered by the Basel Committee in the EU and published in 2004,[6] the variation in the change in capital requirements for Banks under Pillar I of the Basel II proposals could be significant at the individual financial institutions level and at country level. It pointed out that at country level the change could be from a decrease of 10% to an increase of about 2% on total capital requirements. According to QIS 3[7] outcome in the EU system as a whole minimum capital requirements would be expected to reduce by 5,3%, as a result of combined effects both on credit and operational risk based on assumptions as to the likely use of different approaches. Notwithstanding the limitations of this study it is quite useful to view the individual results per EU country split into the estimated contributions of credit and operational risk to the overall change, illustrated in the Figures 2 and 3.

The Committee also wished to highlight the need for banks and supervisors to give appropriate attention to the second (supervisory review) and third (market discipline) pillars of the revised Framework. It is critical that the minimum capital requirements of the first pillar be accompanied by a robust implementation of the second, including efforts by banks to assess their capital adequacy and by supervisors to review such assessments. In addition, the disclosures provided under the third pillar of this Framework are highlighted as essential in ensuring that market discipline becomes an effective complement to the other two pillars.

The Basel Process is a key element of the global financial system and as such plays an important role in coordinating the multilateral efforts of various committees, uniquely geared towards fostering and maintaining financial stability. Identifying potential threats is a key ingredient for a continuous strengthening of the stability of both national and

---

[6] Study on the financial and macroeconomic consequences of the draft proposed new capital requirements for banks and investment firms in the EU, April 2004, final report by PriceWaterhouseCoopers
[7] Third Quantitative Impact Study: EU results, European Commission, July 2003

global financial systems, the boundaries of which have become increasingly vague due to increasing inter-market linkage.

Taking such into account the Committee has designed the revised Framework to be more forward-looking in its approach to capital adequacy supervision, one that would have the capacity to evolve over time.

CHAPTER 3-OPERATIONAL RISK APPROACHES UNDER BASEL II

We now have to discuss in more detail the three different approaches defined by Basel II to calculate the capital requirement from the operational risk component.

As defined by the revised Framework, the Bank Financial Institutions can choose from the three main approaches discussed below.

Figure 4 – Operational Risk Approaches under Basel II requirements

BIA   TSA   AMA

Improved Risk Sensitivity and Sophistication
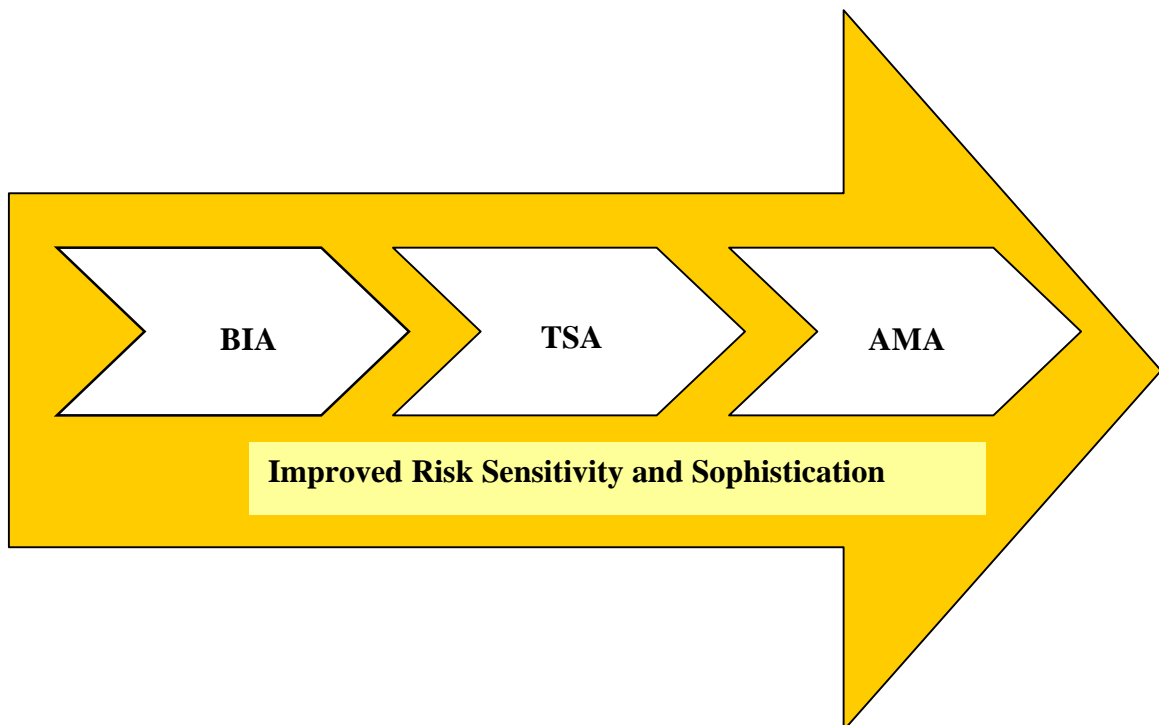
3.1. - BASIC INDICATOR APPROACH (BIA)[8]

In this Approach the capital requirement is based on a fixed percentage (alpha) which is multiplied by a relevant indicator, both of which are defined by the Basel Committee as follows:

$$K_{BIA} = [\bullet (GI_{1...n} * \bullet)] / n$$

K_{BIA} - Capital Charge under the Basic Indicator approach

GI - The relevant indicator chosen by the Committee is the Gross Income (GI), where Gross Income = Net Interest Income + Net non-interest Income, and resulting of the average of the previous three years of positive annual gross income.[9]

α - Currently the fixed percentage (alpha) defined is 15%[10]

n – number of years in the last three years where Gross Income has been positive

3.2. - STANDARDIZED APPROACH (TSA)[11]

In a similar manner to the BIA approach the Capital requirement is based on a fixed percentage which is multiplied by a relevant indicator. The calculation is drilled down into 8 business lines of the institutions, each with its own fixed percentage factor (beta), all defined by the Basel Committee as follows:

$$K_{TSA} = \{\bullet_{years\,(1-3)} \max[\bullet (GI_{i\,(1-8)} \times \bullet_{i\,(1-8)}),0]\} / 3$$

---

[8] Approach defined with no specific eligibility criteria, although banks are encouraged to comply with the principles and recommendations related to the "Sound Practices for the Management and Supervision of Operational Risk", BIS 2002.

[9] As defined by the national regulatory supervisors and in such a manner that it should be gross of any provisions and operating expenses (including fees paid to outsourcing service providers), exclude realized profits/losses from the sale of securities, and exclude extraordinary or irregular items as well as income derived from insurance. Any year in which Gross Income is negative or zero has to be excluded when calculating the average. See Carolyn Currie (2005).

[10] As defined by the Basel Committee, resulting from the QIS 3 value adjusted to represent 12% of the currently minimum level of regulatory Capital.

[11] Approach defined with no specific eligibility criteria, although banks are encouraged to comply with the principles and recommendations related to the "Sound Practices for the Management and Supervision of Operational Risk", BIS 2002.

K_{TSA} – Capital Charge under the Standardized Approach that results from the sum of the regulatory capital charges across each of the business lines.

$_i$ – Business line as defined by the Basel Committee

$GI_{i\,(1-8)}$ - The relevant indicator chosen by the Committee is the Gross Income (GI) per Business Line i , where Gross Income = Net Interest Income + Net non-interest Income, and resulting from the average of the previous three years of positive annual gross income as defined per Business Line.[12]

$\bullet_{i\,(1-8)}$ – Percentage previously defined that factors the calculation of the level of Capital required with the relevant indicator defined per Business Line[13]

The Business Lines and Betas defined by the Basel Committee as relating to the Standardized Approach[14] are as shown just afterwards in Table 1.

---

[12] Applies same criteria as in BIA approach as defined in Note 13 for Gross Income calculation, while in any given year negative capital charges (resulting from negative gross income) in any business line may offset positive capital charges in any other business line without limits, as long as aggregated capital charge within a given year remains positive – otherwise that year has to be excluded from the average. Within each business line the Gross Income is an indicator that serves as a proxy for the scale of business operations and therefore the most likely scale of operational risk exposure within each of the eight business lines defined by the Committee.

[13] The Beta serves as a proxy for the Industry-wide relationship between the operational risk loss experience and the aggregated level of Gross Income as defined for a given business line.

[14] As defined under Basel II there is an Alternative Standardized Approach which is basically defined as follows:

"At national supervisory discretion a supervisor can choose to allow a bank to use the Alternative Standardized Approach (ASA) provided the bank is able to satisfy its supervisor that this alternative approach provides an improved basis by, for example, avoiding double counting of risks. Once a bank has been allowed to use the ASA, it will not be allowed to revert to use of the Standardized Approach without the permission of its supervisor. It is not envisaged that large diversified banks in major markets would use the ASA. Under the ASA, the operational risk capital charge/methodology is the same as for the Standardized Approach except for two business lines – retail banking and commercial banking. For these business lines, loans and advances – multiplied by a fixed factor 'm' – replace gross income as the exposure indicator. The betas for retail and commercial banking are unchanged from the Standardized Approach. The ASA operational risk capital charge for retail banking (with the same basic formula for commercial banking) can be expressed as:

$K_{RB} = \bullet_{RB}$ x m x LA_{RB}, where K_{RB} is the capital charge for the retail banking business line; $\bullet_{RB}$ is the beta for the retail banking business line; LA_{RB} is total outstanding retail loans and advances (non-risk weighted and gross of provisions), averaged over the past three years; m is 0.035

For the purposes of the ASA, total loans and advances in the retail banking business line consists of the total drawn amounts in the following credit portfolios: retail, SMEs treated as retail, and purchased retail receivables. For commercial banking, total loans and advances consists of the drawn amounts in the following credit portfolios: corporate, sovereign, bank, specialized lending, SMEs treated as corporate and purchased corporate receivables. The book value of securities held in the banking book should also be included. Under the ASA, banks may aggregate retail and commercial banking (if they wish to) using a beta of 15%. Similarly, those banks that are unable to disaggregate their gross income into the other six business lines can aggregate the total gross income for these six business lines using a beta of 18%, with negative gross income treated as described in paragraph 654. As under the Standardized Approach, the total capital charge for the ASA is calculated as the simple summation of the regulatory capital charges across each of the eight business lines."

Table 1 – Betas defined by the Basel Committee per Business Line under the Standardized Approach

Business Line	Beta
Corporate finance (• 1)	18%
Trading and sales (• 2)	18%
Retail banking (• 3)	12%
Commercial banking (• 4)	15%
Payment and settlement (• 5)	18%
Agency services (• 6)	15%
Asset management (• 7)	12%
Retail brokerage (• 8)	12%

3.3. - ADVANCED MEASUREMENT APPROACH (AMA)

This method allows banks to determine their own capital requirements for operational risk according to an internal model, provided it meets certain requirements and criteria as defined by the Basel Committee and subject to supervisory approval.

The Operational Risk capital requirement is calculated by the risk measure generated by the bank's own risk measurement system, which must take into account the following elements: combination of internal and external data; scenario analysis; and bank specific environment and internal control factors. This measurement approach may also factor in Risk Mitigation elements like Insurance and Correlation and Diversification elements.

Figure 5 – Distribution of Losses
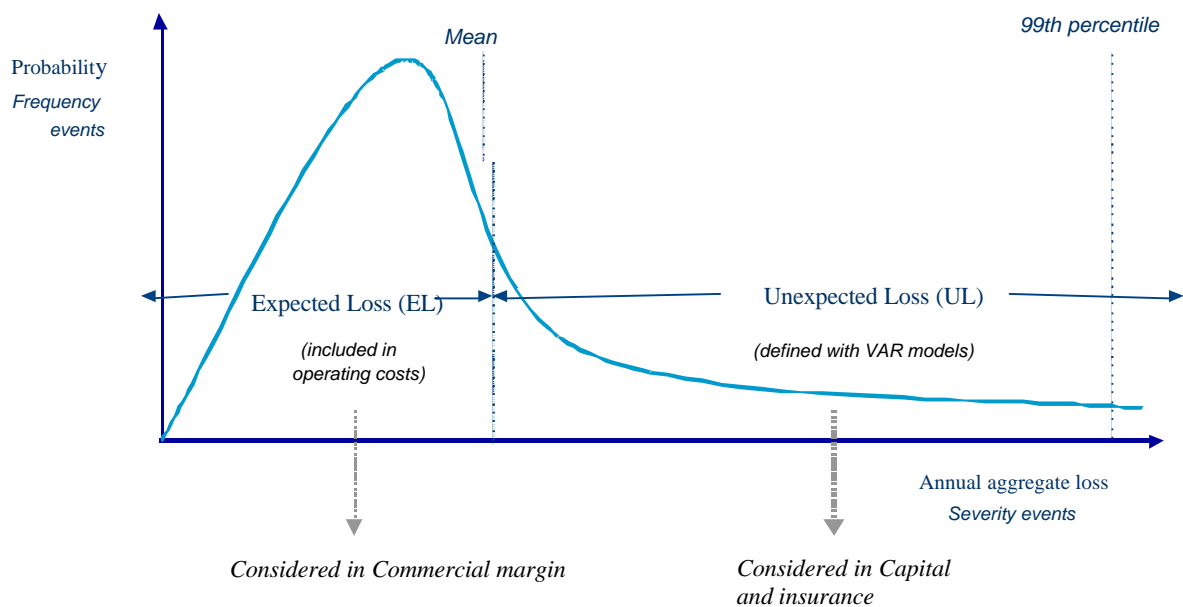
This internal measurement system should estimate unexpected losses combining the elements mentioned in different ways to quantify exposure to operational risk and thus be able to support allocation of economic capital to the respective business units. See Figure 5, which best illustrates Operational Risk Loss Event Distribution. The goal becomes improving the operational risk management framework in such a forward looking manner in order to show accepted evidence to minimize respective capital charge. This comprehensive enterprise framework requires the combination of both qualitative and quantitative data. Analytical frameworks and tailored solutions across business units are expected under the umbrella of an Operational Risk Policy Framework.[15] These cross-dynamic implementation plans require a certain level of effort to comply with Basel II operational risk requirements, specifically for AMA implementation purposes in a forward looking perspective.

---

[15] With procedures covering business risk management, third party risk, risk assessment and approval, fraud risk management, business continuity management, operational loss reporting, non lending loss ownership and model risk.

3.3.1. - Main Qualitative and Quantitative Criteria

To following table illustrates some of the key eligibility requirements criteria.

Table 2 – Key Qualitative and Quantitative Criteria for eligibility requirements towards AMA implementation

Corporate Governance	Procedures and policies for the entire scope of the operational risk framework Board and senior management validation and oversight Reporting of operational risk exposures, losses, risk indicators, etc., to board and senior management Sound internal control environment Independent enterprise-wide operational risk framework and function Independent testing and audit Lines of business responsible for day-to-day risk management
Internal Data	Internally generated operational risk measures used for regulatory purposes must be based on a minimum historical observation period of 5 years or 3 years when first moving to AMA It is crucial to track all relevant internal loss data Process dully documented for assessing the ongoing relevance of historical loss data
AMA soundness	To meet a soundness standard comparable to the internal ratings based approach for credit risk, e.g. 1 year holding period and 99.9% confidence interval This approach has to capture potentially severe tail loss events
Detailed criteria	Regulatory capital requirement = Expected Loss + Unexpected Loss The models and system should include the use of internal and external data, scenario analysis and factors reflecting the business environment and internal control factors It should be sufficiently granular to capture major drivers of risk affecting the shape of the tail of the loss estimates If systems for measuring correlation can be proved sound, correlations may be used across individual operational risk estimates

Table 2 – Key Qualitative and Quantitative Criteria for eligibility requirements towards AMA implementation (cont.)

