

**Report of the  
Operational Risks Working Party  
to GIRO 2002**

## Introduction

### 1.1 Membership

The working party comprised:

- Helen Bradley
- Dick Cheesman
- Paul Duffy
- Jefferson Gibbs
- Grant Maxwell
- Matthew Maguire
- Colin Murdoch
- Annette Oleson
- James Orr (Chair)
- Gregory Overton
- Louise Prior
- David Simmons
- Michael Tripp

Meetings were held on a monthly basis between December and July, with at least half the group attending most meetings (although one memorable meeting had an attendance of two, with a third member arriving two hours late). The group's work commitments have clearly been significant during this time and we are most grateful to those colleagues who have been able to contribute their time towards this study.

### 1.2 Terms of Reference

Initially, the working party had sought to consider the following topics:

- What is Operational Risk and why does it matter?
- Identify areas and sectors where Operational Risk exists
- Review current sources of information on Operational Risk
- How to control and manage Operational Risk
- What is the role for actuaries in Operational Risk and what skills do they need?

However, as our discussions progressed, we realised that it was impractical to try and address all of these issues fully. For this reason, our work has concentrated on consideration of the *definition* of Operational Risk and the *role* that actuaries can play in this field. Nonetheless, we were still able to conclude quickly that Operational Risk exists in all areas and sectors of business!

### *1.3 Background*

When volunteers were asked to put their names forward for this working party at the last GIRO Conference, there was a strong response and an enthusiastic discussion at the initial session. Whilst our discussions since that time have been intermittent, as people's work commitments have taken their toll, this dialogue has continued and our belief in the importance of this topic to the businesses we advise has not diminished. We have also realised that while most actuaries will be familiar with the term Operational Risk, there will be conflicting views on the meaning of the term, and few actuaries will have detailed knowledge of recent developments in this field. Also, our conviction that actuaries have a valuable role to play has strengthened over this time.

Operational Risk as an area of study (and we, believe, practice) is still in its infancy. A clear language has yet to emerge, reflecting the fact that concepts of what it is and how it can be addressed are still evolving. Although there are many risk frameworks, measurement and mitigation methods on offer, there are still no clear winners. For this reason, we have concluded that it would be inappropriate to suggest that we have arrived at a "best" approach to Operational Risk. This conclusion is particularly influenced by our belief that actuaries are not yet sufficiently up to speed with risk management methods from other fields which may be brought to bear on this problem.

Operational Risk is not a new problem. Management has always faced the challenge of managing the business process to deliver near-optimal results, given the resources available. Indeed, significant developments in business practice and regulation (e.g. auditing and separation of key financial roles) have resulted from historical failures in the business process. This reactive development of business structures has served business well in the long run (although investors have too often suffered in the short term!). By studying Operational Risk we hope that gains can be made by taking a more active and forward looking approach to anticipating process failings and developing solutions.

In addition to this paper, the working party circulated a survey on Operational Risk to GIRO participants in June. The response to this was encouraging, and the results will be presented at the GIRO conference in October.

Our firm conclusion is that this is an interesting and relevant field for actuaries, to both study and practice in, where our skills in linking an understanding of business to the theories of risk can add real value.

## *1.4 Structure of the Paper*

Following this first, introductory section:

- the second section considers the definition of Operational Risk, presenting a possible framework for analysing all risks and discussing a number of publicly available definitions,
- the third section gives a brief “check list” of identified methodologies that might be brought to bear in modelling Operational Risk and discusses the modelling challenge,
- the fourth section discusses (or, rather, gives a rallying call for) the role of the actuary in addressing Operational Risk,
- the fifth section gives some concluding remarks and makes recommendations on what further work the profession might do in this field, and
- the final section gives a bibliography of references and web links that we identified in our work.

## 2 Operational Risk: what is it?

Defining the concept of “Operational Risk” is difficult. There are a number of definitions around, many of which were originally devised for the banking industry, but none of them works under all circumstances. The trouble is that Operational Risk is rather a fluid notion, whose exact boundaries depend on what else is being considered. In this section we consider the overall framework of risk and how Operational Risk fits into it, examine some examples and comment on some definitions.

### 2.1 *Why define Operational Risk?*

Risk management continues to evolve, with both shareholders and regulators holding the board of directors and senior management increasingly accountable, prompting the adoption of an integrated and comprehensive approach to risk management. Companies are starting to move away from considering their risks in isolation, and are looking beyond the traditional hazard and financial risk towards strategic and operational risks. This new approach is referred to as Enterprise Risk Management (ERM).

This paper will focus purely on one component of the enterprise risk, namely Operational Risk. In our view the two main contexts within which Operational Risk will be considered are (1) in order to meet regulatory requirements or (2) as part of internal management processes. For regulatory purposes it is obviously necessary to use the definition that is prescribed by the regulatory body, but for other purposes it may be desirable to use some other definition, better suited to the management’s objectives. When modelling risk it is important to make sure that no source of risk is either double counted or omitted. In devising methods to control risk, the exact definition of the risk concerned is not crucial, but it may help to indicate useful measures that can be taken. In some cases risk mitigation is accomplished through insurance, in which case the definition used must be agreed with the insurer, and double counting and omission are again pitfalls.

