Operational Risk Management in Financial Services and the nev Basel Accord

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Today's turbulent financial markets, growing regulatory environments, and increasingly complex financial systems have led risk managers to realize the importance of measuring and managing Operational Risk. According to the Basel Committee on Banking Supervision, Operational Risk is the risk of direct or indirect loss resulting from inadequate or failed internal processes, people, and systems or from external events. Infrastructure failures (e.g., information technology, terrorist attacks), fraud (e.g., rogue trading), legal and regulatory risks (e.g., fines), have become the motivators behind the move to proactively manage Operational Risk in large Financial Services Institutions. In this paper we provide an up to date critical review of the most fundamental issues on Operational Risk Management, e.g., methodology, data collection, analytics, implementation, based on practical experience.

1. Introduction

Of all the different types of risk that can affect institutions, operational risk can be among the most devastating and the most difficult to anticipate. Management of operating risks is a key component of our financial and risk management discipline that drives net income results, capital management and customer satisfaction. Rigorously controlled and well-managed risk, frees up resources and capital for revenue generating opportunities.

Although credit and market risk are now well understood and are therefore more likely merely to wound, operational risk remains an enigma for risk managers. It is the relative lack of understanding of it that is threatening. Unlike market and credit risk, which tend to be isolated in specific areas of our business, operational risks are inherent in all business processes. It is a broader concept than “operations” or back office risk.

Along with established capital charges for market and credit risk, Basel proposes an explicit capital charge to guard the banks against operational risks. Since January 2005, the new capital requirements require financial services institutions to implement robust systems for the collection and tracking of data. As a result of that, the biggest financial institutions have started devoting significant resources to identify, measure, analyze, report and mitigate this potentially catastrophic risk class. They aim to implement a framework that meets all the compliance requirements with the New Capital Accord (Bank for International Settlements, BIS II) regulations: data collection, data tracking and a robust internal risk-control system.

Since operational risk became the focus of intense interest among industry participants, regulators and other observers, there is a great opportunity for operations research specialists, risk managers and management scientists to apply quantitative and qualitative techniques in this field. There is no doubt that the management of operational risk has taken on increased importance in financial services institutions in recent years and banks are becoming increasingly sophisticated in determining how it a can be accomplished. It is a new, exciting area of risk management in the banking sector.

2. Operational risk definition and categorization

In general, operational risk contains the losses that follow from acts undertaken (or neglected) in carrying out business activities. Therefore, when a transaction is priced solely in terms of market and credit risks, an important risk, which can have devastating financial consequences, is missing from the product pricing.

After a number of years of intensive debate on what constitutes an operational risk, according to the Basel’s current definition for purposes of quantification and capital allocation, operational risk can be defined as a risk of direct or indirect loss resulting from inadequate or failed internal processes, people, and systems or from external events 2, pp. 144.

Strategic and reputational risks are not included in this definition. The four operational risk categories are further clarified as follows:

- People,
- Process,
- Systems and,
- External.

People as a risk category are losses associated with intentional violation of internal policies by current or past employees. In some specific cases, the risk extends to people who are being considered for employment.

Process risk can be explained as losses that have been incurred due to a deficiency in an existing procedure, or the absence of a procedure. Losses in this category can result from human error or failure to follow an existing procedure. Process-related losses are unintentional.

Systems risk category consists of losses that are caused by breakdowns in existing systems or technology. Losses in this category are unintentional. If intentional technology-related losses occur, they should be placed in either the people or external category.

Finally, external risk category could be defined as losses occurring as a result of natural or man-made forces, or the direct result of a third party's action.

The definition focuses on the causes of operational risk and is open to endless discussion about the detailed definition of each loss category.

There are three common categorization methods: event, cause and effect. There is a live debate in the operational risk managers and insurance community regarding the pros and cons of each method. Tables 1 and table 2 demonstrate the classification proposed by Basel.

Table 1: Basel Business Line Classification

INVESTMENT BANKING	Corporate Finance
	Trading and Sales
BANKIING	Retail banking
	Commercial banking
	Payment and Settlement
	Agency Services and Custody)
OTHERS	Asset Management
	Retail Brokerage

Table 2: Basel Loss Event Type Classification

Event-Type Category (Level 1)	**Subcategories (Level 2)**
1. Internal Fraud	Unauthorized Activity Theft and Fraud
2. External Fraud	Theft and Fraud Systems and Fraud
3. Employment Practices&Workplace Safety	Employee Relations Safe Environment Diversity&Discrimination
4. Clients, Products&Business Practices	Suitability, Disclosure&Fiduciary Improper Business or Market Practices Product Flaws Selection, Sponsorhip&Exposure Advisory Activity
5. Damage to Physical Assets	Disasters and other events
6. Business Disruption and System Failure	Systems
7. Execution, Delivery&Process Management	Transaction Capture, Execution&Maintenance Monitoring and Reporting Customer Intake and Documentation Customer/Client Accounting Management Trade Counterparties Vendors&Supplies