External Data	Banks should use relevant external data with a systematic process to determine when and how to apply the external data Sufficient information to help the bank assess the relevance of the loss event for other banks Conditions and practice for use must be regularly reviewed, documented and subject to periodic independent review
Business environment and internal control factors	Capture key business environment and internal control factors that can change its operational risk profile to make a bank's risk assessment more forward looking. Factors should be: subject to independent review, documented and justified as a meaningful driver of risk, considered for their impact on the bank's risk estimate and validated over time
Scenario Analysis	In conjunction with external data to evaluate its exposure to high severity events use scenario analysis In a systematic manner over time the assessments should be validated and re-assessed through comparison to actual loss experience

Risk Mitigation	Mitigation of risk using insurance will be limited to 20% of the total operational risk charge.
	 The criteria for eligibility is :
	     Consider a minimum claims paying ability for the insurance provider, residual maturity term and notice period for cancellation of the contract
	     Require a 3rd party insurer
	     Disclosure requirements
	 Bank's methodology for recognizing insurance under the AMA should capture:
	     Uncertainty of payment and mismatches in coverage
	     Potential concentration risks to insurance providers
	     Potential associated liquidity risks

3.3.2. – Event Types

Going further, Basel II has also proposed an operational risk categorization by Levels of Event Types, which are the basis for the classification shown in Table 3 below, attempting to segment sources of operational risk that could stand for the main event type categories to be considered.

It is also essential to segment each event type by frequency and severity, in order to distinguish low frequency, high severity loss events (major) from high frequency, low severity loss events (minor).

Table 3 – Event Types as defined by Basel II

EVENT TYPES			
Level 1	**Definition**	**Level 2**	**Activity Examples (Level 3)**
INTERNAL FRAUD	*Losses due to acts of a type intended to defraud, misappropriate property or circumvent regulations, the law or company policy, excluding diversity/discrimination events, which involve at least one internal party.*	**Unauthorized Activity**	Transactions not intentionally reported Unauthorized transactions Intentional miss-marking of position
		Theft & Fraud	Fraud, credit fraud, worthless deposits Theft, extortion, embezzlement, robbery Misappropriation of assets Malicious destruction of assets Forgery, check kiting, smuggling Account take-over, impersonation, etc Tax non compliance, evasion, bribes Insider trading

Table 3 – Event Types as defined by Basel II (cont.)

EXTERNAL FRAUD	*Losses due to acts of a type intended to defraud, misappropriate property or circumvent the law, by a third party*	**Theft & Fraud**	Theft, robbery, forgery, check kiting
		Systems Security	Hacking damage Theft of information
EMPLOYMENT PRACTICES & WORKPLACE SAFETY	*Losses arising from acts inconsistent with employment, health or safety laws or agreements, from payment of personal injury claims or from diversity/discrimination events*	**Employee Relations**	Compensation, benefit, termination issues Organized labor activities
		Safe Environment	General liability Employee health and safety rules events Workers compensation
		Diversity & Discrimination	All discrimination types
CLIENTS, PRODUCTS & BUSINESS PRACTICES	*Losses arising from an unintentional or negligent failure to meet a professional obligation to specific clients (including fiduciary and suitability requirements) or from the nature or design of a product.*	**Suitability, Disclosure & Fiduciary**	Fiduciary breaches, guideline violations Suitability, disclosure issues Retail consumer disclosure violations Breach of privacy Aggressive sales Account churning Misuse of confidential information Lender liability
		Improper Business or Market Practices	Antitrust Improper trade, market practices Market manipulation Insider trading Unlicensed activity Money laundering
		Product Flaws	Product defects Model errors
		Selection, Sponsorship & Exposure	Failure to investigate client per guidelines Exceeding client exposure limits
		Advisory Activities	Disputes over performance of advisory activities

Table 3 – Event Types as defined by Basel II (cont.)

DAMAGE TO PHYSICAL ASSETS	*Losses arising from loss or damage to physical assets from natural disasters or other events*	Disasters and other events	Natural disaster losses Human losses from external sources (terrorism, vandalism…)
BUSINESS DISRUPTION & SYSTEM FAILURES	*Losses arising from disruption of business or systems failures*	Systems	Hardware, Software Telecommunications Utility outage/disruptions
EXECUTION DELIVERY & PROCESS MANAGEMENT	*Losses from failed transaction processing or process management, from relations with trade counterparties and vendors*	Transaction Capture, Execution & Maintenance	Miscommunication Data entry, maintenance or loading error Missed deadline or responsibility Model/system disoperation Accounting error/entity attribution error Other task miss performance Delivery failure Collateral management failure Reference data maintenance
		Monitoring and Reporting	Failed mandatory reporting obligation Inaccurate external report
		Customer Intake & Documentation	Customer permissions/disclaimers missing Legal documents missing/incomplete
		Customer/Client Account Management	Unapproved access given to accounts Incorrect client records Negligent loss or damage of client assets
		Trade Counterparties	Non-client counterparty miss performance Miscellaneous non-client counterparty disputes
		Vendors & Suppliers	Outsourcing, Vendor disputes

Source: Basel Committee on Banking Supervision (2003), "The 2002 Loss Data Collection exercise for Operational Risk; Summary of the Data Collected" and Currie (2005)

3.4. – TOP DOWN VERSUS BOTTOM UP APPROACHES

Widely agreed to be a rather complex process, due also to its heterogeneous causes, the 3 approaches proposed by the Basel Committee can be grouped into two main methods:

- Top down method – more backward looking – Operational Risk is measured and hedged from a Central level not involving the business units. It does not usually distinguish either frequency or severity of loss event types and is usually the outcome of the variance calculation in a target variable unexplained by market and credit risk factors. One of its basic advantages is obviously its simplicity and low data input requirements. An example is the BIA method, where the calculation is made using variables strongly correlated with the risk exposure.

- Bottom up method – more forward looking than top down method – Operational Risk is measured at the level of each business line or process according to the nature of each event type and then aggregated up. Notwithstanding the fact that it is much more expensive and complex to implement, depending on the degree of sophistication aimed at, it allows much better management control and planning, permitting allocation, intervention and monitoring per business line or process. AMA can be included in this category of more risk sensitive approaches. Individual processes and procedures are mapped to a combination of risk factors and loss events that are then used to generate probabilities for future scenarios. Potential changes in events and risk factors are simulated to achieve a loss distribution incorporating correlations between events and processes. Extreme value theory and standard Value-at-Risk models are most widely used to represent expected and unexpected losses from operational risk exposure.

Rising in complexity and aimed at decreasing in outcome of capital requirements, from BIA to TSA and ultimately to AMA. This latter is expected to allow lower levels of capital requirements, since models are more sensitive to the individual bank operational risk profile, where the internally generated risk measure model is expected to accurately capture the tail of the operational risk loss distribution. Suited for larger sized banks, as each bank can create its particular model under the AMA as long as compliant with the qualifying criteria set by the Basel Committee.

CHAPTER 4 - IDENTIFICATION OF THE PROBLEM

Acknowledging that operational risk is one of the most innovative and focal points of the Basel II guidelines should be driving current investigation work as well as preparing the ground for future framework developments. So far mainly credit risk and market risk management have been dominating banks' concerns.

Banks have been recognizing the growing significance of operational risk in attempting to manage it for many years, but now they have to measure it, which is one of the most controversial aspects of Basel II.

Further on I will highlight some of the major challenges regarding the implementation of the more risk sensitive Advanced Measurement Approach proposed, which are currently preventing most banks from adopting this more advanced approach in the short term, against my initial expectations. I also discuss possible areas of improvement in terms of Basel II, as banks still have a long way to go before becoming compliant with the Basel II framework as relates to AMA.

The main points discussed are the following:

§   Against my initial expectations, banks are still very reticent towards AMA implementation and far from being motivated to move to this more Advanced Approach; I discuss further on some of the major issues.

§   Most Models and techniques used for measuring Operating Risk still lack predictive capabilities according to AMA requirements.

§   To allow feasible and earlier AMA implementation worldwide I propose an alternative development approach based on both loss event type behavior differentiation with increased use of external data and an incentive framework to motivate more banks to adopt and start implementing AMA.

CHAPTER 5 – REVIEW OF THE LITERATURE ON BASEL II OPERATIONAL RISK CHALLENGES

According to the revised framework published in 2004, Basel II (2004), "Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events". This definition includes legal risk,[16] but excludes strategic and reputation risk. A number of discussion papers, consultation and preliminary documents[17] have been at the origin of the guidelines published by the Basel II revised framework, which for the first time required the incorporation of an explicit capital charge relating to Operational Risk, further to Market and Credit Risks.

In a manufacturing context, literature and science have evolved over the past decades, discussing and presenting several techniques for measuring operational risk, with divergent approaches to quality measurement. Pioneered by Walter Stewart (1931), the SPC (Statistical Process Control) knowledge process has developed a framework for measuring the consistent performance on an eclectic variety of measures. Still, operational risk in banks remains as an "amalgamation of many disparate risks" of heterogeneous nature with its primary definition remaining that of a residual risk, e.g. all that is not related to credit or market risk.

Michael Power (2003) has developed an inner discussion on the "Invention of operational risk". As Power mentions, "The concept is neither a discrete category not a set of well defined practices but marks the potential for a new organization of management knowledge, a "constellation" or assembly in which multiple elements combine to create a new hybrid regulatory and managerial practice". Notwithstanding the definitional problem, there are also boundary issues between market and credit risks. Most bankers, as highlighted by Ed Blount (2005), have considered the Operational Risk charge as a counterbalance to the market and credit risk capital reductions that are expected to occur through the use of more sophisticated approaches. Yet as maintained

---

[16] See Basel Committee on Banking Supervision (2004) – part II – V.A.644. "Legal risk includes, but is not limited to, exposure to fines, penalties, or punitive damages resulting from supervisory actions, as well as private settlements."

[17] See: CP3 – Third consultative paper, The new Basel Capital Accord (2003); Sound Practices for the Management and Supervision of Operational Risk – BIS (2002); The 2002 Loss Data Collection exercise for Operational Risk: Summary of the Data Collected – Risk Management Group - BIS (2003); Operational Risk systems and controls – Financial Services Authority - FSA (2002); Implementation of the Capital Accord for Operational Risk – FSA (2003); QIS 2, QIS 3 ad QIS 4 results.

by Allen and Bali (2004)[18] large unexpected losses are more likely to emanate from operational risk events and therefore Value-at-Risk from operational risk is significantly higher than from other types of risk events such as market or credit risks. Cornalba and Giudici (2004) state that "the objective is to estimate a loss distribution and to derive functions of interest from it, such as the Value at Risk in particular, losses in market risk are realizations of continuous stochastic process, while losses in credit risk are realizations of a convolution between a binary process (default or not) and a continuous one. Differently, losses in Operational Risk are realizations of a convolution between a counting process (frequency) and a number of continuous ones (severities)." Ebnother; Vanini et al. (2002) show evidence to conclude that severity dependence as opposed to frequency dependence changes the independent results significantly with the risk factor "fraud" dominating all other factors. Also most relevant is the conclusion that only 10% of all processes, after performing sensitivity analysis to test their robustness under this stress testing, have a 98% contribution to the resulting Value at Risk. Much discussion has taken place lately in view of the recognized difficulty of measuring and modeling Operational Risk. Most models are essentiality descriptive and backward looking, as Holmes (2003) pointed out, and most of them take the form of a self assessment scorecard or a loss-data approach. For a more detailed example of a Scorecard approach see Scandizzo (2005). Furthermore, Currie (2005) states there is no evidence to conclude that these models do work and can be predictive.

To overcome the underlying difficulties already mentioned as to the sound measurement of operational risk in a forward looking scope, as expected under the Basel guidelines, some authors have shown increasing interest in other approaches like the Bayesian Belief Networks explored by Carol Alexander (2004) and Cornalba and Giudici (2003) and applied to Extreme Value Theory models like Medova (2001) and the Fuzzy Logic approach, for instance Scandizzo (2000).

Moving a step further from measurement issues and looking ahead into the managerial issues related to operational risk requirements as defined under Basel II, Holmes (2003) summarizes a list of detrimental consequences that can arise from the use of such models. Many empirical and analytical studies have been lately carried out in relation to this, analyzing implications on banks' portfolio strategy, market competitiveness, structural changes in risk strategy, pricing, and macro-economic impact in the global

---

[18] They found that two thirds of the equity risk premium for all types of financial institutions derived from operational risk. (which could have included reputation risk where scientific literature is still very scarce or inexistent)

financial system, setting several spectrums of discussion. The main conclusions stress both the need for continuous progress as related to Basel II framework future developments, pointing out some structural and articulation fragilities not addressed so far, and raising questions for further research and impact analysis yet to be validated. Although how the articulation of the three instruments, designated the 3 pillars, are to be used in a concrete manner remains unclear,[19] many positive changes were incorporated in this new revised framework as related to its prior versions. Nevertheless these changes[20] are still unlikely to bring on board many countries which have declared that they will not apply the New Accord or will just limit its application to a minority of their banks. Greater coherence has not however been accompanied by a reduction in complexity, reflecting financial innovation and the growing complexity of banking practice, which are a continuing source of problems for regulation. The main challenges towards implementation of Basel II are also examined by Ian Wilson (2004). Through the experience and results of the Barclays Basel II program case-study Wilson has developed a gap analysis tool for the implementation process of Basel II. Given the complexity and the fact that the rules are not fully defined, to meet Basel II standards and minimize very expensive mistakes he suggests that there are a few critical areas of focus: Capital management, Program management, Risk Management and Relationship with the regulator.

Further to its main implementation challenges both at national level and on the level of each individual bank, one of the major issues widely cited is the possible effect on the banks' behavior in the future as a consequence of changes to the in the regulatory capital requirements system. A change in banks' risk behavior had already been identified by Steven A. Dennis and Andrew Jeffrey (2000) as related to initial Basel implementation, where these authors identified several structural changes due to regulatory changes. Some analysts suggest that further examination and literature should focus on the incentives for banks to properly estimate and truthfully report Operational Risk. This is precisely one of the subjects for the supervisory review process (or Pillar 2) of Basel II, whose analysis by academics has only started. Capital regulation affects behavior which is reassuring but stresses the need to refine existing regulation. Andrea Sironia and Cristiano Zazzara (2003) also highlight the need to look at local standards at national level, pointing out that national specificities will cause different impacts of the implementation of Basel II. An overview of some of the main research questions that the

---

[19] See Paul Decamps, Jean-Charles Rochet and Benoit Roger (2003)
[20] See Andrew Cornford (2004)

New Basel Accord raises is given by Marc Saidenberg and Til Schuermann (2003). Again it is stressed that the output of the risk calculations under the New Basel Accord may also change bank behavior as some internal risk metrics are disclosed to the public. On their view a research agenda going forward would then be focused less on regulatory design; instead it might be more oriented towards understanding the Accord's likely impact on the banking system, possible changes in bank behavior through different uses of the risk measurement framework, and important analytical issues around model development and general validation in terms of operational risk in a narrow perspective, and the development of relevant risk summary statistics in a wider one. As of today most banks hold a capital to asset ratio well above the required minimum defined by the present capital adequacy regulation. Kkjersti-Gro Lindquist (2004) finds support for the hypothesis that this buffer capital serves as an insurance against failure to meet capital requirements.