### 2.2 *Risk framework*

Operational Risk is rarely considered in isolation: whether modelling risk or seeking to control it, Operational Risk is only a part of the overall risk to which an enterprise is exposed.

#### 2.2.1 **Cause and Consequence**

We propose a basic framework for analysing risk based on the notions of *cause* and *consequence*. A single consequence can have more than one cause; in order to analyse risk effectively it is necessary to work from the causes rather than the consequences.

For example, let us consider some of the adverse financial effects in the Chicago Board Options Exchange (CBOE) that resulted from the market crash of 1987. MacKenzie and Millo (2001) give some examples of systems problems that arose during the crash.

- CSLOUCH, the risk management system at O'Connor & Associates, was hastily reprogrammed so that it could accommodate a move of 24% in one day, instead of the 12% that had been allowed for previously. This helped the firm to reduce its losses. The 12% had been used because the worst that had been seen in the past was 12.8% in 1929. If this reprogramming had not taken place, the losses suffered by O'Connor & Associates would have been much worse than they were.
- The systems of many clearing firms could cope only with double-digit dollar prices. When prices rose to say \$106, they appeared as \$6, and the trading firm's accounts with the clearing firms were off by millions of dollars: but at the time, it was impossible to tell in which direction the errors were.
- The markets at CBOE and the Mercantile Exchange were intimately connected, but their clearing systems were not linked, so what were actually well-hedged positions could be subject to huge margin calls.

These three examples demonstrate that a single consequence, a financial loss, may arise from several causes: in this case, from adverse market events exacerbated by systems problems. The loss cannot be ascribed solely to any one of the causes, and so cannot be put down simply as the result of either a core business risk (the market event) or an operational risk (the systems failures); rather, it is a combination of the two.

In general, we believe that by analysing risk of financial losses in terms of their causes, rather than in terms of consequences, it is possible to avoid many of the problems of double counting and omission. For example, reputational risk is often proposed as a risk category: however, loss of reputation is frequently caused by other problems, such as system failure or failure to meet regulatory requirements. If reputational risk is taken to be a separate category, to be considered alongside systems risk and regulatory risk, there is a risk of double counting.

## **2.2.2 Risk Categories**

It is usually necessary to categorise risk before any meaningful analysis can be performed. It would be a hopeless task to try to model enterprise risk en masse, or to devise control mechanisms that would work for all risk. A common division of enterprise risk that we have considered is into two categories, core business risk and operational risk, each of which is then further subdivided.

$$\textit{Enterprise Risk} = \textit{Core Business Risk} + \textit{Operational Risk}$$

Simplistically, Core Business Risks are those that arise as a result of the business decisions taken by the management, while Operational Risks are those that arise as a result of the implementation of those decisions, or from outside factors

Core Business Risk in this context includes all risks that are part of the core business of the enterprise. For general insurance companies, core business risk can be seen as having three components:

- Insurance Risk
- Investment Risk
- Reinsurance Risk

These three categories compare to the two main categories often seen in the banking industry, Market Risk and Credit Risk.

Operational Risk is then defined as any risk that does not form part of core business risk. Needless to say, once you start looking at particular examples this neat two-way division appears increasingly arbitrary. It may be necessary to introduce further categories beyond these two.

Other splits are of course possible: the CAS, in its analysis of Enterprise Risk Management, uses four categories of risk:

- Hazard Risk
- Financial Risk
- Operational Risk
- Strategic Risk

This analysis is difficult to reconcile with the division into Core Business Risk and Operational Risk. Many of the risks classified by the CAS as Hazard Risks, such as theft and other crime, fire and other property damage, and windstorm and other natural perils, would come under our notion of Operational Risk for non-insurance companies. It is not clear where insurance risk fits into the CAS classification, which is intended to apply to all industries. It seems likely that it would be considered to be a Financial Risk for insurance companies, and that of the four CAS categories, Hazard Risk and Operational Risk together comprise our notion of Operational Risk, and Financial Risk and Strategic Risk constitute our notion of Core Business Risk.

The CAS notion of Strategic Risk includes the following:

- Competition
- Customer wants
- Demographic and social/cultural trends
- Technological innovation
- Capital availability

- Regulatory and political trends

We agree with the CAS that these are to be distinguished from Operational Risk.

A thorough analysis of Core Business Risk is outside the scope of this paper; however, we note here that within any categories that are used, whether the three way split presented at the beginning of this section or the CAS categories, it is still useful to use the cause/consequence framework to distinguish operational risks.