3. Basel treatment of operational risk

Capital Adequacy Framework 2 identified operational risk as a key area of regulatory consideration. The New Capital Accord identifies three methods for calculating operational risk capital charge, with increasingly sophistication and advanced qualitative criteria:

(1) Basic Indicator Approach (BIA),
(2) Standardized Approach (STA) and,
(3) Advanced Measurement Approach (AMA).

According to basic indicator approach, the capital charge should be derived as a fixed multiple (alpha) of some aggregate activity measure such as gross income that has to be positive (in either case, should be excluded from numerator and denominator) 2, pp. 144. The charge may be expressed as follows 2, pp. 144:

$$K_{BIA} = (GI_{1,..n}) \quad n \qquad (1),$$

Where K_{BIA} is the capital charge under the Basic Indicator Approach; GI is annual gross income, where positive, over the previous three years; N is a number of the previous three years for which gross income is positive and; is 15%, which is set by the Committee, relating the industry wide level of required capital to the industry wide level of the indicator.

On the other hand, standardized approach suggests that different business lines are assigned individual gross activity measures and the regulators determine the appropriate fixed multiple (beta) to calculate the regulatory capital requirement. The business lines are defined in detail in table 3.

The total capital charge is calculated as the three-year average of the simple summation of the regulatory capital charges across each of the business lines in each year. The total capital charge may be expressed as:

$$K_{TSA} = \{\Sigma_{vear\ 1\text{-}3} \max \Sigma(GI_{1\text{-}8} \times \beta_{1\text{-}8}), 0\} / 3 \qquad (2),$$

Where K_{TSA} the capital charge under the Standardized Approach; $GI_{1\text{-}8}$ is a annual gross income in a given year; as defined in the Basic Indicator Approach, for each of the eight business lines and; $ß_{1\text{-}8}$ is a fixed percentage, set by the Committee, relating the level of required capital to the level of the gross income for each of the eight business lines. The values of the betas for the corporate finance ($ß_1$) trading and sales ($ß_2$) and payment and settlement ($ß_5$) are 18%; for the commercial banking ($ß_4$) and agency services ($ß_6$) are 15% and; for the retail banking ($ß_3$), asset management ($ß_7$) and retail brokerage ($ß_8$) are 12%.

Table 3: Mapping of Business Lines

Level 1	Level 2	Activity Groups
Corporate Finance	Corporate Finance Municipal/Government Finance Merchant Banking Advisory Services	Mergers and acquisitions, underwriting, privatizations, securitization, research, debt (government, high yield), equity, syndications, IPO, secondary private placements
Trading & Sales	Sales Market Making Proprietary Positions Treasury	Fixed income, equity, foreign exchanges, commodities, credit, funding, own position securities, lending and repos, brokerage, debt, prime brokerage
Retail banking	Retail Banking	Retail lending and deposits, banking services, trust and estates
	Private Banking	Private lending and deposits, banking services, trust and investment advice
	Card Services	Merchant/commercial/corporate cards, private labels and retail
Commercial Banking	Commercial Banking	Project finance, real estate, export finance, trade finance, factoring, leasing, lending, guarantees, bills of exchange
Payment and Settlement*	External Clients	Payments and collections, funds transfer, clearing and settlement

Level 1	Level 2	Activity Groups
Agency Services	Custody	Escrow, depository receipts, securities lending (customers) corporate actions
	Corporate Agency	Issuer and paying agents
	Corporate Trust	
Asset Management	Discretionary Fund Management	Pooled, segregated, retail, institutional, closed, open, private equity
	Non-Discretionary Fund Management	Pooled, segregated, retail, institutional, closed, open
Retail Brokerage	Retail Brokerage	Execution and full service

Source: BCBS, "International Convergned of Capital Measurement", Annex 8, pp. 302
** Payment and settlement losses related to a bank's own activities would be incorporated in the loss experience of the affected business line.*

According to advanced measurement approach, there is a range of internal approaches currently under development, which may be broadly categorized as:

- Internal Measurement Approach (IMA),
- Loss Distribution Approach (LDA) and,
- Scorecard Approaches.