CHAPTER 6 – METHODOLOGY AND DATA

To further sustain the comments and the analysis developed I have carried out a consistent research method based on techniques such as direct interviews as well as analysis of databases from international surveys, namely:

§ **Interviews**

- Personal interviews with three major Portuguese banking institutions representing 57% of total Net Assets in the Portuguese Banking Industry (based on June 2005 account statements). Two interviewees were Risk Department heads and one a Risk Director.
- Interviews were held with Operating Risk Head officers in three Large International Banks from the UK and the Netherlands and Risk Officers in the Supervisory department of two European Central Banks.
- Interviews with several international researchers and experts in the Risk Management field, whose works have been published in several scientific, finance and risk Journals, some of them quoted in this work.
- Interviews and discussions held in specialized forums such as www.baselallert.com and B2-ORM@yahoogroups.com

Interviews and information gathering took place from October 2005 to June 2006 and for confidentiality reasons there is no disclosure, as from the beginning it was a primary assumption underlying all contacts held, on names, entities represented and internal and/or sensitive data that could eventually be strictly confidential and damaging to the respective institutions and responsible officers. No national or international institution contacted has indeed accepted to provide quantitative data on Operational Risk.

§ **International Surveys on Banks**

The International surveys carried out worldwide or at regional level such as European, at US level and in the Asia Pacific region that constitute a significant component of my research data are:

- Quantitative Impact Studies by the Basel Committee[21]

- Study commissioned by the European Community[22]

- Survey conducted in several European countries on a significant number of international banks[23]

- Survey conducted within the United Stated on a significant number of US Banks[24]

- Survey conducted at Asia-Pacific level on a significant number of banks[25]

- Two Surveys conducted worldwide on large banks[26]

---

[21] QIS 1,2 and 3

[22] Study conducted by National Institute for Economical and Social Research in Risk Management in partnership with PricewaterhouseCoopers in 2004.

[23] Database on a survey conducted in 2004 by CGEY (not published).

[24] Survey conducted in 2004 by Gartner Inc.

[25] Survey conducted in 2005 by Asia Risk and E&Y.

[26] Surveys conducted in 2004 by SAS and Risk Magazine and in 2006 by Ernst&Young

CHAPTER 7 – DIAGNOSIS OF IMPLEMENTATION STATUS AND ISSUES AS RELATED TO AMA ADOPTION

7.1. - IMPLEMENTATION STATUS

I begin this chapter by diagnosing the current implementation status as regards Basel II Operational Risk guidelines and approaches with a specific focus on AMA, based both on the interviews conducted and the analysis of databases and survey data.

According to the Basel fundaments as well as to several authors and risk experts, Banks adopting more advanced methods and specifically AMA, as proposed by the Basel II, should obtain more competitive advantages. When adopting more advanced and customized approaches, like AMA, banks should achieve lower regulatory capital requirements tailored by their market, portfolio actuation and strategies, as opposed to banks adopting more basic approaches.[27] However, I found that there is still much evidence to be gathered in a sound and quantifiable manner to prove this. Banks are still struggling to understand the full scope of AMA implementation requirements, prior to evolving into AMA compliance, as they question as well evidence on cost benefit advantages.

Every single risk officer from the banks I contacted both in Portugal and abroad indicated they were still extremely reluctant about AMA implementation. To start with, their primary focus was still on the credit and market side; secondly, they were having enormous difficulty in assimilating and fully understanding how to implement the guidelines as proposed by the Committee. Thirdly, they were still far from having more developed operational risk frameworks and policies in place and from fully understanding operational risk definition and scope. At the same time they felt a strong lack of internal cultural sensitivity from staff up to senior management in terms of awareness and understanding of the full scope and potential impact of operational risk.

---

[27] Like Basic Indicator Approach, Standard approach or Alternative Standardized approach as per defined in Basel II guidelines.

Figure 6 – Status of the decision taken by banks as regards having already opted for any of the approaches to measure operational risk
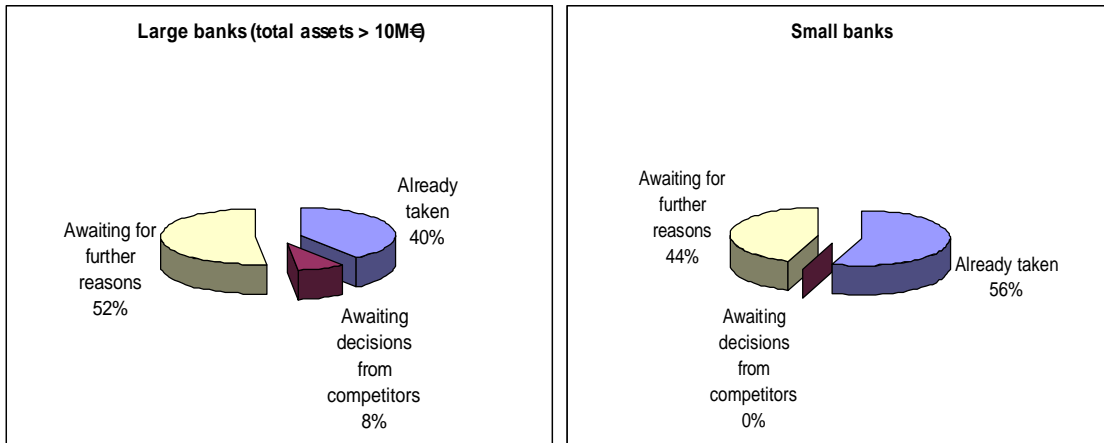
Source: Database of an unpublished survey conducted in 2004 on 35 banks in 10 EU countries.

I also found relevant data to support these findings in some of the databases I have analyzed from several European and International surveys (CGEY 2004 Gartner G2 2004; Risk Magazine 2004; Asia Risk 2005; E&Y 2006) relating to operational risk implementation status and challenges, according to the Basel II guidelines, that will be analyzed further on.

First I have tried to understand if banks had already made a formal decision, regardless of which Approach they proposed to adopt, and secondly, whether already decided or as a declaration of intentions, I tried to find which of the Approaches banks would presumably adopt in terms of operational risk measurement for capital allocation. Simultaneously – and where possible – I have tried to determine whether there were any major discrepancies between smaller and larger banks, assuming that large banks would eventually be ahead in terms of the decision and implementation process and moving mainly to the AMA approach. Last but not least I have investigated if there were any significant regional discrepancies worldwide.

From my analysis of a database from an unpublished survey conducted in Europe on 35 banks (CGEY 2004), 56% of all small banks surveyed had already made their decision in terms of which approach to adopt, regardless of which, as opposed to just 40% of large banks (see Figure 6). As large banks represented 73% of the total banks surveyed, these findings are far from being ideal, as most banks and particularly large banks had not taken their decision at all, which reflects the earlier stage of this process at the time of the survey. The large banks were considered to have Total Assets in Balance Sheet

higher that 10M€ for this analysis carried out in Europe. It can be observed that at the time of this survey (CGEY 2004) most banks had not yet taken their final decision on which approach to adopt, particularly large banks that are more exposed to the complexity of operational risk management. I expect that further yearly updates will show increasingly mature decision processes. As relates specifically to the expected approaches to adopt, the discussion is wide open and there are very few certainties shown by the banks surveyed as well as by the banks I have interviewed at this stage on the method to adopt.

As late as 2006 only one of the larger multinational banks that I contacted manifested its intention to move to AMA. Specifically in Portugal, the banks I contacted in 2006 and that together represent the majority of total Bank Industry Net Assets are aiming at implementing the Standardized approach, but are still very reluctant to start planning AMA implementation, which is left for further analysis from 2008 onwards.

While this is not exactly unexpected, the major surprise comes from the fact that most Risk experts, who are part of the risk decision making process of their BFI, seem to neglect at this stage the high relevancy of operational risk as a discipline and field. I believe this is due to stronger focus on Credit and Market Risk at this stage, and to the lack of regulatory incentive to be more proactive in this field. I also believe that the historic absence of a business educational and cultural environment on Operational Risk discipline is an important factor. The learning curve is just beginning, as confirmed also by the regulatory entities themselves.

Still within Europe (CGEY 2004), figure 7 shows that only 9 out of 35 banks (26%) would eventually consider a move to AMA, none of them being small banks. The main point here is not the timeline but the intention declared by the banks as to the probable approach they will implement. The major evidence is that of all respondents 69% planned to implement the Standardized Approach, against just 26% planning to implement the AMA in the future. Even considering that the panel pretended to measure expectations, the results are well below my initial expectations, even taking into consideration the timeline of this survey.

Figure 7 – Expected approaches to adoption of operational risk measurement and implementation timings

	2006-2007	2008-2009	2010-	Not decided	Never
☐ BIA	5	0	0	24	6
■ Standardised	24	0	0	11	0
■ AMA	5	2	2	24	2
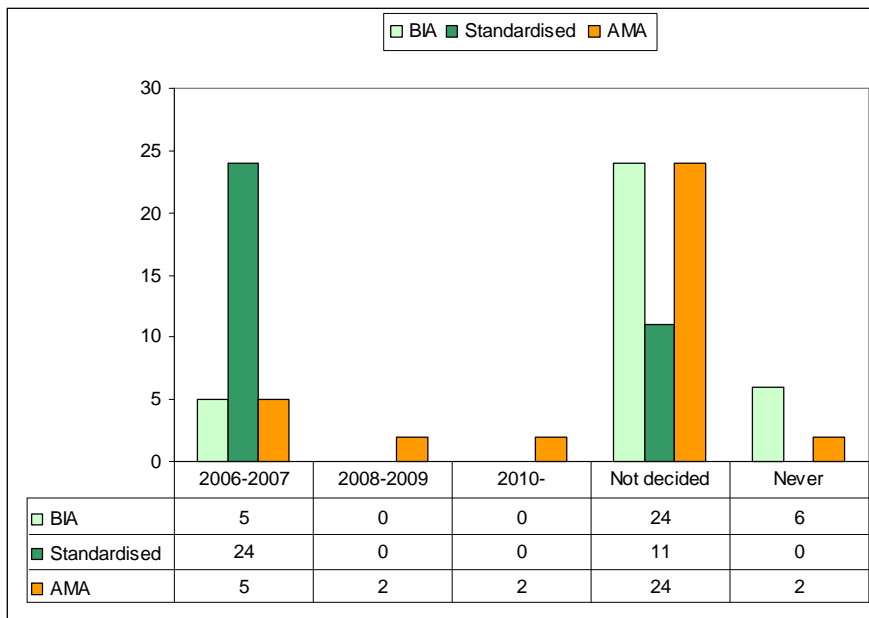
Source: Database of an unpublished survey conducted in 2004 on 35 banks in 10 EU countries.

Moving on to an appraisal of where banks are in terms of implementation status I have segmented the activities which are listed in Figure 8 into 2 main categories – ongoing or finalized, and planned or not yet started. Again these findings highlight the fact that most banks are still in a very early stage as regards operational risk, where planning has not yet strongly evolved into implementation stage, with only Self Assessment and Loss Event Database reported on an ongoing phase by more than 50% of the banks surveyed. With regard to AMA specific tools and Key Risk Indicators, more than 60% of banks are still in a planning stage or have not yet started. It is also relevant to observe that 60% of these banks had not begun to make the organizational changes needed, or were still planning these changes, which seem to me one of the pillars of the overall process, as it may induce the cultural and educational level of the organization on this overall process. This seems to me an essential element of the success of a formal operational risk program. Furthermore it is one of the slower processes over time as it entails a cultural change within the organization which can not be achieved in a short time frame.

Figure 8 – Status of implementation of these activities of the Basel program in the organization
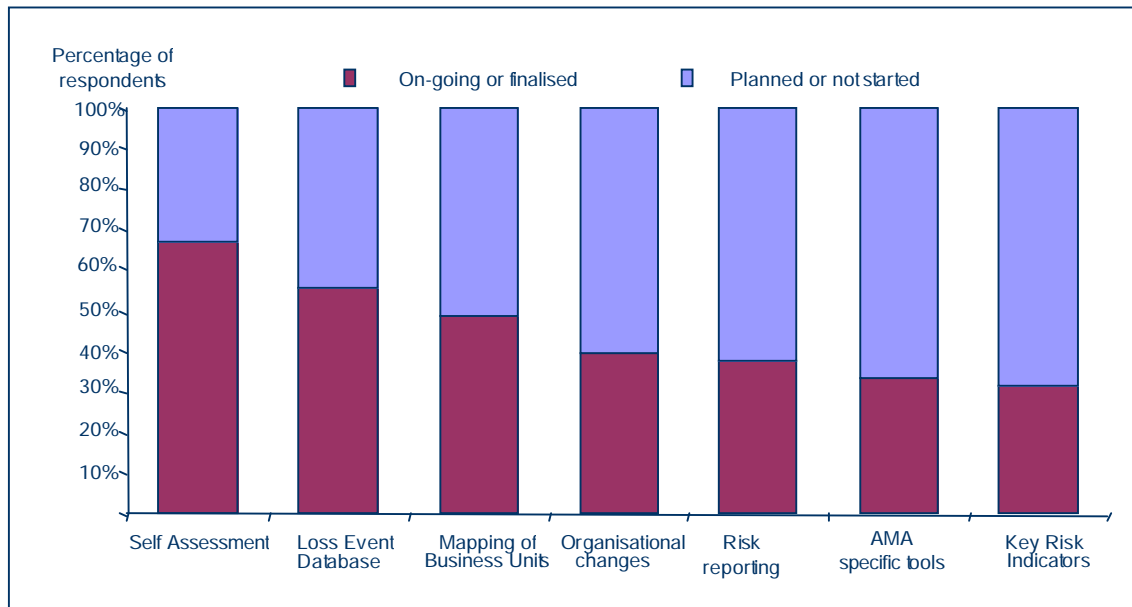
Source: Database of an unpublished survey conducted in 2004 on 35 banks in 10 EU countries.

I believe that banks are seriously behind in this overall process. Future Basel updates along with national regulatory support will be required to encourage banks to focus more concern on Operational Risk Management.

As mentioned earlier, and as can be observed in Figure 8, most of the major activities referred to are far from being ongoing or finalized – especially Key Risk Indicators and AMA specific tools. This is consistent with the information gathered from the banks I have directly interviewed, who also confirmed that their main difficulties were understanding and putting in practice AMA specific tools as defined by the Basel Committee as well as a correct definition and mapping of Key Risk Indicators. Furthermore I acknowledged that banks are still essentially concerned with, and much more sensitive to, credit and market risk and are still failing to wholly understand the full scope of Operational Risk. I strongly believe that the education factor is essential and that is crucial to have BFI entirely committed and more proactively involved within this key risk component, which is emerging as the dominant and remaining risk exposure so far not hedged.

While it might be plausible to assume that different regional behaviours exist, I actually found that, despite some slight variations I mention further on, findings are basically the same worldwide.