As an example, let us consider Reinsurance Risk. The question of what reinsurance cover to take out is a business decision: the risk that a bad decision is made, and the reinsurance programme turns out not to be suitable, is a Core Business Risk. Similarly the risk that the reinsurers don't pay out on claims is a Core Business Risk. However, the risk that the programme that has been decided on is not in fact implemented is not a Core Business Risk: the cause of the financial loss (reinsurance not paying out as expected) is an operational failure, caused by poor communications, incompetence, or some other reason, and the risk is therefore an Operational Risk. This means that a failure to recover the expected amount could be a result of either a Core Business Risk or an Operational Risk; we have to look to the cause rather than the consequence to determine which.

Let's look at reputational risk again, ie the risk that loss will be suffered because of damage to the firm's reputation. Surely the cause of the damage to reputation determines whether the risk is operational or not. If there is a systems failure, which leads to a breakdown in claims handling, which leads via a poor reputation to lower sales, then that loss can certainly be seen to arise from an Operational Risk. However, if the firm loses its reputation because it writes bad business, leading to a shortage of funds and a consequent delay in claims handling, the resultant loss cannot be said to be operational. Reputational risk is particularly interesting in this regard, as nearly anything that can go wrong, whether core business or operational, can result in a loss of reputation and hence in financial loss. Many risk classifications include reputational risk as an operational risk, regardless of the originating cause of loss. This is likely to result in confusion.

### **2.2.3 Operational Risk**

In general, we think that Operational Risks are those that are caused by problems in the day to day operations of the enterprise rather than the overall strategy.

Like Core Business Risk, Operational Risk can be broken down into subcategories, for example: :

- Internal Fraud
- External Fraud
- Employment practices and workplace safety
- Clients, products and business practices

- Damage to physical assets
- Business disruption and system failures
- Execution, delivery and process management

These categories are based on the causes of losses, and they all concern how the business operates rather than what the business is.

**Examples:**

<u>Category of Operational Risk</u>	<u>Example</u>
Internal Fraud	Rogue traders
External Fraud	Fraudulent Insurance Claims
Employment practices and workplace safety	Inadequate work conditions leading to Repetitive Strain Injury
Clients, products and business practices	Contamination of product at Perrier
Damage to physical assets	Natural/Man-made catastrophe (WTC)
Business disruption and system failures	Y2K
Execution, delivery and process management	Failing to buy or properly document the intended reinsurance

### 2.3 Definitions

Here is a selection of definitions of Operational Risk we have found, mainly from the banking industry:

1. A measure of the link between a firm's business activities and the variation in its business results. (King 2001)
2. Operational risk is the risk of adverse impact to business as a consequence of conducting it in an improper or inadequate manner and may result from external factors. (Doerig, 2000)
3. Operational risk results from costs incurred through mistakes made in carrying out transactions such as settlement failures, failures to meet regulatory requirements, and untimely collections. (Pyle, 1997)
4. Operational risk is the potential for adverse financial developments due to effects that are attributable to customers, inadequately defined controls, system or control failures, and unmanageable events (Laycock, 1998)

5. Risks deriving from a company's reliance on systems, processes and people. These include succession planning, human resources and employment, information technology, accounting, audit and control systems and compliance with regulations (EIU Research Report)
6. The risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. (BCBS 2001)
7. Operational risk is the risk of loss, resulting from inadequate or failed internal processes, people and systems or from external events. (FSA)

Of these definitions, definition 4 is in some ways the most intuitive: it is expressed in terms of causes and consequences. However, it is not clear that its list of causes is a good one: in particular, most if not all losses that are caused by customers can be attributed to other causes in the list, such as control failures.

Definitions 6 (Basel) and 7 (FSA) are probably the two most significant, as they are used by regulatory bodies.

### **2.3.1 Basel Definition**

Perhaps the most noteworthy aspect of the Basel definition is that it was changed as recently as September 2001: the definition used to read 'The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events,' but the words 'direct or indirect' have now been removed. There may be further changes as the consultation process continues. However, it seems unlikely that the basic message of the definition will be changed.

The definition as it stands has a major drawback for general insurance firms, as the risk of loss arising from external events is too broad. For example, consider the case of major flooding in a metropolitan area. An insurance company writing property business should consider the insurance risk of such an event; but they should also consider the risk that their own office might be flooded and their operations disrupted.

With this caveat, we think that this is an extremely useful definition; again, it is expressed in terms of the cause of loss rather than in terms of consequences.

### **2.3.2 FSA definition**

For many readers, the FSA's treatment of Operational Risk is much more relevant than that of the Basel committee. Like the Basel committee, the FSA has moved towards a risk-based approach to prudential supervision with the draft Integrated Prudential Sourcebook ("PSB") which is applicable to insurers, banks and investment firms in the UK. The PSB covers capital requirements together with the systems and controls needed to measure and manage risk.

The PSB defines operational risk as "Risk other than market, credit and insurance risks arising from its business and from external events and influences" (PROR 1.2.2).