When applying internal measurement approach, the business lines are overlaid with a series of operational risk types. For each business line/risk type combination, regulators define an exposure indicator (EI). Banks then use internal data to define the probability of a loss event (PE) per unit of the exposure indicator, and the expected loss given such an event (LGE). Expected losses (EL) by business line and risk type are the product of these three components. Regulators supply a fixed multiplier (gamma) to translate these expected losses into a capital charge, i.e., Value-at-Risk (VaR) figure for unexpected losses.

Loss distribution approach involves estimating two distributions based on internal loss data. One distribution is the loss associated with a single event and the other is the frequency of loss events over a given (usually one year) time horizon.

Scorecard approaches are using forward-looking risk indicators and built them into "scorecards", to measure relative levels of risk. In order to qualify for the advanced measurement approach, the approach must have a sound quantitative basis.

It is clear that basic and standardized approaches are not scientific ones. Allocating capital based on simple aggregate activity measures, fails to distinguish between well-run and poorly-run units. However, these approaches are not out of line with the practice in many internal efforts to allocate economic, as opposed to regulatory capital. The internal measurement approach framework is similar to the one followed for market risk. However, without data to calibrate such a framework objectively, it will have the appearance of scientific sophistication with little of the reality.

The Basel Accord states that as banks move along the continuum, they will reap the reward of a lower capital charge. Further, the Accord also mandates that failure to comply will be addressed by a variety of supervisory actions including increased oversight, senior management changes, and the requirement of additional capital.

The Accord emphasizes the importance of data collection and stipulates that banks must have data collection processes in place long before the January 2005 deadline, when the new capital requirements became mandatory. It also mandates that banks must be able to prove that these systems are robust and auditable. After the January 2005, the majority of the institutions have not had sufficient internal data to support loss distribution approach.

The intention of the Basel Committee was to keep the aggregate capital requirement roughly constant for most banks under the new Accord. On the other hand a desirable secondary goal was the creation of internal incentives for improved operational risk management as well as the reliable basis creation for the trend analysis.

4. The operational risk framework

The large financial services institutions are in the process of building a framework that provides an enterprise-wide view of losses and allows them to proactively manage operational risk, no matter if the risks lie in operational processes, resources, systems or external

events. This framework should meet the compliance requirements with the BIS II Regulations, in terms of data collection, data tracking and a robust internal risk-control system.

It should deal with operational risk measurement and management issues, such as: developing efficient management and organizational frameworks, economic capital allocation, advanced operational value-at-risk (operational VaR) measurement techniques, internal loss database design and implementation, data collection and reporting, definition and categorization issues, risk indicators analysis, and the integration of operational risk measurement with control self-assessment scores and insurance.

The basic components of the operational risk framework are:

(1) Risk identification&assessment,
(2) Risk quantification & measurement,
(3) Risk analysis, monitor & reporting,
(4) Risk capital allocation and,
(5) Risk management & mitigation.

Risk identification & assessment is usually done through a Risk and Control Self-Assessment (RCSA) program. Managers of line of business identify key processes, risks and controls in those processes, gaps and action plans to close gaps. They could also assess the impact and likelihood of risk, in a qualitative manner.

A quantitative framework that follows the advanced measurement approach is suggested, so operational risk can be measured accurately. Typically, exposure indicators, e.g., gross income, past losses and Key Risk Drivers/Indicators (KRDs/KRIs) constitute the internal database. Availability and integrity of internal data as well as relevance and scalability of external data are important issues. Risk profiles, provided by RCSAs, have fundamental information as well.

Risk analysis contributes to the integration of risk and business performance, making risks transparent and identifying gaps. Risk monitoring of operational risks, key risk drivers/indicators and action plans, should reflect changes in the enterprise and raise awareness. Risk management performance, which links the risk to value creation, becomes important. Consolidated reporting across the enterprise, should be appropriate for various levels of management, including the Board of Directors.

Operational Capital at Risk (CaR) (both regulatory and economic capital) is calculated for every line of business, to protect for unexpected losses at a certain time horizon and percentile, e.g., 1 year – 99.9% operational VaR.

Risk management & mitigation consists of sophisticated alternative risk financing and transfer arrangements (through insurance programs), as well as updated business continuity plans. Ongoing communication making risks transparent, training and sharing of best practices becomes vital.

5. The information support for operational risk management

The data needed for operational risk management is insufficient and inconsistent. Definitions of what constitutes an operational loss differ from institution to institution and even across departments. Even the range of items to be considered under the operational loss heading is a subject to dispute. In addition to that, even with agreement on the relevant risk categories, there remains room for dispute on how to calibrate exposure drivers for each area. On a "purely scientific" basis, the problem is great in the current environment.