In the Asia Pacific region, banks are still very reluctant about implementing AMA, with 65% of total local surveyed banks (Asia Risk 2005) either in the early implementation stages of their overall Basel II implementation programme or not yet started. About 33% could not yet estimate overall Basel II implementation costs. Institutions mostly aimed at implementing the simpler approaches, with 26% indicating the Basic Indicator Approach and 39% the Standardized Approach. Still, and as opposed to initial outcomes inferred in Europe, over 50% at this stage planned to implement the Advance Measurement Approach by 2010. Though no more than expectations, they seem more optimistic in this respect than in Europe, it might be beginners' expectations at this stage or effectively confirming some regional dependency in terms of the decision to move to AMA. This study was also conducted one year later, which is relevant to the scope of the observations made. About 40% had completed some form of risk and control assessment and up to 50% planned to complete implementation of other components by the end of 2006, in particular key risk indicators, scenario analysis and loss data collection. Almost 75% of banks planned to integrate key components through technology, though 66% had not yet completed their planning for the Information Technology Infrastructure required under Basel II. While 50% believed that total capital charges, including the operational risk component, would increase, 40% believed that capital charges for credit risk would decrease after implementation of Basel II.

Looking at the US (GartnerG2 2004), only 57% of total surveyed banks had so far introduced a formal process and program to manage operational risk, while 21% had no plans yet to establish such a formal program.

A common belief, repeatedly mentioned either by the Risk Officers from the Banks I interviewed or by other Risk Experts I also interviewed, is that the cost-benefit of AMA implementation is very questionable or even negative. The perception is that they do not have yet the capability to seize sound and favourable business cases to evolve into more complex and sophisticated developments of internal risk modelling.

The most recent global surveys I have consulted (Risk Magazine 2004; E&Y 2006); indicate that, as some uncertainty prevails, most respondents believe that there will be further postponements in the Basel II implementation deadlines. I too strongly believe that future postponements will occur, as the banking community along with regulators are only just beginning to wake up to the importance of the issues at stake. According to the latter survey (E&Y 2006) three-quarters believe that the new Accord will bring substantial change to the business of banking through the use of more active portfolio

management, risk-based performance measures and risk-based pricing, while 89% believe that banks with robust risk infrastructures will have a competitive advantage over others. An interesting point of research would be to investigate whether banks investing more in the IT area would be more prepared to face AMA requirements and obtain more competitive advantages in face of lower Capital charges from operational risk. Other related questions could be raised in this specific field, but it is too soon to find out evidence on this subject, as banks are still very discrete and are delaying their decisions as much as possible since they know they still have a long way to go in their internal reorganization.

Most respondents (E&Y 2006) are adopting the Standardized Approach for operational risk. Those that are investing less than 50M$ in Basel II programs will not adopt AMA until 2008 or latter. Most of the respondents adopting the Basic or Standardized Approach expect further delays in the adoption of the advanced operational risk measures, whereas fewer than 30% of those aiming for AMA expected it to be implemented within the current regulatory timeframe.

Another important finding of this survey is that the benefits derived from investments in operational risk management may not provide the perceived level of advantages as those derived from the investment in credit systems. The majority of the surveyed banks highlight the fact that additional education on Basel II would be required, as well as significant cultural change.

Again, the uncertainty as regards the economic benefits and competitive advantages brought by AMA, along with the low perception of internal levels of education and cultural awareness, tend to become the key inhibitors for banks to devote more attention and focus to Operational Risk.

It would be interesting at this stage to understand why some banks *are* looking at AMA, even if clearly not in the majority. If there is a geographic or regulatory dependency effect, and is it for competitive and "reputation" reasons on the wide markets they operate in, or because they believe they can gain competitive advantages in the long run? It is also worth mentioning that while it may be true in general that most banks remain reluctant about AMA implementation, there may be a regulatory and regional dependency effect. For example, in Australia all four Tier 1 banks and all three Tier 2 banks are AMA declared, while Tier 3 are presumably TSA declared. In South Africa, two of the four Tier 1 banks are AMA and the other two TSA declared. In the USA,

while nothing is finalized, there is regulatory expectation that the top 15 banks will be mandated to move to AMA.

No single bank that I have contacted believes at this moment that they will have a positive cost-benefit trade-off at medium term. I also believe that the major triggers are awareness, understanding and education, which are the key to developing the cultural changes needed to grasp the magnitude and vital role and impact that operation risk represents. Only then can Risk Managers and Senior Management take decisive steps to making their organizations AMA-compliant, while all agree that internal and bottom-up methods, though more complex, are bound to be much more forward looking.

7.2. - ISSUES RELATED TO AMA ADOPTION

In addition to evidence from the interviews I conducted and the databases and surveys consulted, the Quantitative Impact Studies[28] developed under the guidance of the BIS[29] have also highlighted that Operational Risk requirements raise a number of difficulties, from definition to data collection, calculation limits, implementation and strategy planning to meet the AMA requirements.

Examining in greater depth the key challenges preventing or hindering AMA adoption by banks, I have investigated some of the major issues and challenges in implementation, based on my analysis of the databases from the surveys.

As it can be observed in Figure 9, the key challenges are indeed those previously identified, as well as AMA specific tools and Key Risk Indicators. Another interesting finding is that even though Loss Event Database and Self Assessment were previously referred to as the activities within the Operational Risk Program which were more advanced in terms of progress, these now rank just third and fourth among the more challenging activities. Furthermore, all the activities indicated were rated as quite challenging (none ranked with a lower factor), which is a clear indicator of the infancy of the overall process and the reluctance to move to AMA, as banks are far from ready to fully understand and be able to implement it.

It is most relevant to cross this same data and rescale the answers in a more illustrative way in terms of ranking the challenges with their degree of completion (see Figure 10). Clearly in terms of reaffirming AMA specific tools, Key Risk Indicators and Organizational Changes are at a very low stage of completion and the former are rated the more challenging issues.

---

[28] QIS 1,2,3,4
[29] Bank for International Settlements

Figure 9 – Major challenges in implementing an operational risk program
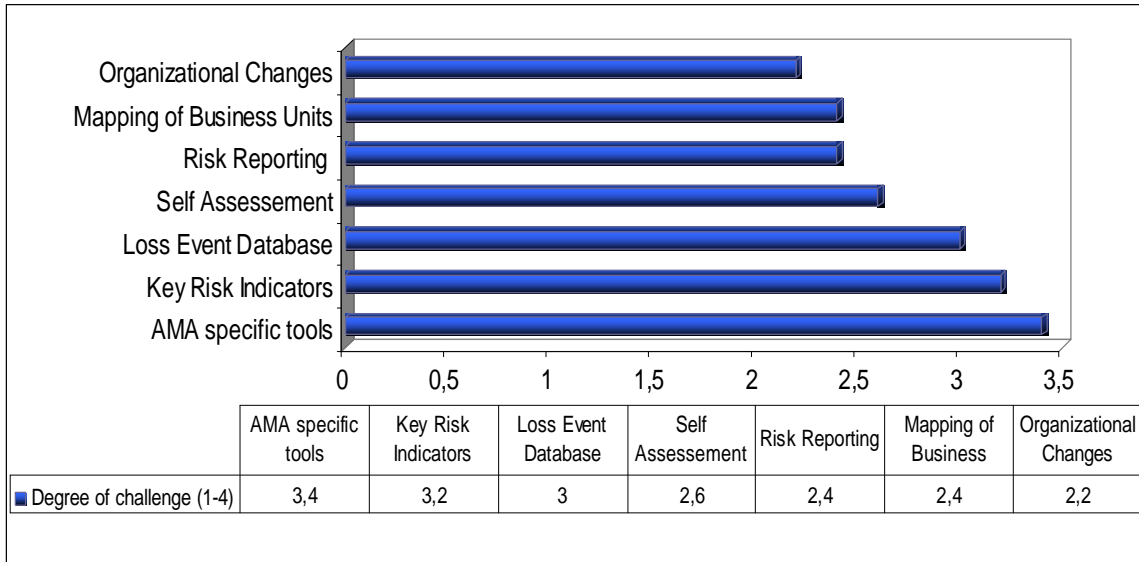
	AMA specific tools	Key Risk Indicators	Loss Event Database	Self Assessement	Risk Reporting	Mapping of Business	Organizational Changes
■ Degree of challenge (1-4)	3,4	3,2	3	2,6	2,4	2,4	2,2

Source: Database of an un published survey conducted in 2004 on 35 banks in 10 EU countries.

Figure 10 – Completion status versus challenge degree of identified major challenges
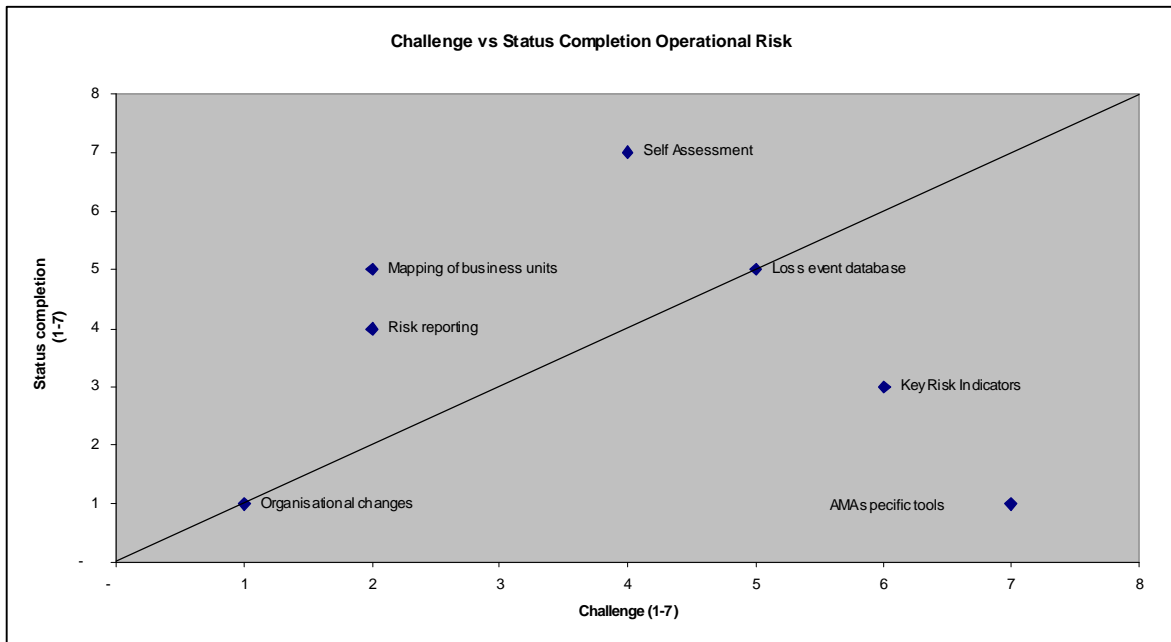
Source: Database of an unpublished survey conducted in 2004 on 35 banks in 10 EU countries.

Figure 11 – Top five concerns for Operational Risk Management

	Identification of Key Risk Indicators	Quantification of Operational Risk	Lack of Internal and External Data	Implementation of Loss Data Collection	Implementation of Risk and Control
■ Degree of concern (%)	50%	45%	39%	38%	36%
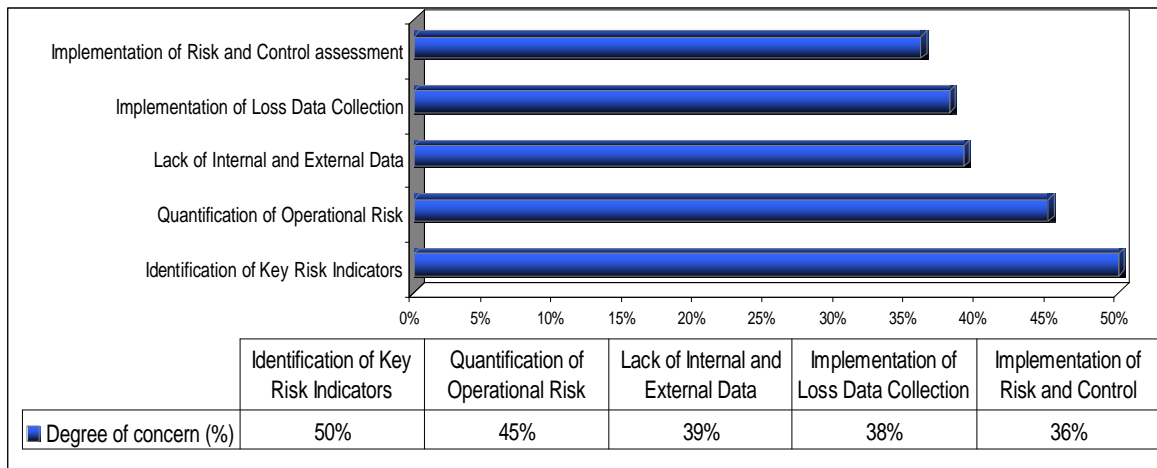
Source: Information based on a survey conducted in 2005 on 245 bank participants in Asia Pacific.

Complementing this information with data obtained in the Asia Pacific region (Asia Risk and E&T, 2005) as shown in Figure 11 above, findings and concerns are much the same, with Identification of Key Risk Indicators and Quantification of Operational Risk dominating the ranking of the top five concerns. The Lack of Internal and External Data and the Implementation of a Loss Data Collection System come right afterwards as third and fourth top concerns.

The interviews I conducted are absolutely in line with these findings, the major concerns consistently pointed to being AMA specific tools, Operational Risk Quantification and Key Risk Indicators (how to identify them? which measurement criteria? best segmentation?).

One area of growing interest is effectively the framework of risk indicators as an extremely useful operational risk management tool. For greater precision in risk identification and measurement, financial institutions can leverage KRIs as context-sensitive indicators within a comprehensive risk assessment process. Seeking to identify potential risk areas and/or issues proving the insight into a bank's risk profile, the KRI may be lagging, current or leading. Banks who want to adopt the AMA approach, and thereby be able to calculate their own capital requirements, have been given clear pointers that KRIs are expected to form part of that approach, and this is clearly one of the major challenges yet to be overcome.

As relates specifically to Operational Risk Data, which drive all the major areas of concern pointed out, I found it relevant to understand the degree of accuracy, timeliness and breadth of risk data collection.

A study conducted in the US (GartnerG2, 2004) found that nearly all banks (95%) have a form of collecting and analyzing internal data, while 60% collect and analyze external data. While only 10% have a procedure for updating information on operational failures and losses more than once a day (equally true for internal and external data), almost 25% have a procedure for updating information on operational failures and losses more than once a month (equally true for internal and external data). Most banks (42%) update monthly, while the remainder reported quarterly, bi-annual or yearly updating procedures (equally true for internal and external data).

This study also addressed the quality and timeliness of the operational risk data collected. Fewer than 30% of respondents were satisfied with the detail and breath of the data collected either internally and externally, while fewer than 40% were confident in terms of the accuracy and timeliness of both internal and external data.

It is clear that banks have not yet acquired the necessary degree of satisfaction and confidence to validate the accuracy, timeliness, detail and breadth of the internal and external data required. While it is likely that these results improve in time, it is also essential that every effort be made to improve them as soon as possible to prevent further delay. Another essential point here is collaboration between regulators, banks and agents to have best practices shared, implemented, back-tested and benchmarked.