The FSA is clearly following the Basel definition. According to the latest draft of the PROR section of the PSB to which we have access at the time of writing this paper, the FSA is unlikely to present a more detailed definition. However, it is likely that PROR will consist mostly of guidelines. Firms will be expected to set out their Operational Risk policy in their documented business plan. This policy should include the definition of Operational Risk that the firm is using, including the scope of the definition. It should also include a description of how the firm intends to identify, assess, monitor, and control its operational risks.

Firms will thus have to define Operational Risk in enough detail that they are confident of being able to describe how they will identify it.

## *2.4 Conclusions*

A major problem in the field is that there are several different risk classifications that are difficult to reconcile with each other. In many cases it probably does not matter much which analysis is used, as long it is internally consistent. A significant feature of all risk classifications is the lack of hard and fast divisions between the categories, and the fact that a single event can give risk to effects that come under several different categories. This phenomenon of risk combination means that it is especially important to be very clear on definitions used for risk modelling, so that the effects are not double counted. The use of a framework based on causes, rather than on consequences, will facilitate an analysis that avoids this pitfall.

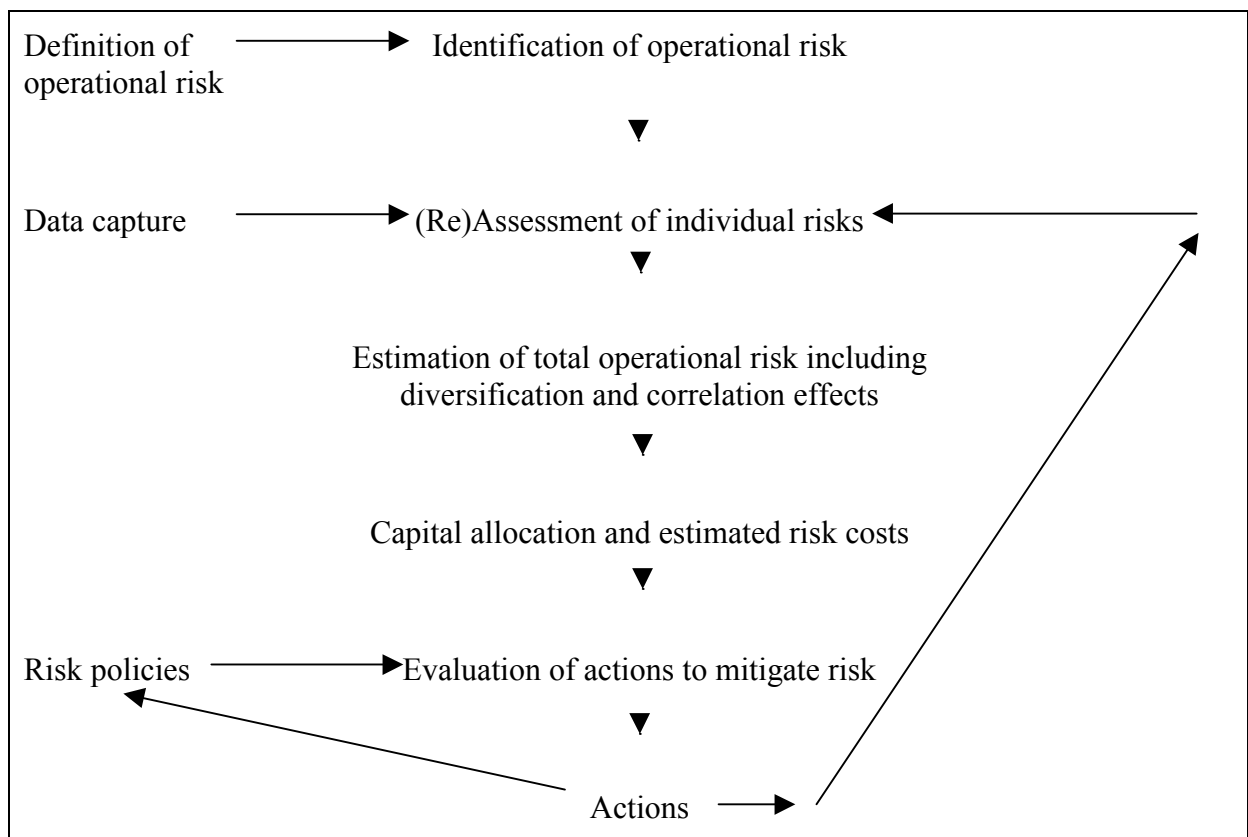
### 3 Data & Methodology

#### 3.1 Introduction

Why model Operational Risk? This is the first question that you should ask before setting out on an Operational Risk measurement exercise. The purpose of your model may be purely regulatory or driven by management's wish to understand risk in different areas of the business for inclusion in risk-adjusted rate-of-return on capital calculations. Alternatively, management may wish to understand the risk to effectively mitigate it.

A model targeted at risk mitigation will need to be based around the loss causes while a model purely for economic cost analysis may limit its scope to the loss consequence. Whichever route you follow the data available will dictate the methodology you can adopt.