Sources of data can be: internal operational loss data and exposures, collected from and within the institution; educational opinions (e.g. management scenarios or self-assessments); key risk drivers/indicators for each risk type in order to signal problem in the earliest stages so that preventive action can be undertaken and; other institutions' operational loss data (i.e. external data can be used as a proxy for the institution that is being analyzed).

Integration of data (objective and subjective) provides details of events and risk indicators for model calibration, a predictive look at new initiatives, and a retrospective picture of the historical patterns of risk in the business processes.

5.1. The internal operational risk database

The development of a model for measuring operational risk begins by building an internal database. Events therein should carry their losses or potential losses, the business activity giving the losses, and other risk indicators. The creation and management of the database is important to understand the business environment. The aiming target should be a comprehensive database that provides reliable information on significant losses, e.g., losses above a certain threshold. Major financial institutions have started putting in place a process for ongoing tracking and monitoring of operational risk losses, to facilitate the effective measurement and management of operational risk.

Data should be reviewed for accuracy and completeness thoroughly, i.e., being of high-quality. The database should include only those losses that have impacted the institution and not losses that have been realized by individuals or shareholders, since this information cannot reliably be used for modeling purposes.

There are several technical issues that managers face when it comes down to designing an internal operational risk database. The first issue refers to kind of data to be collected and the reason for the data collection, regarding losses, exposures, key risk drivers/indicators, and management control information. The second issue refers to the definition of the optimal database structure. Third issue is the treatment of so-called "near misses" data, i.e. the mistakes that almost cost the bank but which are sorted out just in time. There are many other technical issues, regarding: losses and key risk drivers/indicators data module design and implementation, database features and specifications, security and user authorization issues, hardware and software requirements, integration with the bank's internal systems, e.g. accounting system, etc.

The "granularity" of loss and risk data records by the different line of business is another important issue. If banks record their internal losses in very general categories, and do not associate losses with enough contextual information, it may be impossible later to drill down into the data looking for finer gradations of risk or it may be very hard to reclassify the database according to an agreed industry or regulatory standard.

Operational risk teams should identify the sources of data and how to obtain it, ensuring it is all captured and reported to a central database. "Open issues" type of events should not be included in the database but should be made available upon request.

However, a certain number of practitioners argue that the main barriers to data collection are not technical and methodological, but rather the economic and cultural ones. For example, some managers worry that admitting to mistakes and quantifying total losses will weaken their position. Also, to the collection of key risk indicators, the bank would need to be convinced that there would be considerable benefits. The decision about whether to gather data comes down to a cost/benefit analysis, just like any other decision.

5.2. External data provision and operational risk management

Operational risk data is unique in the financial world because operational risk events often occur in private, out of the public eye. Unlike market and credit risk observations, operational risk observations are not summarized on a Reuters or Bloomberg screen.

Internal operational loss data is the most relevant information for measuring operational risk, but it is generally insufficient for purposes of modeling operational risk. More specifically, in order to measure operational VaR one must be able to accurately measure the probability of rare loss events taking place. Rare events, by definition, occur infrequently, so it is unlikely that a single institution will have experienced a sufficiently large number of these events to develop a useful data pool. Therefore, based on internal data alone, an institution could find it extremely difficult to estimate the shape of the tail of its loss severity distributions. To address this dilemma, the institution has two options: it can estimate the shape of the tail using "expert" opinion and scenario analysis (people usually question and dispute those scenarios), or it can use external data.

Banks cannot develop their operational risk strategy in isolation. Once a bank has begun to gather a rich set of data on internal losses and key risk indicators, it may decide that it needs to compare this information to the pattern of losses incurred by other banks. The use of external loss data can also strengthen and extend the knowledge that has been gleaned from internal data gathering. With more public understanding of the magnitude and frequency of operational risk events, stakeholders will become less sensitive to these events and not use operational risk losses as a proxy for bad management. In addition, by sharing data, the possibility of creating efficient operational risk financing and transfer markets, increases dramatically.

However, there are consistency and technical issues related to the use of external data, which makes the whole problem more challenging. Mainly reliability issues of data drawn from so many different institutions of varying sizes with different control structures, different cultures and different countries. This information is also subject to numerous truncations and data capture biases. A number of problems have not been resolved yet (for example, scalling problem, aggregation problems with the internal data, consistency problem in categorization of event types between different institutions etc.).

In last few years there are initiatives and efforts to industry-wide database creation, as well as effort in sharing data promotion, which could be beneficial for institutions and which could help them to model operational losses and find risk-transfer solutions.