Assuming that regional variations do not differ substantially in terms of key findings and key evidences, the quality of operational risk reporting information is still amazing – and significant. 96% of the banks surveyed in the US reported manual review of data, and by the end of 2006 89% would still be employing manual intervention on data review processes; only 67% reported some level of automated review. There is still a high level of manual intervention in operational risk data review. It would also be interesting to understand how manual review of data can influence operational risk outcomes. Is it possible to implement a model that excludes all manual intervention?

Figure 12 –Maturity of the operational risk programs in place

	More than five years	Three to five years	Two to three years	Between one and two	Less than 12 months	No program in place
■ Maturity of operational risk programs in place	12%	14%	17%	22%	16%	19%
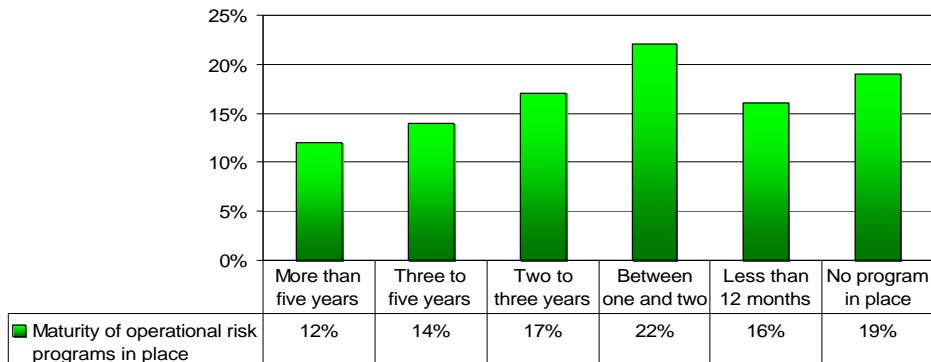
Source: Information based on a global survey conducted in 2004 on over 250 banks

While the outcomes clearly show an excess of manual intervention and while I maintain that automation should be increased, it is also crucial to understand some of the more critical processes and discuss whether some form of manual intervention could adjust the required qualitative judgement to deliver the best model in a forward looking manner.

The information, based on a global survey (Risk Magazine & SAS, 2004), shown in Figure 12 well illustrates the spectrum of the maturity of operational risk programs as well as the key obstacles to a successful implementation of an operational risk management system.

As can be observed, the operational risk programs implemented in the financial institutions are still at a very early stage, with just 26% of total respondents worldwide having some form of program in place since 2002. With such preliminary programs in place it's necessary to implement processes to motivate and get banks moving in a more proactive way to develop their internal operational risk programs and models. The risk being that passive management of operational risk is mainly based on top down methodologies like BIA or TSA, which are absolutely not in line with a forward looking approach.

Operational risk by its intrinsic nature is far from being objective and does not accommodate a linear parameterization. It is a dynamic concept and as such causes some disagreement as to its definition. Nevertheless, it is widely agreed to be the ultimate source of bank risk and indeed potentially the major risk that BFI faces nowadays.

Figure 13 – Major potential obstacles towards a successful implementation of operational risk management systems and degree of impact (1- no impact; 4 - high impact)
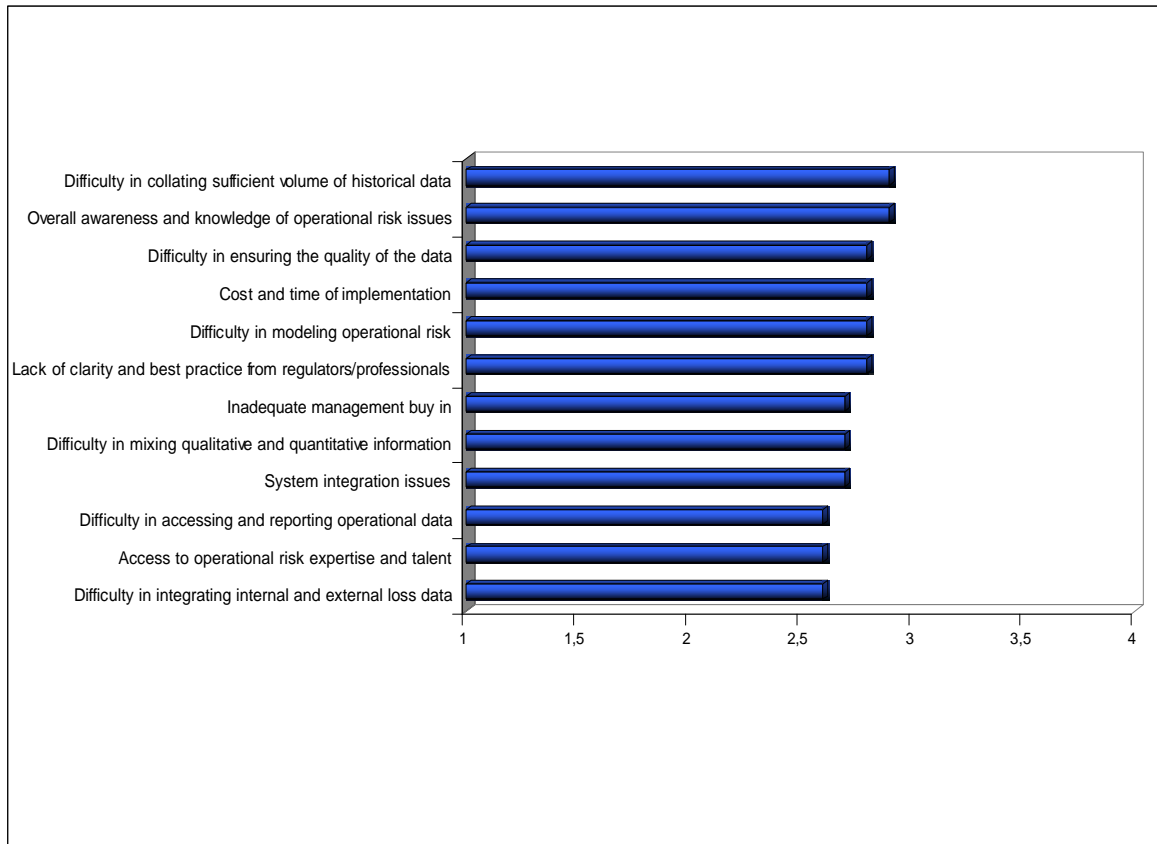
Source: Information from a global Survey conducted in 2004 on over 250 respondents.

I believe therefore that we urgently need to understand the major potential obstacles to a successful implementation of operational risk management systems. In the light of my analysis of all the information gathered, through direct interviews, from the surveys cited and other specialized forums consulted, I maintain that supervisory bodies must become more involved. It is clear that banks need to work much more closely with supervisors and within banking industry collaboration frameworks to further develop and improve at higher pace their operational management programs.

In line with the above mentioned I have highlighted the major potential obstacles pointed out by the banks, as shown in Figure 13, that could indeed be inhibitors to successful operational risk management programs.

It is useful to reflect upon and discuss each of the numerous obstacles cited as most likely to prevent a successful implementation of an operational risk management system.

There is clear evidence of the major challenges and difficulties banks are still facing in moving to a successful AMA implementation, and the figures explain why banks are still so reluctant to move to AMA. Given the major outcomes of the diagnosis and in the light also of interview data there is strong evidence to believe that compliance with the specific AMA requirements will not be reached by most of banks within at least the next 5 years, presumably not before 2010 of after.

The major risk is effectively that banks neglect or attach secondary importance to more operational risk sensitive approaches in view of the difficulty of achieving the specific criteria required, and furthermore of implementing an acceptable cost-benefit analysis that could support a strategic decision to move to AMA as it stands. Most of the interviewed banks state that their focus continues to be on credit risk approaches, relegating operational risk to a secondary role, and at most envisaging implementation of the Standardized approach. AMA is still perceived as too complex and its full scope difficult to grasp. Even though this is a fast moving field and as time goes by experience increases and the learning curve rises, most Risk Experts contacted were of the opinion that complying with AMA is still a chimera. However, they stress the importance of developing more operational risk sensitive approaches as one of the last emerging risk fields that need to be fully understood, mapped and hedged. The predictive capabilities of modeling are still wide open to dispute as well, and most state that AMA is so far seen as important for reasons of reputation, to keep up and or lead competitive positioning. With this in mind and in view of the importance of this last risk component as previously discussed I stress the importance of deeper structural focus on this issue. Preparing the ground for increased collaboration panels and forums as well as incentive frameworks should be a priority for supervisory authorities in line with Basel guidelines to promote Bottom up Approaches as a priority goal for implementation.

CHAPTER 8 – OPERATIONAL RISK QUANTIFICATION ISSUES

Modeling and quantification of Operational Risk remains a key concern as previously highlighted, so at this point it is fundamental to analyze some of the most widely used models and techniques for measuring Operational Risk.

Though the state of the industry in Operational risk systems, processes and methodologies is effectively quite diverse, moving ahead to modeling operational risk and in a forward looking scope as proposed by the Basel Committee remains rather challenging. Most of the models and techniques currently used for measuring Operational Risk still lack sound predictive capabilities, according to AMA requirements. While the banking industry has made progress in its operational risk data collection processes, methodologies and approaches are still at the development stage in most banks. They show significant vulnerabilities in terms of completeness, robustness and substantial time windows data. Unlike the credit and market mathematical models currently used for decision making purposes, which provide clear links between risk indicators or "risk generators" and potential financial impacts that can be fully tested and validated as to its predictive qualities, operational risk models are not yet delivering these predictive properties. The issue of Capital modeling, as relates to Operational risk brought by the Basel II, though a relatively new area is precisely the focal point at this stage.

Measuring operational risk is basically measuring the loss resulting from inadequacies or failures in processes due to technology, personnel, organization or external factors, incorporating both high frequency/low severity with low frequency/high severity events.

No disclosure was made in the interviews either with banks or as a result of the surveys made in relation to the specific models that banks tend to implement when planning to achieve AMA compliance somewhere in time. It was also mentioned that so far most of the models being applied are essentially qualitative approaches such as self assessment, in some combination where feasible with statistical modeling such as the more standard actuarial and causal models.

Recent developments in literature and theory, also reiterated by some industry risk experts, raising increased attention particularly to Bayesian theory applied to models development and at a second extent as well to Fuzzy Logic applied to such models, were not yet commented on by the banks I interviewed and contacted.

To best illustrate this issue it is useful to discuss some of the most important models currently highlighted.

8.1. - SELF ASSESSMENT MODELS

Here the elements of subjectivity entirely characterize the process as this is not based on a mathematical process to develop the analysis of the available data.

This process is based on the judgment of internal "experts" from the banks' business units that are responsible for the internal procedure of control self assessment. It can be performed through questionnaires addressed to the internal risk managers, allowing them for instance to capture information on the quality both of internal and external control systems of the organization. This model is essentially based on their experience in a given time period and should also make it possible to foresee the operational risk per business unit or process. There are also subjective quality measurement issues. Three dimensions of quality have proved useful: suitability and functionality, security and reliability, and availability and accessibility. Tangible results are often measured in a scale like a Lickert Scale.[30]

Increasing its sophistication these experts can in this manner access the frequency and severity of the losses for such operational risks, with the inherent limitations and difficulties of this process. Measuring the potential loss severities and frequencies of possible events is typically assessed by scenario analysis. Identifying and quantifying a wide range of potential loss scenarios and attaching frequency and severity estimates will allow joint simulations to be run across all possible scenarios and to estimate worst case losses in an aggregated manner, measuring the impact of combined loss scenarios.

The difficulty relating to scenario approaches lies not only in the determination and specification of the scenarios but also in the process for estimating parameters, due to the extreme subjectivity inherent to the whole process. Banks using these models (for instance the scorecard approach) contend that subjective expert judgment is essential for providing more reliable and robust capital charges than purely mathematical models analyzing available data, given that historic data is usually insufficient and not forward looking. The better choice, according to these banks, is to make the bank's experts

---

[30] See Anders (2003)

responsible for evaluating the internal risks based on their understanding of business processes, their banking and industry experience, their knowledge of embedded controls, insurance cover, loss industry historic and defined key risk indicators. For more detailed insight on an example of a Scorecard approach see Scandizzo (2005). The analysis of both internal and external data can assist parameters testing and determination of the scope of operational risks faced, tempering to a certain extent the subjective nature of the parameter's judgment.

8.2. - ACTUARIAL MODELS

These models are based on quantitative data collection, such as the Loss Distribution approach suggested by Basel II. Banks use internal and/or external loss data to infer statistical distributions of potential operational losses. The convolution of frequency and severity determines the loss distribution on which minimum capital requirement can be calculated through Operational Value-at-Risk, on the basis of the percentile defined by Basel II, reflecting a confidence level of 99,9% under a holding period of one year.

The loss behavior is captured in separate severity and frequency distributions, for instance frequency distributions are often assumed to be Poisson and severity distributions include normal, lognormal, lognormal gamma, Pareto and others. Using Maximum-likelihood fitting, the model distributions are selected allowing the simulations of worst-loss years by sampling the tail of the aggregated loss distribution. The 99,9% percentile capital estimation is implemented typically via a Monte Carlo simulation of severity and frequency along all business lines and types of events. The estimated Capital model depends obviously on the best-fit model parameters that are determined by the input data. Any change to the input data (addition of new events for instance) will immediately change the model parameters and therefore the capital estimation model. Another concept that is worth mentioning is the "Shock Theory" applied to operational risk, where models are defined based on shock frameworks for losses caused by the different types of events allowing both dependence on loss severities and dependence on loss frequencies across types. See McNeil, Lindskog (2001) for a more detailed discussion of multivariate and compound Poisson shock processes. The precise specification of the shock model has significant consequences on the nature and the tail of the aggregate loss distribution.

One of the major problems that these models present is their extreme sensitivity to the specification of the model parameters, which can significantly impact the tail of the distribution. Another critical issue is the scarcity and time lag diversity character per event type, which makes their use questionable as relates to the quality of their predicting properties in such a large and open field as Operational Risk. Their extreme sensitivity to very small changes in parameters is a great source of instability in these models. On the other hand, these approaches can hardly model relationships between loss events and their causes. For a better understanding in terms of the extreme impact that severity and frequency parameters estimations cause to capital charge calculation, see for instance Ronchalli, Frachout (2003).

8.3. - BAYESIAN MODELS

To overcome the difficulties involved in the sound measurement of operational risk in a forward looking perspective, as required under the Basel guidelines, some authors[31] have been turning their attention to Bayesian Belief Networks approaches.

These models are based both on qualitative and quantitative data and use the Bayes theorem to integrate different sources of information like Loss Distribution Approach, external industry loss data and self-assessment, based on risk managers' opinions, to evolve into an aggregated and unified model. This aggregated model would allow us both to determine minimum capital requirement charge through Operational Value-at-Risk in a more risk sensitive way and to better manage Operational Risk. It is also possible to incorporate the correlation existent between losses per risk types and business lines and causal factors. Those who defend Bayesian networks models declare them to be one of the best and more risk sensitive models to best combine backward looking data and forward looking expectations in terms of operational risk and in view of all previously mentioned limitations and difficulties as relates to other approaches. For a more detailed explanation see footnote[32]. A Bayesian Networks model is made of a set of nodes representing random variables (loss data from self assessment and loss data statistical collection) and a set of dependency links between them per business line or process or event type. The network is defined based on the expert's opinions and the

---

[31] Like Carol Alexander in "Operational Risk Regulation Analysis and Management" and Cornalba and Giudici (2003) "Bayesian Networks for Operational Risk Management compliant with Basel II"

[32] Giudici, P, 2003, "Applied Data Mining; Statistical Methods for Business and Industry" and Jensen, F.V. (1996), "An Introduction to Bayesian Networks".

topology of the graph defines the probabilistic dependencies between the variables and a set of conditional distributions per variable given its "parent". Each variable has states (loss levels) which give information on the existence, quality and effectiveness of controls allowing prediction of operational risk. Throughout this network is inferred the description of the dependencies induced by the data (which can also be built based on experts' opinions), determining the conditional probability distribution and local distribution per variable given its "parent", which allows us to calculate marginal distributions per node. The overall Operational Value-at-Risk and subsequently the Capital charge required are then determined by the simulation of total losses from each marginal loss distribution originated by the structure of the network based on the Bayes theorem. While yet to be proven effective, it makes sense that these models can eventually leverage the advantages of self-assessment, actuarial and causal models in an integrated manner, whilst mitigating as much as possible their limitations.