In diagrammatic terms the modelling and management process may be summarised as the classic control cycle



This cycle is repeated until an optimal risk management process is agreed.

The sections that follow give a brief introduction to some of the data issues and the methodology options for modelling and measuring operational risk.

### 3.2 *Data Capture*

There are three broad sources of information as follows:-

- Internal loss events recorded by an institution
- External loss events reported in the public domain
- Expert knowledge/opinion.

Each source has benefits and drawbacks and ideally all three are required for a complete model.

In order to build an internal cost database an institution must build a platform to identify, capture, monitor and report on internal operational losses. It is crucial to insure consistency of data collation across the global enterprise in order to avoid distortion in loss experience due to differences in loss reporting. This is made particularly difficult when local management can see that reporting many losses may lead to increased scrutiny from group headquarters but can see no personal benefit in providing loss information. Clearly, not all business cultures will support such initiatives.

*Internal* loss databases will tend to record high frequency low severity events simply because they happen more often. The low frequency high severity operational loss events that may cause significant damage to an institution may only appear once in 20 years within one particular company, but the modelling challenge will lie in extrapolating the low level “noise” to high level “shocks”.

*External* loss databases have the benefit of being able to gather these significant events from many institutions and can be used to supplement an internal loss database by providing crucial information in the tail.

This external loss data must, however, be used with caution. The institution has little control over the accuracy of the data. It may also find it difficult to apply losses from perhaps different industries and different sized companies to its own operations.

The most concentrated source of information on Operational Risk within an organisation is likely to be found in the heads of management and risk functions. It is important to mine this information to provide context and calibration to the more objective loss databases. Of course, management may be proved wrong, but this process can still add value in building a consensus on the risks and risk tolerances of the business.

Having a system in place for recording loss information still is not enough. The system needs to have been running for 3-5 years before it will have a credible level of data in it unless management’s collective memory can be used to source information on historical

losses. Obviously information on insured losses may be more readily available but also useful will be information on near misses, which is a lot less plentiful.

Losses typically arise from a combination of factors, i.e. more than one contributing cause. If one cause is missing then the result may be a near miss as opposed to a loss with a consequence. As near misses will be more common than actual losses, an ability to capture information on these will be invaluable.

Further, more information from risk indicators will be necessary to apply information from historical losses to future situations in the same way that an exposure measure is required in pricing insurance. Local management will not see an incentive in spending money to control risks if it does not reduce the allocated capital to their business unit. Risk indicators will enable the modeller to calibrate the model following risk mitigation measures.

The level of data available including years of history and whether losses have been classified into cause and consequence, will determine the methodology that may be adopted for the model. In all cases it is likely that the model will balance the measurement of Operational Risk through quantitative and qualitative information.

### *3.3 The Banks' Databases*

Bankers Trust was one of the first institutions to collect data for the purpose of applying an actuarial model to the measurement and understanding of Operational Risk. Nowadays many banks are collecting their own internal loss data. Many banks are at the stage where they are joining a consortium to share loss data with similar organisations for the mutual benefit of each. Such collaboration is key to producing a credible volume of information especially for lower frequency losses.

There are also external loss databases, which have been collected over a period of years and are available for purchase by institutions wanting to model operational risk. Databases like these form the backbone of the service offerings from companies like "Opvantage" for tailored or off-the-shelf operational risk solutions.

The insurance market should consider collecting and sharing this sort of information in a similar way if modeling is to be achievable in the medium term. This job could be taken on by the FSA, the ABI or even the Actuarial profession itself.

### 3.4 Models

There are 4 stages which modeling can encompass

- data capture (as we have already mentioned),
- setting up a scenario generator to describe the evolution of variables over time - this can include both stochastic and deterministic events
- a decision simulator to depict management actions and reactions
- a dynamic optimisation module

A number of methods have been suggested for quantifying operational risks based on the availability of historic data or expert knowledge both within and outside the Financial Services Industry. It is difficult to say whether any of these methods or combination of methods are better than others. It is important, however, to maximise the credibility of data available to you. A brief description of each follows.

#### 3.4.1 Empirically from historic data

Standard applications of historic experience to project the future - identify drivers and outcomes and project forward eg loss development triangles

#### 3.4.2 Fit parameters to a theoretical pdf

With some additional work distributions may be fitted to the empirical loss data and results may be simulated from these theoretical distributions in order to better describe the risk.

#### 3.4.3 Regression over variables that affect risk

Standard statistical analysis identifying key drivers (independent variables) and outcomes (dependent variables) and fitting a generalised linear model to the available data. This approach has been adopted by Lloyd's in the development of their Operating Risk adjustments within the Risk Based Capital system.

#### 3.4.4 Extreme value theory

Given its application for low frequency/high severity events, an extreme value theory model can be very useful for representing the tail of an operational loss distribution.

There are statistical models describing rare phenomena, which mainly lie outside the range of available observations. Consider first the subset of historical data, which constitute extreme events and use statistical methodologies to fit specific distributions.