6. Operational risk Quantification and capotal allocation

According to Basel a capital charge for operational risk should cover unexpected losses, so the provisions should cover expected losses 2. The measurement of operational risks along the different line of business enables the allocation of risk capital to be determined from historical loss information and/or scenario analysis. The Accord highlights risky business activities, and help management monitor and manage the risk. An operational risk system could take a tool-kit approach, permitting users to select various combinations of quantification approaches 4, depending on their preferences. In future we could expect the more use of curve fitting using maximum likelihood estimators to various types of distributions, Monte Carlo simulations, modeling the benefits of insurance, and methods to consider both internal and external data for calibration.

The financial services institutions could do this by assuming families of distributions, based on descriptive statistics and empirical evidence on observations of public and non-public loss events. Families of distributions often suggested: frequency distribution (the chance that a loss event will occur, such as: Poisson, binomial and, negative binomial distribution) and severity distribution (the size of the loss, such as lognormal, Weibull, Frechet, Gumbel, Pareto, beta, gamma, mixture, etc.). Institutions, then, need to estimate the parameters from the available sets of data. The next step consists of determining whether fitted distributions are representative or not. The parameters might be selected on the basis of opinion, or by visually inspection, or by applying "goodness of fit" tests to the existing data (e.g. Chi-square, Kolmogorov-Smirnov and weighted Kolmogorov-Smirnov tests). However, "goodness of fit" tests make sense when a moderate amount of data is available. Therefore, the "best fits" derived from very limited sample sets may not necessarily reflect that would be expected from the complete distribution (were it available) 3.

Once the distributions have been established, an operational Capital-at-Risk (CaR) model can be applied, and CaR results obtained. The key to stable and robust CaR numbers is to find distributions that best fit the data. For example, using multiple distributions to estimate the distribution of the underlying data means that the CaR results will be more robust, as long as the basis for selecting the curves can be justified. There are several problems to overcome: sample size (usually limited data sets), "fat tails" (a relatively high proportion of "unusual" or "catastrophic" events), data-capture biases, scale, mixing internal and external data for calibration, truncation, fitting data to the most appropriate frequency and severity distributions, inflation, factoring in insurance, VaR, etc.

The relative scarcity of operational risk data means that the risk managers often have to adjust either the data that is available, or the models that they use. There is a series of techniques that can be applied to limited data sets, or that estimate/extrapolate data using limited data samples. For example "resampling with replacement" ("bootstrapping") allows analysts to create multiple distributions for analysis, all of which are based on empirical data – thus eliminating the need to "assume" any distribution 1.

It is critical that attention be paid to how well the distributions employed by the analyst fit the empirical operational risk data. To combat fitting problems, the severity distribution can be broken up and different distributions can be fitted to different portions of the curve. For example, the risk manager might use an empirical distribution for the bulk, lognormal for the middle, and generalized Pareto for the tail.

Currently, most operational risk groups have adopted an actuarial based approach, using either real loss data (when available) or scenario analysis. The approach is theoretically valid, for the purposes of quantification of operational risk. The model, e.g., a compound Poisson, derives frequency and severity distributions which drive the cumulative loss distribution (losses due to different risk types) for each line of business (for example, a compound Poisson process with lognormal severity intensity, is commonly used). Monte-Carlo simulation calculates the expected losses and the operational VaR percentiles. A typical time horizon is one year. The better the data, the more reliable the resulting VaR figures are.

In addition to the actuarial approach for risk quantification, operational risk specialists experiment with Bayesian modeling, extreme value theory and causal modeling 5. Extreme value theory (EVT) provides a useful framework for the application of parametric smoothing methods to fit the tail of loss distribution beyond a certain level. The extreme value theory helps the risk manager to estimate the shape of the distribution deep into the tail, where relatively little data are available. Correlations are usually assumed to be perfect across line of business and zero among the risk types per line of business. However, this is a stylized assumption. Copulas is a tool for combining correlated risks, which is getting popularity 3. It can be used in conjunction with Monte Carlo simulations to aggregate

correlated losses. Finally, possible correlations between operation risks and market and credit risk should be investigated as well.

7. Conclusions

Deregulation and globalization of financial services institutions, together with the growing sophistication of financial technology, are making the activities of banks (and thus their risk profiles) more diverse and complex. Developing banking practices at internationally active banks suggest that risks other than credit and market risk can be substantial.

Although the operational risk management is still immature, there is a growing industry. The Risk Management Group of Basel and other regulatory bodies have been stressing the importance of operational risk in the last few years.

By creating operational risk awareness, financial services institutions can enhance their ability to achieve their objectives and improve their processes, technology and business practices. Sustainable best practices would lead to reduced losses, higher profitability, improved customer and employee satisfaction. Finally, financial services institutions serious and careful operational risk consideration, can lead to relief of capital charges and reduced corporate insurance premiums.

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