8.4. – EXTREME VALUE THEORY

Extreme value theory and standard Value-at-Risk models are most widely used to represent expected and unexpected losses from operational risk exposure. Assuming as mentioned by the Basel Committee that "A capital charge for operational risk should cover unexpected losses. Provisions should cover expected losses", these models are focused on extreme and rare operational risks, therefore on unexpected losses, assuming that low value frequency losses are covered at provisioning and management control levels. A very interesting contribution is given by Medova (2001), who applies extreme value theory to calculate capital requirements from unexpected operational losses. Furthermore, an integrated risk framework between the three risk contributors (credit, market and operation) is advocated, where extreme operational risk losses should be measured and modeled as an excess over a consolidated value-at-risk level for both credit risk and market risk, mitigating as well ambiguous boundaries and double counting between the different risk types. Only large magnitude losses above a defined threshold should be taken into account for operational risk capital modeling, focusing on tail events. The accuracy of this model depends of course on accurate estimates of parameters and threshold definition. Furthermore its overall quality is quite limited by rare and small data sets. Medova proves that Bayesian simulation methods make it

possible to overcome the problems attendant upon data scarcity for parameters estimation, performing better than maximum likelihood estimates. The EVT analysis using Bayesian hierarchical procedures can also be of great value for the more efficient modeling of operational risk capital allocation, since the estimation of extreme and heavy tail distributions can be proven more robust.

8.5. - MANAGERIAL ISSUES WITH MODELING

Moving a step further from measurement issues and looking ahead into the managerial issues related to operational risk requirements as defined under Basel II, it is also important to take into consideration some of the management risks arising from the use of these models. Among the most relevant risks is the Management of the model rather than reality itself, with a misdirected focus based primarily on historical data which is composed essentially of high frequency and low severity events against major risk which are scarcely captured historically. This can raise the danger of false reliance e.g. to perceive, analyze, control and manage operational risk exclusively and/or even primary through these models. Holmes (2003) even mentions the danger of encouraging "blissful ignorance" along with discouraging "whistle-blowers". A greater understanding of controls and risk exposures should also assume that those organizations that identify and report more accurately and frequently weaknesses and risk events are indeed more exposed to potential capital charge increases. In a similar manner potential information that can represent an increased risk exposure would entail increased capital charges. This stresses the need to better reflect upon and fully understand and develop incentives and frameworks to adequately cope with this "incentive/discouragement relationship" dynamic.

CHAPTER 9 – ALTERNATIVE DEVELOPMENT APPROACH TO AMA REQUIREMENTS

9.1. - AGGREGATED EVENT TYPE DIFFERENTIATED TREATMENT FOR OPERATING RISK MODELING AND THUS CAPITAL CALCULATION

The current Basel II proposals are far from clear about what indeed banks should do to comply with the requirements standards of AMA. While this lack of clarity is due to the early stage of research, it leaves too much room for uncertainty, subjectivity and ultimately a certain reluctance. It became evident from the surveys and interviews conducted that most banks are still very skeptical about AMA implementation capability and effectiveness. Moreover, some banks' experience from QIS3 highlights the fact that they would have to hold more capital under AMA than under TSA or BIA. This is a clear inhibiting factor when it comes to encouraging banks to move to AMA. The embedded incentives like risk diversification and insurance are likely to be insufficient to motivate banks to pursue AMA adoption. Furthermore, the quantification of operational risk specifically in a forward looking manner is still very challenging and at a very early stage of completion. It is my confirmed opinion that an urgent review of Basel II is required specifically as relates to AMA in order to widely motivate more banks to evolve into developing their own operational risk models. An increased number of banks intending to move to AMA would leverage significantly inherent scientific research and improved modeling and testing on operational risk frameworks. In this manner it would also enable a broader and sound data gathering process which combined could facilitate the wider development of significant external databases, which are fundamental to balance the paucity of internal data, specifically as relates to certain specific loss event types.

To allow feasible and earlier AMA implementation in an extended global scope I propose a development alternative approach based on event type differentiated treatment for operating risk modeling in function of severity and frequency dimensions.

Table 4 – Framework of segmentation of event types per frequency and severity

```
                        Frequency
            High                        Low

  High  ┌──────────────────┬──────────────────┐
        │                  │                  │
        │  Event types A   │  Event types B   │
        │                  │                  │
Severity│                  │                  │
        ├──────────────────┼──────────────────┤
        │                  │                  │
        │  Event types C   │  Event types D   │
        │                  │                  │
  Low   └──────────────────┴──────────────────┘
```

Also taking into account all relevant inherent risk mitigating elements, if proved sound, such as for instance correlation and diversification factors across business lines, which will not be further developed, it would in a combined manner support the allocation of capital charge calculation per business line. It is my belief that such framework could allow a more efficient and optimized cost-effective and risk-effective outcome in terms of capital estimation under AMA, allowing banks to leverage capital optimizations as opposed to one size-fits-all models such as TSA and BIA.

Table 4 illustrates this point. I believe that future revisions of AMA should entail a clearer identification and breakdown per event type in the proposed distinct four segments of event types segmented by severity and likelihood, which should be treated differently. In this sense the best fit combination of a multi model system could be scoped to have an optimized overall capital charge calculation.

The mapping of the 7 event types Level 1 as per defined by the Basel Committee into these aggregated categories is highly controversial at this moment, as at the individual bank and at industry levels there are insufficient databases to allow such analysis.

Based on a number of discussions with risk experts I would expect the division to be more as illustrated in Table 5 as follows.

Table 5 – Expected Segmentation of event types per frequency and severity

	Frequency		
	High	Low	Event Types
High Severity	Event types A ET 4	Event types B ET 5	ET 1 Internal Fraud ET 2 External Fraud ET 3 Employment pratice and Workplace safety ET 4 Client, Products and Business Practices
Low Severity	Event types C ET 2 ET 6 ET 7	Event types D ET 1 ET 3	ET 5 Damage to Physical Assets ET 6 Business Disruption and Systems failures ET 7 Execution Delivery and Process Manager

Low Severity/Low Frequency - Internal Fraud, Employment Practice and Workplace Safety;

Low Severity/High Frequency - Execution delivery and Process Management, External Fraud, Business Disruption and Systems Failure;

High Severity/Low Frequency – Damage to Physical Assets

High Severity/High Frequency – Clients, Products and Business Practices

As data becomes available both at individual and regional aggregated levels, the relevancy of this segmentation will clearly increase.

I strongly believe that the use of external databases to moderate the scarcity of data at individual level is crucial to increase the accuracy of the multi model system proposed, depending on the event types segmentation proposed, for capital calculation resulting from operational risk.

I have not had access to other databases such as the ORX,[33] which I believe could be far more appropriate to this analysis, but did have access to ABA data, which I acknowledge may be quite controversial and not widely supported. Still, for the purpose of this discussion I will use it as a mere example with no other purpose than just to support the principles upheld. Segmenting as previously proposed, based on ABA[34] data, the results would be somewhat different to those expected as shown previously in Table 5.

---

[33] Operational Risk Data Exchange Association (www.orx.org)
[34] American Banks Association - Blount (2005)

Table 6 – Details on Event types per frequency and severity according to ABA data

Types of Events	# events	Weight (%)	Total losses (M$)	Weight (%)	Average loss per event (K$)
ET1	111	3,08%	5,8	2,32%	52,25
ET2	2201	61,05%	125,8	50,30%	57,16
ET3	56	1,55%	5	2,00%	89,29
ET4	171	4,74%	40,5	16,19%	236,84
ET5	53	1,47%	13,6	5,44%	256,60
ET6	7	0,19%	0,4	0,16%	57,14
ET7	1006	27,91%	59	23,59%	58,65
Total	3605	100,00%	250,1	100,00%	69,38

Figure 14 – Event types per total number of events and average unitary loss according to ABA data
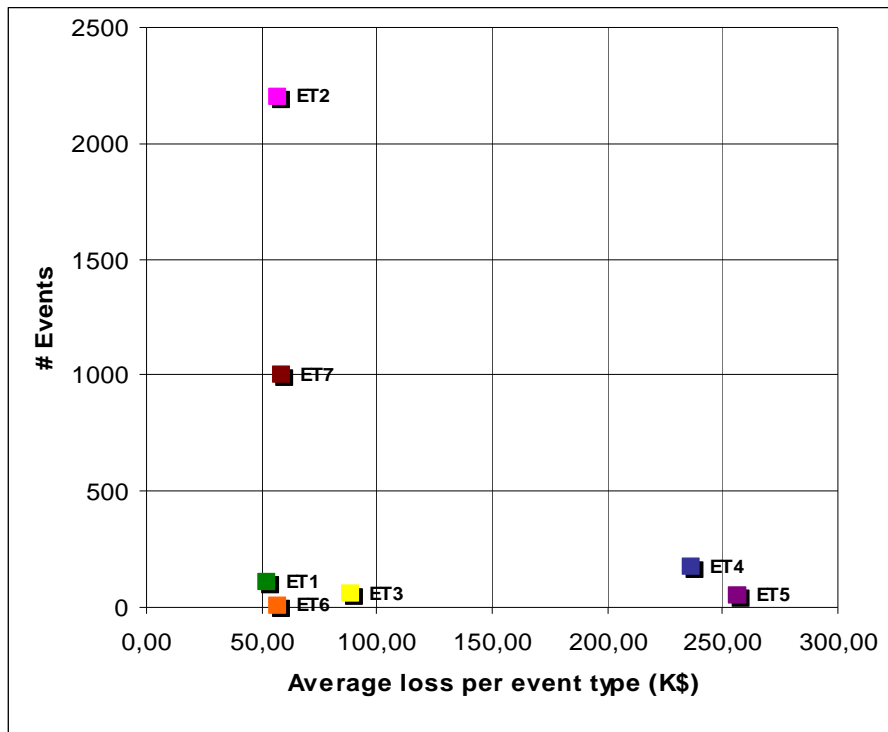
Event Types

ET 1	Internal Fraud
ET 2	External Fraud
ET 3	Employment pratice and Workplace safety
ET 4	Client, Products and Business Practices
ET 5	Damage to Physical Assets
ET 6	Business Disruption and Systems failures
ET 7	Execution Delivery and Process Management

Table 7 – Segmentation of event types per frequency and severity according to ABA database

	Frequency		Event Types	
	High	**Low**		
High	Event types A	Event types B	ET 1	Internal Fraud
		ET 3	ET 2	External Fraud
		ET 4	ET 3	Employment pratice and Workplace safety
		ET 5	ET 4	Client, Products and Business Practices
Severity			ET 5	Damage to Physical Assets
	Event types C	Event types D	ET 6	Business Disruption and Systems failures
	ET 2	ET 1	ET 7	Execution Delivery and Process Management
	ET 7	ET 6		
Low				

To provide a deeper insight into impact and dimension per event type, I have based this analysis on the only database results I had access to, compiled by ABA banking consortium members in 2005, which combined 3605 loss events reported above 10KUS$, resulting altogether in 250.1M$ losses reported. The results are shown in Table 6 and Figure 14 (amounts in US$).

The External Fraud (ET2) loss event clearly dominates all other event types, representing 61% of total number of reported losses and 50% of total losses in value (loss events like robbers, forgers, check frauds, computer hackers and data thieves). Only 3% were due to similar losses by Internal Fraud (ET1) events. Execution, delivery and process management accounted for 28% of total number of loss events (ET7), usually from bank transaction problems (ranging from keypunch errors to full blown model failures, and closely tied to bank customers, vendors and counterparties). Higher reported average loss per event (256,60KUS$) is recorded for Damage to Physical Assets (ET5), although with a low frequency, accounting just for 1,47% of the total number of loss events reported. In terms of higher loss per event it is closely followed by Clients, Products and Business Practices (ET4) (236,84K€), representing 4,74% of the total number of losses reported. This latter event (ET4) ranks third after ET2 and ET7, which rank respectively first and second in terms of total losses originated in M$ due to the high frequency of these loss events in total losses.

If we repeat the exercise proposed previously, when I first defined the expected segmentation of event type segmentation per severity and frequency, and map it now with ABA data, the results would be somewhat different but not that contrasting as per

shown in Table 7. In terms exclusively of severity except for ET3 (that ranges high severity according to ABA results) all other Event Types match the expected segmentation. Frequency divergences are more significant, only ET2 and ET7 ranking in a similar manner with high frequency, where I was expecting ET4 and ET6 also to be high frequency events.

Two remarks should be made at this point: while expected segmentation shown in Table 5 results purely from qualitative analysis based on discussions with risk experts and my personal beliefs, the ABA database is widely acknowledged as lacking detail and is not widely supported in the USA by a considerable number of banks.

Regardless of the event types mapped but assuming the segmentation framework as an accepted assumption to differentiate loss events, there is evidence to realize that high severity events will surely drive higher concern from risk management specially if combined with observed higher frequencies.

It is also worth noting that capital accuracy is highly dependent on the soundness and accuracy of the frequency and severity parameters, specifically in a forward looking perspective. Additionally, the intrinsic nature of some event types, for instance external fraud, forces us to consider the relevancy of using external data to better benchmark and parameterize this event type modeling. Even though there is a strong component of intrinsic features of the bank that make them more or less exposed to this kind of fraud event types, external and non controllable factors play a fundamental role given the nature of some of these event types. Significant identified impacts caused in the more recent history of the banking industry can as well contribute in a considerable manner to this analysis. I believe that the operational risk modeling related to these events should not only be benchmarked by external industry parameters but incorporate all relevant external data based on comprehensive bank loss event databases. Scaling factors and regional standards to increase accuracy on the use of this external data could also be useful, as long as fully validated by regulators.

The exact border may be questioned for sure as the breakdown of the loss event types into these proposed aggregated segments of likelihood and severity should be effectively agreed between banks and regulators also according to their own profile and regionally coherent available databases fully validated. While increased historic and relevant databases are combined, the final configuration of aggregated across-industry related event types mapped per severity and frequency may differ, which will surely allow an overall increased accuracy on the models developed.

The soundness and accuracy of parameters and modeling estimation will likely increase with greater data availability. To overcome internal data scarcity, the use of external data is highly relevant to avoid capital over charge.

As shown by Roncalli (2003), error increases with the confidence level and decreases with the number of loss events in the database. So in order to comply with the 99,9% confidence target required by the Basel Committee[35] there is significant capital optimization to achieve by expanding the database and incorporating external data. In this way it would be possible to develop operational risk models per event type or coherent group event type, mitigating as much as possible the negative impact of the potential increased error component due to the high confidence interval required up to 99,9% on the capital calculation model.