Tail related risk measures such as Value-at-risk (VaR) have been developed to analyse results - how much capital needs to be held to cover losses from all bar the nth quantile of the distribution of possible losses?

### **3.4.5 Stochastic differential equations (SDEs)**

Users of dynamic financial analysis (DFA) models will be familiar with the output from economic scenario generators. Actuaries have been involved in such modelling since the 1980's when the MGWP with John Ryan presented its results. The use of SDE's has conceptual similarities to the Wilkie model but implementation differences (Wilkie uses a ARIMA time-series framework rather than SDE).

Stochastic differential equations are used to generate the thousands of possible scenarios representing possible operational loss histories that the operational loss event may follow over the projection period.

SDE's add a random element,  $\eta$ , to ordinary differential equations;

$$\frac{dx}{dt} = a(x,t) + b(x,t) \eta(t)$$

or in differential form  $dx = a(x,t)dt + b(x,t) \eta(t)dt$

and generate time series for each operational loss event as a function of a deterministic portion and a stochastic section.

Models may include functions to create a reversion to mean, momentum or other autoregressive components. Random components may be correlated to other components and typically the scenario generator will model several variables together to develop scenarios that are internally consistent.

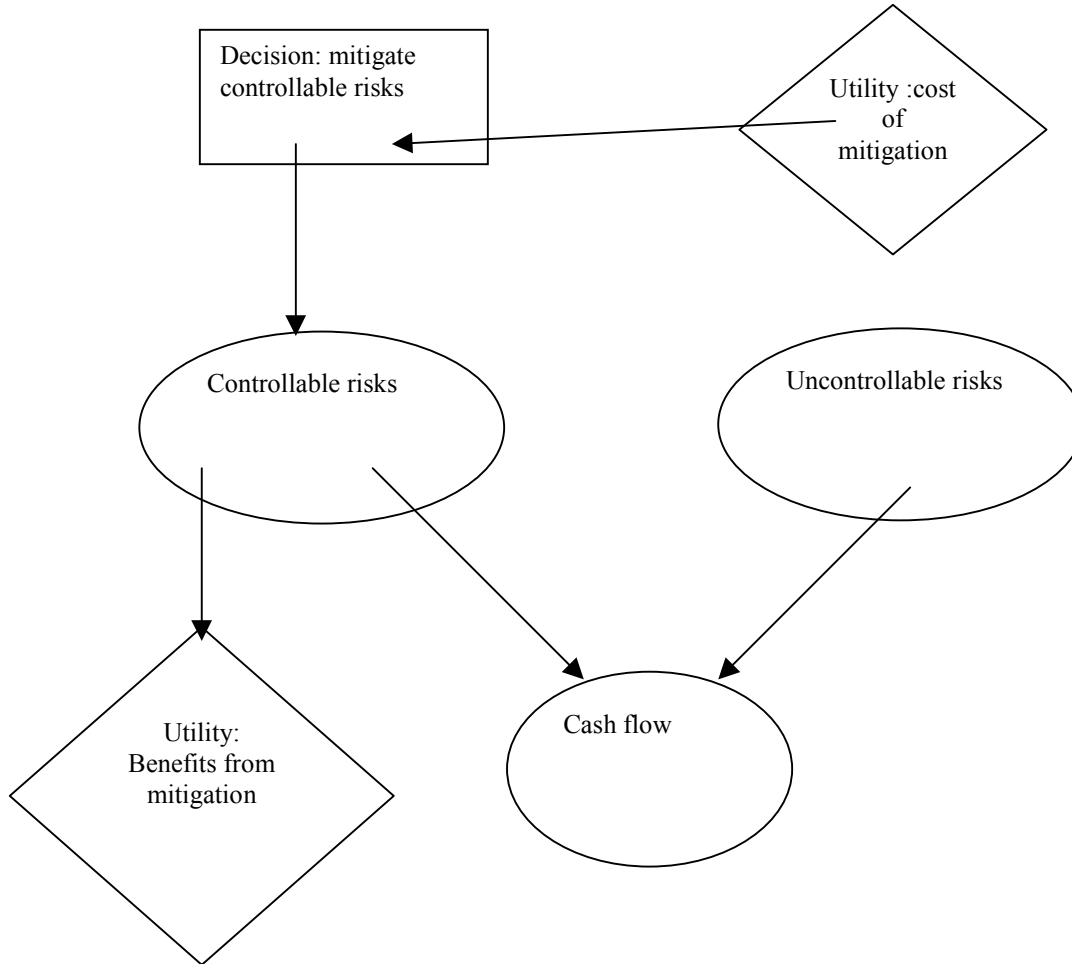
The modelled behaviour is calibrated from the historic behaviour of the time series but does allow for judgement on how the future may differ from the past.

### **3.4.6 Bayesian approaches**

Bayesian methodologies are useful in formalising expert input in complex systems where the probability of an event  $P(A)$  is difficult to visualise. Opinions or evidence of conditional probabilities  $P(A|B,C)$  can be used to deduce the probability of an event. The modeller can then incorporate further evidence to revise the opinion.