Furthermore I believe that there is significant value in introducing Extreme Value Theory and Bayesian analysis methods to reduce model dispersion, yielding probabilities in a best fit sense with relevant qualitative data as well, particularly in terms of high severity events. One could also argue the case for such approaches also being differently tailored to high severity/low frequency and high severity/high frequency events.

On the other hand, low severity/high frequency event types, could eventually be measured by a combination of most self assessment and actuarial models in discussion, such as Scorecards or other relevant models together with a Loss Distribution approach. Nonetheless it could be questioned if low severity/low frequency events could be a result of scarce historic of data and in such a way should equally be treated with external data sets to reduce model dispersion and minimize fat tailed probability density functions.

Further to this and until data is proven to be treated with sufficient accuracy, extent, amplitude, timeliness and sufficiency, the constant use of benchmarking and external data where relevant should be viewed seriously.

An important boundary that also needs to be clearly defined with regulators is the expected versus unexpected nature of risk event types, in terms of their adequate treatment and consideration in terms of business provisioning and or consideration for the capital charge calculation.

Despite the limited character of this analysis, due to quantification limitations as relates to available data and testing capabilities, I believe that there is sufficient evidence, based

---

[35] The Basel Committee states the soundness criteria as "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 (i.e. comparable to a one year holding period and a 99,9th percentile confidence interval)."

on the extent of existing information and data collected along with the analysis developed, not to reject this development approach as a proposal for future revisions on AMA guidelines, to cope with some of the major difficulties pointed out towards its implementation effectiveness and timeline.

Clearly there is no "one size fits all" rule for calculating capital charge in an accurate way. Like credit and market value-at-risk models requiring sensitivity analysis and peer analysis as acceptance criteria, operational risk models too will to be tested in view of acceptance criteria. Operational models being created can not easily be tested. Stress testing and scenario testing poses problems without both sound market values and historical loss databases. To complement the absence and/or insufficiency of internal databases, as well as to enrich this process, benchmarking is essential, and therefore external databases are being developed to this purpose, by groups like RMA,[36] the American Bankers Association and others.

While the possible use of external data to off-set or minimize absence of sufficient internal data can be relevant we still need to reflect as accurately as possible on the probability of large losses within the bank related to observed internal losses.

Financial institutions need to assess the risk profile of each Basel defined business line by evaluating the possible risk and loss events that can occur. In view of the AMA method, operational risk capital charge should then be allocated per business unit. Capital would then be derived from a bank's internal operational risk measurement models, being the only approach that would allow banks to utilize correlation and other risk mitigating factors such as insurance in their operational risk estimates, provided it is validated by regulators.

The focus on statistical testing is obvious and tempting, given as well the dominance of such tests and models in market and credit risk. However the specific nature of operational risk and operational loss data makes it even more difficult to back test the 99,9% operational risk capital estimates than in market and credit risk, where similar challenges also exist in achieving this level of confidence. Being fat-tailed, meaning that very large and very infrequent losses dominate the operational risk capital estimates modeling, the AMA Quantitative expert group estimates that it would on average take 20 years for a bank to observe the 99,9% worst annual operation loss – while banks have only been collecting more exhaustive and detailed operational loss data for the past three or four years at most.

---

[36] Risk Management Association (RMA)

How participants plan to meet the 99,9% soundness standard of the AMA is currently one of the biggest challenges within the Basel II banking industry. Both the scarcity of operational loss data (internal and external) and the diverse time lag character per event type of an event and its loss impact, add difficulties and challenges to these models (especially when considering very large impacting events). Furthermore a few large outlier events can have a significant material impact on the 99,9% estimates as can be observed by the available historical loss databases.

Most models are essentiality descriptive and backward looking,[37] and most of them take the form of a self assessment scorecard or a loss-data approach as previously discussed. The former methodology is basically qualitative and there is no evidence[38] to conclude that these models work and can be predictive. The latter being more sophisticated in a statistical scope, still, by virtue of the distribution, based on adding new loss events, the model is basically the data and the distribution.

None of these models is able to provide reliable information on the bank operational risk over time, size and risk of the portfolio. Furthermore a critical point relates to the fact that most modeling based on loss data approaches tends to consider in a primary essence operational risk modeling in a similar way as credit and market risk models, which would entail assuming that operational risk behavior and properties would be similar to market and credit risk. This is a dangerous assumption by the inherent nature of Operational Risk as known. While market and risk exposures can easily be benchmarked, quantifiable and explicit, capable of being validated in a discrete decision making process (easily quantified in scenarios, value at risk models and stress testing validation) and in a certain sense are easily mitigated or "exported", the operational risk profile of a bank is of a unique nature, exclusive and implicit.

Ebnother; Vanini et all. (2002) show evidence to conclude that severity dependence as opposed to frequency dependence changes the independence results significantly with the risk factor "fraud" dominating all other factors. Also most relevant is the conclusion that only a key 10% of all processes, after sensitivity analysis to test its robustness under this stress testing, have a 98% contribution to the resulting Value at Risk. This evidence can also be confirmed from the results shown previously resulting from the loss database collection performed by the ABA.

---

[37] See Holmes, M (2003) "Measuring operational risk" a reality check", Risk, September 2003
[38] See Currie, C (2005) " A Test of the Strategic effect of Basel II Operational Risk Requirements on Banks"

So not only the relevance and comprehensiveness of historical data collection is per se questionable as the foundation of a modeling approach to operational risk, but so is the specific operational risk loss experience as the foundation of a loss distribution. Let's assume that the first assumption is overcome in terms of soundness, comprehensiveness and completeness of historical loss data collection that could be then the basis to infer a loss distribution and therefore an operational risk model. This approach would be essentially backward looking and would in no way consider unknown risk event types like new fraud events or new types of system breakdown. It is very difficult to grasp the full portfolio of operational risk exposures and acknowledge it. As an aside it should also be pointed out that the most important risks deriving from operational nature are indeed impacts in terms of reputation and strategic risk levels which are excluded from the Basel II operational risk definition. Additionally, high severity events, which are for obvious reasons the primary challenge for the banks to address in view of their ability to severely impact the banks' capital, business, solvability and reputation, can hardly be captured by a model based on historical loss data. Adding to this the stable and reliable properties of, for instance, credit risk or market risk, variables taken over time are absolutely not alike when focusing on operational risk, which is fast evolving and shows high environment and context dependency proprieties. So the validation of such models remains highly challenging, particularly considering that due to its nature, the time needed to capture sound and comprehensive data to validate the model would comprehend a significant change in the profile and character of the operational risk exposure over time. The 99,9% point of the aggregated loss distribution assumes the knowledge of the 99,9999999% of the severity distribution as highlighted by Lawrence (2003), which renders questionable the accuracy of these methods.

The main purpose relates to having a proactive operational risk management, where the risk identification efforts focus on the business risks of the functional processes. The goal is to identify potential high risk hotspots and to anticipate a potential problem before it occurs. So if the intent is to engage risk issue proactively, risk practitioners should "think out of the box" in a consistent manner with scenario analysis. The unknown territory or the absence of historical losses within a specific operational risk assessment process leads to the need for a greater focus on "unexpected losses".

The dynamic and extremely sensitive nature of these models makes them very volatile and liable to significant change as a result of very small changes in parameters as more data is added. Constant benchmarking and statistical meaningfulness testing is thus

essential. To reduce instability I strongly believe that the parameter updates on the models defined should be subject to Bayesian techniques based on a relevant and significant amount of new data available, particularly spotted high severity event types.

Another focus of discussion is the difficulty in obtaining comparability with the 99,9% soundness standard, especially taking into account the intrinsic impact in terms of Capital charge calculation resulting from the Operational Risk component. The relevance of calculating losses at a 90% or 95% confidence level (or other base percentile to be defined) could also be questioned, which could comprehend the reach of direct observations on actual loss experiences and then use scaling factors to increase the soundness level to a comparable level of 99,9%. The challenge being obviously to determine the most appropriate and accurate scaling factors that should be fully validated and accorded together with the regulatory authorities.

The purpose is effectively to measure as most efficiently and forward looking as possible Operational Risk at the level of each business line or process according to the nature of each event type, being then aggregated up. This internal measurement system should estimate unexpected losses combining all the elements mentioned in different ways to quantify exposure to operational risk and thus should be capable of supporting allocation of economic capital to the respective business units.

9.2. - INCENTIVE FRAMEWORK FOR EARLIER ADOPTION OF THE AMA BY BANKS

Last but not least I maintain that an incentive framework should be put in place to motivate banks to move to more advanced and risk sensitive approaches such as AMA. I acknowledge that this proposal can be quite controversial, but I believe that there is great value in considering it as plausible. I believe that the development of such an incentive framework would have the ability to cause considerable positive effects in terms of bringing more banks to move to AMA that would otherwise take no steps in this direction for fear of a negative cost-benefit situation, particularly Tier 2 and Tier 3 banks (especially in regions where the adoption of AMA will not be mandatory under the regulators).

I will present and discuss the basic assumptions of this proposal, which I cannot yet test due to the unavailability of accessible and aggregated data at present. The framework proposed is based on the settlement of a maximum capital charge derived by the Operational Risk component that would be applicable to banks declaring to adopt the AMA and applicable within the transition phase to the AMA.

This capped capital charge would be based on the capital charge formula defined for the Standardized Approach, which is based on pre-defined betas (see Chapter 3.2.). The focal point is to allow banks to feel encouraged to move on to AMA, if given the possibility to account for a lower Capital charge than the one resulting from the adoption of the Standardized Approach, providing their own operational risk profile.

This model would be based on a minimum reducing balance framework for calculating adjusted lower betas that would then be applied to calculate the inherent Capital charge per Business line resulting from the Operational Risk in this transition period.

The adjustment of the betas would need to be validated by the regulators and would be effected in function of several variables to be defined. I believe that two of the most important variables to consider should be the bank's aggregated total margin of error, obtained on the aggregated loss distribution per respective business line (based on a confidence interval of 99,9% as required by the Basel Committee), and the other one being the bank's expected value of the total loss per business line. Let's assume that a bank is able to calculate the capital charge under the standardized approach in a much simpler manner as it is a top down method. In this approach the beta factors are given by the Basel Committee using pre-defined variables considered to be strongly correlated with the risk exposure such as Gross Income per Business line. The formula proposed to

calculate the Capital charge under the Standardized Approach is open to dispute, but such discussion lies outwith the scope of the present work.

I will assume as a given, as defined by the Basel Committee, the formula for the capital calculation under this approach as follows:

$$K_{TSA} = \{\bullet_{years\,(1\text{-}3)} \max[\bullet\,(GI_{i\,(1\text{-}8)} \times \bullet_{i\,(1\text{-}8)}), 0]\} / 3$$

Where the defined variables stand as follows:

K_{TSA} – Capital Charge under the Standardized Approach that results from the sum of the regulatory capital charges across each of the business lines.

$_{i}$ – Business line as defined by the Basel Committee

$GI_{i\,(1\text{-}8)}$ - The relevant indicator chosen by the Committee is the Gross Income (GI) per Business Line i , where Gross Income = Net Interest Income + Net non-interest Income, and resulting from the average of the previous three years of positive annual gross income as defined per Business Line.[39]

$\bullet_{i\,(1\text{-}8)}$ – Percentage previously defined that factors the calculation of the level of Capital required with the relevant indicator defined per Business Line

Let's then assume for the sake of simplicity that the capital calculation is defined as shown in Table 8 for bank Z, in which the total Capital charge calculated for the bank Z would be 373,5 monetary units relating to the operational risk component.

---

[39] Applies same criteria as in BIA approach as defined in Note 13 for Gross Income calculation, still in any given year negative capital charges (resulting from negative gross income) in any business line may offset positive capital charges in any other business line without limits, as long as aggregated capital charge within a given year remains positive otherwise that year has to be excluded from the average. Within each business line the Gross Income is an indicator that serves as proxy for the scale of business operations and therefore the most likely scale of operational risk exposure within each of the eight business lines defined by the Committee.

Table 8 – Example of Capital Calculation charge as relates to Operational Risk under the Standardized Approach for Bank Z

Business line (bl)	GI i=1	GI i=2	GI i=3	Betas bl	SUM (GI i * Beta bl)
Corporate finance (•1)	200	210	180	0,18	106,2
Trading and sales (•2)	100	110	150	0,18	64,8
Retail banking (•3)	2000	2100	2200	0,12	756
Commercial banking (•4)	100	110	200	0,15	61,5
Payment and settlement (•5)	100	80	110	0,18	52,2
Agency services (•6)	10	20	30	0,15	9
Asset management (•7)	150	160	180	0,12	58,8
Retail brokerage (•8)	30	20	50	0,12	12
TOTAL	2690	2810	3100		1120,5

$$K_{TSA} = \{•_{years\ (1-3)}\ max[•(GI_{i\ (1-8)} \times •_{i\ (1-8)}),0]\} / 3 = 1120,5/3 = 373,5$$

The incentive framework proposed would be based on a set of relevant criteria to be validated with the regulators. What I stand up for it that among these criteria it would be most worthy to consider the margin of error of the estimation in function of severity and frequency aggregated per business line, weighted with the value of the loss estimation itself or the expected value of the loss per business line, to build up a reducing balance model for lower beta adjustments ranging within a possible interval [min beta; max beta].

This proposal is open to dispute; however, its basic purpose is to discuss possible development approaches for creating an incentive framework. The reason being the significant benefits I believe this could produce in terms of facilitating and creating additional incentives to motivate banks to develop more advanced measurement approaches like the AMA.

The potential for adjustment downwards on the betas to be applied per business line would be an outcome of several variables, with particular focus essentially on the dispersion degree and the expected value of the loss per respective business line, potentially compared as well to the average of the sector, to be fully defined by the regulatory entities.

As databases are being developed and information is being gradually built, developed, processed and shared, this incentive framework could as well favour this overall process. The lower the corresponding expected value of loss and margin of error, calculated by the bank as compared to its peers, and industry related, per business line, the more it would positively impact a beta adjustment downwards. This could make it possible to set

a lower maximum cap for capital allocation per business unit when transitioning to AMA methodology as opposed to the Standardized Approach.

Developing this kind of incentive frameworks could motivate banks to further develop their internal risk sensitive models, increasing their sensitivity and, inherently, their sophistication. In this way banks would feel more motivated to drive major focus on developing increasingly accurate and forward looking dynamic models. They would also be extremely motivated to outdo their peers as growing databases could be raised increasing availability of external data and therefore contributing to higher precision of estimates as previously mentioned. This framework would allow these banks the opportunity to develop more sophisticated models within the transition phase and if fully validated by regulators achieve even more efficient results in terms of capital calculation, totally adjusted to their own intrinsic operational risk profile.

It is obvious that this proposal constitutes just a draft approach to raise further discussion that would require further research and consistency, as data is increased and expertise is developed within this field. Such an incentive methodology would need to be carefully and relevantly designed, still I find that there is considerable value in the overall idea of taking these variables – expected loss and margin of error at business level, as the foundation of an incentive framework within a transition phase (where sometimes banks do not yet have the necessary historical data set to comply with AMA requirements but could account with a favourable framework to further evolve towards AMA).