Probabilities can be assessed using a combination of theoretical insight, data analysis, and various other more or less subjective estimates.

### 3.4.7 Influence diagrams



Influence diagrams are simply Bayesian networks extended to include two additional functions - utility and decision.

Decision functions allow alternative actions to be modelled. The utility functions quantify the cost or benefit associated with the resulting state.

### 3.4.8 Neural networks

Neural networks consist of several layers of nodes starting with a layer of input nodes. Between the input and the output nodes there are normally 1 or 2 hidden layers.

Weights and thresholds in the layers determine the outcomes.

The network is calibrated using a training algorithm which takes a large number of examples where the input and output values are known. The model is then calibrated so that the difference between outputs from the network and the outputs from the examples are as small as possible.

Valid predictions of Operational Risk loss can be made but it is not possible to identify the specific nature of the interactions of the variables on which the predictions are based i.e. the causes of the losses will not be apparent.

#### **3.4.9 Direct assessment of likelihood or fractiles**

Outcomes can be quantified by a single figure mean or median where in reality there is a full probability distribution of all potential outcomes. Experts may be able to suggest 5% and 95% confidence bounds. Hypothetical distributions can then be tested with the three values to simulate possible operational loss outcomes.

#### **3.4.10 Preference among bets**

Expert opinion can be converted into probabilities by for example asking whether a particular event is more likely than the roll of a 6 on a dice.

#### **3.4.11 Fuzzy Logic**

Fuzzy logic is a multivalued logic that allows intermediate values to be determined between conventional yes/no, hot/cold etc evaluations. Notions like “rather warm” can be formulated mathematically and processed through models. Fuzzy logic can handle approximate information in a systematic way, and so model complex non linear systems where an inexact model exists or systems where ambiguity or vagueness is common. A typical fuzzy system consists of a rule base, membership functions, and an inference procedure.

This can be used as an augmentation of a Bayesian or Neural Network approach to model operational risk

#### **3.4.12 Delphi method**

A technique for seeing management opinion converge on a consensus. A group of experts are asked a question individually and in isolation - the responses are played back anonymously to the whole group and they are asked the question again - the final responses are used as the consensus view.

### 3.5 *Challenges for the modeller*

The varied range of Operational Risk events and choice of techniques, used individually or in combination, present challenges for the modeller.

The modeller must:

- Consolidate individual risks into an aggregate model in order to bring out the relative risks and benefits of correlation and diversification and relate the overall risk borne by the firm to its risk appetite;
- Recognise that Operational Risk is not always to be avoided or minimised as a level of Operational Risk is a necessary and desirable contributor to a dynamic entrepreneurial organisation. Some uncertainty and therefore risk will always be present. The Operational Risk distribution will indicate a likely or mean level of loss and the risk appetite (the upper percentiles of risk the organisation is willing to bear) may be used to gauge the capital that must be held against the unexpected loss;
- Be able to bring together disparate data sources for
  - Low frequency high severity, and
  - High frequency low severity events, and
  - Separately model frequency and severity;
- Relate a wealth (hopefully!) of historic time series data which may or may not be appropriate to future events, depending on risk indicators and mitigation measures employed;
- Extract data or opinions from experts within the company in a systematic and unbiased way;
- Create a model which recognises the complex relationship between cause and consequence;
- Reconcile conflicting objectives from management who variously focus on capital, revenue or descriptive analysis of risk;
- Present complex information to management in a way that non-financial managers can comprehend. Whilst not all consequences can be presented graphically, the pictorial formats of Bayesian and other network models can make this process easier – but rapidly become more complex as detail is added;
- Recognise that, whilst complex stochastic models can provide robust analyses of capital needs or VaR over a large number of simulations, they are time consuming to construct and validate and repeated simulations are needed to identify the causes.

Actuaries have tackled these problems before in other areas and can do so again!

## 4 A role for actuaries?

### 4.1 Overview

All too often general insurance actuaries remain in the technical reserving and pricing boxes - for a variety of reasons they don't make the contribution they might to strategic decisions. Is this a lack of ability? The wrong personality profile? Or are they just too cautious and "risk adverse"?

We believe, as do the FSA, that the whole area of (operational) risk management presents a wonderful opportunity. True, not many actuaries have had hands-on operational experience or run supply chains or done process design. That said no one else is really tackling the challenge - there is a gap. The risk framework is not being consistently tackled - underwriting, reserving and asset risk are in hand but other areas are not really covered; certainly not as an integral part of a holistic framework.

Looking ahead we see that if properly trained actuaries can become "plugged in" to the business in real time, they will be able to pinpoint not only mathematical solutions but also black holes emerging from sources as diverse as management ambition/power struggles or devious fraudsters. Naturally this implies further changes in our training and education so we can leverage information better, gain credibility and report in a continual sense against an ongoing risk log.