As I found in the course of my work, and contrary to my initial beliefs, banks are still effectively quite skeptical with regard to AMA implementation. They are still very focused on credit and market risk issues and at the same time making very tentative steps within the field of operational risk management quantification. On the other hand AMA specific tools and for instance KRIs have yet to be fully understood or digested. There is still a long way to go before there exists industry-wide maturity in this field. Simultaneously there is strong reluctance as relates to the cost-effective analysis outcome of moving to AMA. On the other hand, and at the same time, it is generally accepted that the magnitude of potential operational risk losses will increase in the future as large unexpected losses are more likely to emanate from operational risk events and therefore Value-at-Risk from operational risk is significantly higher than from other types of risk events, such as market or credit risks.

Taking this into account, it is my strong belief that it is urgent and critical to motivate banks to focus more on operational risk management discipline and practice and evolve

more risk sensitive approaches using the bottom-up paradigm. This would also entail an exponential – and beneficial – development of related scientific knowledge and literature.

CHAPTER 10 – CONCLUSIONS

The implementation process as regards Operational Risk under the Basel II proposals remains controversial, and much discussion has also taken place about what constitutes an operational risk 'event' (actual loss, possible loss, a near miss?).

It has been shown that most banks are not yet prepared to implement advanced methods as opposed to the standard approach in the first phase of Basel II implementation timeframe in relation specifically to operational risk. Furthermore they are still far from reaching a feasible ground as regulatory updates are also suggested to cope with limitations detected. Future postponements and updates as relates to Basel II guidelines and specifically AMA (Advanced Measurement Approach) implementation are therefore to be expected. While banks declaring an intention to adopt more advanced methods can be expected to gain competitive advantage in terms of capital requirements and subsequent pricing implications, there is utterly no evidence to conclude so at this point in time.

It is generally accepted that the magnitude of potential operational risk losses will increase in the future, as global financial institutions specialize in volatile new products and services that are heavily dependent also on technology. Moreover, large unexpected losses are more likely to emanate from operational risk events and therefore Value-at-Risk from operational risk is significantly higher than from other types of risk events, such as market or credit risks, as also stressed by Allen and Bali (2004).[40] There is evidence to suggest that operational risk is substantial and is emerging as the dominant and remaining risk exposure so far to remain largely non hedged and only partially insurable, against market and credit risk exposures which can be extensively hedged, also thanks to the development of derivative instruments.

Furthermore, the cases observed suggest that significant operational risk events can occur from Clients, Products and Business Practices; Fraud; and Damage to Physical Assets. By their very intrinsic nature and sometimes lack of sufficient historical data, they challenge the limits of manageability. In spite of this, a great deal of management activity in the field of operational risk in financial institutions is focused on routine systems errors and malfunctions. The process of managing unknown risks cannot be

---

[40] They found that two thirds of the equity risk premium for all types of financial institutions derived from operational risk. (which could have included reputation risk where scientific literature is still very scarce or inexistent)

disguised or replaced by an easier task which can be successfully reported upwards to senior management. The relevant question as formulated by Michael Power (2003) is "whether operational risk specifically, and internal control in general, really stimulate an intelligent risk management capable of challenging existing ways within and outside organizations, or whether they simply end up as the 'normalization of deviance' in a dense network of procedures and routines." Whereas operational risk indeed facilitates a greater risk management via new organizational processes, extending the scope and work of both the risk manager and the regulator, it can on the other hand also reinforce a myth of controllability in a field where the latter is at best very limited. The same reflections can also be made relating to reputation risk management.

In this context, it is presented an alternative development approach to AMA based on a segmentation of event types per frequency and severity. The operational risk modeling emanating from high severity should incorporate all relevant external data and should be benchmarked in accordance with regulators in view of industry patterns and regional standards if relevant, as comprehensive loss data bases mature. I strongly believe that there is value in introducing some Bayesian or other rationale techniques to reduce model instability and increase mapping to reality. On the other hand the operational risk derived from low severity should be modeled by each bank according to its own profile based on the models discussed. I also believe that there is relevant value, in both a statistical and practical sense, in introducing as much external data as possible to increase capital calculation optimization and accuracy. This would result in a better assessment of cause and effect and possibly in a sounder basis to better align with required adjustments to AMA modeling, and therefore increase motivation and implementation capabilities to more banks.

I also recommend that an incentive framework be put in place to motivate banks to move as early as possible to AMA implementation. Though still under development, there is value in the possibility of establishing a maximum capped capital calculation, derived from the Standardized Approach method, but allowing banks at the implementation stage to access lower maximum capital charges, based on adjusted lower betas per business unit. Such adjustment could eventually be made as a function of both the expected loss value and error margin of the compound loss distribution inferred per business unit and depending on the way it would compare with the average of the sector (regionally relevant). As AMA matures one would then expect the resulting capital charge to decrease as customized modeling increases in bottom up sensitivity and

reality. A positive side effect would be increased availability of external data, research, scientific and management knowledge and tools on operational risk and modeling.

Notwithstanding the problems mentioned, the quality and quantity of the data collected is improving rapidly and future data collection processes, as a result of continued growth on the number of participating banks, will surely yield improvements in depth, robustness and comprehensiveness of data and subsequent analysis and modeling based approaches. Such comprehensive data will be fundamental for improving confident statistical and analytical inferences on the nature and incidence of operational risk. It would therefore also be crucial to implement, as successfully as possible, extended improved operational risk assessment management frameworks and models.

While some analysis[41] of past bank crises do not support the view that operational risk capital adequacy requirements may contribute to greater financial stability of the financial system, it is widely accepted that better management practices, governance and accountability as relates to operational risk assessment will certainly contribute positively to this goal. Operational risk is far from being a mature discipline and, as discussed, there are still a large number of difficulties to overcome. There is still limited literature and specific and robust scientific knowledge to grasp its quantification in both an accurate and forward looking scope as intended by the Basel Committee. True model validation may have to await the completion and comprehensiveness of such historic and sound databases. Furthermore, to ensure an effective future capital regime Basel updates do need to assure that capital requirements improve the capture of diversification and risk mitigation. One of the key aspects is collaboration in operational risk management from the banking institutions to regulators, customers and suppliers.

One final remark on the fact that some banks have been approaching Operational Risk from a Basel perspective while others have been doing so from a Sarbanes-Oxley perspective.[42]

The ideal would be to approach it from an enterprise wide perspective serving both regulatory guidelines compliance, leveraging joint efforts and major goals.

Last but not least I would acknowledge that this thesis is rather limited, since all the major development axes proposed, based on extensive investigation, cannot be tested due both to the scarcity of data available and to its intrinsically subjective nature. It is important to be aware that the points of discussion in this thesis reflect developing

---

[41] "The value of privatization: the case of the state bank of NSW", Economic papers, March 2001

[42] Martyn Emery states that "what is different with Sarbanes-Oxley is the near real time nature of the requirement and the opportunity to link risk with consequential impact and hence capital adequacy."

methodologies and approaches. This, together with the small sample size of available data, should suggest the need to be cautious in using any of the discussed proposals to arrive at any conclusions about the operational risk profiles and exposures, either for individual applications or for the industry as a whole. While an exciting field for future and ongoing research, it still needs much improvement, which I believe will occur as more data is collected, analyzed and shared. I consider cooperation and wider availability of data within the industry to be crucial to greater development in this field.

Other suggestions for future research:

All future developments and tests related to different and combined modeling techniques and testing results, on the basis of available and more mature and extended internal and external operational loss event databases, will be essential for increasing current knowledge in this field. It is also crucial to analyze future evolution with updated surveys and interviews reviewing the progress made by the banking community in view of the major points of research developed.

Tough KRIs are not originally designed to track risks that cannot be readily measured; their capability to map in a multiple dimensional way risk event types should not be neglected as the industry knowledge develops beyond its current horizons. Benchmarking KRIs should help institutions to better understand whether their own KRI trends and volatility are common to their peers, and to better define meaningful management thresholds for KRIs.

Another interesting subject in the future is the applicability of the AMA approach to non Basel II organizations, that can significantly learn from it namely to improve operational risk Governance (corporate Governance, risk Management and risk culture) and operational risk management practices (risk identification, risk assessment, risk management, risk mitigation) based on scenario analysis and key risk indicators.

REFERENCES

Allen, L; Bali, T (2004), *"Cyclicality in Catastrophic and Operational Risk Measurements"* Working paper, May 2004

Allen, Linda; Saunders, Anthony (2004), *"Incorporating Systemic Influences into Risk Measurements: A Survey of the Literature"*, Journal of Financial Services Research 26:2 161-192

Alexander, Carol (2004), *"Operational Risk Regulation Analysis and Management"*

Asia Risk (2005), Survey conducted in Asia Pacific by Asia Risk and Ernst & Young to 245 participant banks representing most major countries in the region

Anders, Ulrich; Sandstedt, Michael (2003), *"An operational risk scorecard approach"*, Risk Journal

Basel Committee on Banking Supervision (1998), *"International Convergence of Capital Measurement and Capital Standards"*, Basel Committee Publications, Bank for International Settlements

Basel Committee on Banking Supervision (2002), *"Sound practices for the Management and Supervision of Operational Risk"*, Basel Committee Publications, Bank for International Settlements

Basel Committee on Banking Supervision (2003), *"The New Basel Capital Accord: Third Consultative Paper"*, Basel Committee Publications, Bank for International Settlements

Basel Committee on Banking Supervision (2003), *"The 2002 Loss Data Collection exercise for Operational Risk; Summary of the Data Collected"*, Risk Management Group, Basel Committee Publications, Bank for International Settlements

Basel Committee on Banking Supervision (2004), *"International Convergence of Capital Measurement and Capital Standards, A Revised Framework"*, Basel Committee Publications, Bank for International Settlements

Bieri, David S. (2004), *"The Basel Process and Financial Stability"*, Bank for International Settlements

Blount, Ed (2005), *"Coping with the Operational Risk evolution"*, ABA Banking Journal; Apr 2005; 97, 4

CGEY (2004), Database from a survey conducted in Europe by Cap Gemini Ernst Young to 35 participant banks (not published)

Cornalba, Chiara; Giudici, Paulo (2003) *"Bayesian Networks for Operational Risk Management compliant with Basel II"*

Cornalba, Chiara; Giudici, Paolo (2004), *"Statistical models for operational risk management"*, Elsevier Physica A 338 166-172

Cornford, Andrew (2004), *"Basel II - Vintage 2003"*, Journal of Financial Regulation and Compliance, 12 (1) - 21

Currie, Carolyn (2005), *"A Test of the Strategic Effect of Basel II Operational Risk Requirements on Banks"*, University of Technology Sydney, ISSN: 1036-7373

Decamps, Jean-Paul; Rochet, Jean-Charles; Benoît, Roger (2003), *"The three pillars of Basel II: optimizing the mix"*, Journal of Financial Intermediation, 13, 132-155

Dennis, Steven A.; Jeffrey, Andrew (2000), *"Structural Changes in Australian Bank risk"*, Journal of International Financial Markets, Institutions & Money, 12, 1-17

Ebnother, Silvain; Vanini, Paolo; McNeil, Alexander; Antolinez-Fehr, Pierre (2002), *"Modeling Operational Risk"*

Emery, Martyn (2004) *"Monitoring Sarbanes-Oxley Act, Section 409 Compliance"*

E&Y (2006), Survey conducted world-wide by Ernst & Young to 307 large banks

Financial Services Authority (2002), *"Operational Risk systems and controls"*

Financial Services Authority (2003), *"Implementation of the Capital Accord for Operational Risk"*

Financial Services Authority (2004), *"AMA Soundness Standard"*

Financial Services Authority (2005), *"Operational Risk management practices. Feedback from a thematic review"*

Finlay, Mike; Davies, Jonathan; McLenaghen Tara; Wilson, Duncan (2005), *"Key Risk Indicators – Their role in Operational Risk Management and Measurement"*, Risk Business International Limited

GartnerG2 (2004), Survey conducted in the United States by GartnerG2 to 97 participant commercial banks

Giudici, P (2004), *"Applied Data Mining; Statistical Methods for Business and Industry"*

Herring, Richard J., Litan, R.E. (1995), *"Financial Regulation in the Global Economy"*, The Brookings Institution, Washington DC.

Herring, Richard J. (2004), *"The subordinated debt alternative to Basel II"*, Journal of Financial Stability, 1, 137-155

Holmes, M. (2003), "*Measuring operational risk: a reality check*", Risk, September 2003

Jensen, F.V. (1996), *"An Introduction to Bayesian Networks"*

Lawrence, D. (2003), *"Operational Risk Implications of Basel II/CP3"*, Risk Magazine

Lindquist, Kkjersti-Gro (2004), *"Bank's Buffer capital: how important in risk"*, Journal of International Money and Finance, 23, 493-513

McNeil, J. Alexander; Lindskog, Filip (2001), "*Common Poisson Shock Models: Application to Insurance and Credit Risk Modeling*", Federal Institute of Technology Zurich, September 2003

Medova, E.A.; Kyriacou, M.N. (2001), "Extremes in operational risk management", Centre for International Research, University of Cambridge

Montgomery, Heather (2004), *"The effect of the Basel Accord on banks portfolios in Japan*", Journal of the Japanese and International Economies, 19, 24-36

Power, Michael (2003), "*The Invention of Operational Risk*", Centre for Analysis of Risk and Regulation, The London School of Economics and Political Science

Repullo, Rafael; Suarez, Javier (2004), "*Loan Pricing under Basel Capital Requirements"*, Journal of Financial Intermediation, 13, 496-521

Risk Magazine (2004), Survey conducted world-wide by SAS and Risk Magazine to 250 participant banks worldwide

Roncalli; Moudoulaud; Frachout (2003), "*Loss Distribution Approach in Practice*", Crédit Lyonnais

Saidenberg, Marc; Schuermann, Til (2003) *"The New Basel Capital Accord and Questions for Research"*, Federal Reserve Bank of New York, 03-14

Scandizzo, Sergio (2000), *"Operational Risk Measurement in Financial Institutions: A Fuzzy Logic Approach"*, in B. Bouchon-Meunier, R. R. Yager and L.A. Zadeh (eds), *Uncertainty in Intelligent and Information Systems*, Singapore: World Scientific

Scandizzo, Sergio (2005), *"Risk Mapping and Key Risk Indicators in Operational Risk Management"*, Economic Notes by Banca Monte dei Paschi di Siena SpA, vol. 34, no 2-2005, pp. 231-256

Shafer, Dorothea (2004), "*The New Basel Capital Accord and its impact on Small and Medium-sized companies"*, Springer Financial Bulletin

Sironi, Andrea; Zazzara, Cristinano (2003), *"The Basel Committee proposals for a new capital accord: implications for Italians banks"*, Review of Financial Economics, 12, 99-126

Stewart, Walter (1931), "*Economic Control of Quality of Manufactured Products*"

Study conducted by National Institute for Economical and Social Research in Risk Management in partnership with PricewaterhouseCoopers (2004), "*Study of the Financial and Macroeconomic Consequences of the Draft proposed New Capital Requirements for Banks and Investment Firms*"

Wilson, Ian (2004), *"Implementing Basel II: A Case study based on the Barclays Basel II preparation"*, Journal of Financial Regulation and Compliance, 12 (4) – 297

Other sources of information:

Personal, Phone and E-mail Interviews conducted between 2005 and 2006

Discussion Forums such as B2-ORM@yahoogroups.com and www.baselalert.com