### 4.2 What needs doing?

The risk management process involves:

- identifying and understanding sources of risk
- defining/articulating in a systematic framework
- quantifying
- managing, mitigating and monitoring.

To this outline can be added:

- the allocation of capital and other resources, to ensure risks of all sorts do not put an enterprise out of business, or perhaps more relevantly that risks are run with a clear understanding by all stakeholders of the issues and consequences
- the need to meet regulatory requirements
- the ability to work across a variety of industry disciplines

and above all:

- taking a holistic, forward looking view.

### *4.3 What skills are required?*

We have considered skills under three headings:

- The generic
- The specific
- Personality attributes.

#### **4.3.1 Generic**

- first and foremost an enquiring and challenging mind - open and questioning, but tough enough to probe
- analytic and systematic
- practical, pragmatic and able to identify with a variety of other people.

#### **4.3.2 Specific**

It becomes more difficult to identify a complete list of specific skills, or combinations of skill. We put forward the following as a tentative list of skills for discussion:

- data management and manipulation
- mathematical modelling
- statistics
- human assessment skills
- psychological
- organisational
- personality profiling
- financial
- accounting and financial reporting
- knowledge management
- outward looking skills (political, economic, social, technological)
- practical insurance experience (and banking?)
- engineering skills to understand processes and systems.

### **4.3.3 Personality attributes**

Perhaps the strongest attribute would be the ability to be tough and independent minded. Many other characteristics come to mind, including:

- a probing mind
- an ability to question - to be enquiring
- imaginative - to expect the unexpected
- creative
- foresight and forward looking
- innovative
- visionary
- entrepreneurial
- energetic
- challenging
- influencing and persuasiveness
- communications
- the ability to exercise judgement
- a "T shaped" ability to think broadly and strategically, and yet probe details
- outward looking.

Perhaps we expect too much to find all the above in one person, but at least the ability to develop a team with these skills integral to its performance.

At this stage, what is required is a good leader who has vision, drive and a desire to move forward, develop new ideas/techniques and sell the benefits to businessmen, with a sense of responsibility.

#### **4.3.4 The skills of an actuary**

How would you define these? We can refer to our exam system and the backing of our professional body ensuring certain standards of conduct. Perhaps we might start with:

- statistical
- financial
- analytic
- economic
- data management
- independence
- professional.

Hopefully it is not too contentious to observe that some actuaries prefer to operate in narrow technical and detailed ways, whilst others are more inclined to grapple with strategic issues, seeing the whole picture and integrating many different threads. Clearly both have a contribution to make and both are needed.

We question if skills are needed beyond our traditional industry boundaries within insurance - eg banking.

#### **4.3.5 But there are gaps?**

Yes there are!

- human assessment/profiling, psychological and organisational
- process, systems - engineering (see also RAMP)
- an open-minded, wide looking approach to model selection and choice of methodologies
- financial economics - CAPMs.

#### **4.3.6 So, is there a role?**

We think without doubt, a resounding yes. We are more divided about how big this role can, or should be. Others have a contribution:

- risk managers
- accountants/auditors
- financial controllers
- HR experts.

A question for discussion is how extensive do we believe our involvement should be. We could stay as we are now, experts in some areas, or we could try to move forward. In the banking world, Operational Risk is on the agenda, and people are co-operating to assess and manage this. Very rarely (if at all) would a search consultant look for an actuary for this role (we are aware of one or two exceptions) - so a long way to go.

#### **4.3.7 What do we do now?**

Nothing?

We think not. We need to continue to raise our profile and develop new skills. There is a spectrum of possibilities from trying to develop our skills as "full enterprise risk managers", to being providers of specific statistical analyses. We suggest there are things we can do to boost the supply side (to prepare ourselves) and things we can do to heighten demand (to generate more requirements).

On the supply side:

- more specific training and development
- further guidance notes and guidelines
- development of a relevant industry database (eg with the ABI)
- operational risk practising certificates.

On the demand side:

- further research, as a service to the industry
- trail blazers
- seminars, to promote ourselves and develop a reputation
- development of FSA thinking and requirements.

So we believe we have a role, but we need to work hard to develop our contribution and prepare to add value. Nothing is easy and it will require adventurers and experimenters - just as in the early days of actuarial involvement in general insurance. There are a number of issues to consider further.

#### Issues

- Is this a top priority for the profession - do we risk spreading our resources too thinly?
- What professional issues will we encounter - professional indemnity is already stretched - will this exacerbate matters?
- The fit with the overall strategy (vision and values) of our profession appears good - is there sufficient support at either Council level, or at grass roots levels?
- How will it affect the profile and reputation for the profession?
- What dialogue do we need to start with other industry bodies (including for example the ABI/the BBA who are themselves discussing merger)?
- What does (or will) industry convergence mean?

We hope to encourage discussion and that further issues will surface.

#### **4.3.8 Conclusion**

All to play for!

## 5 Conclusion

The working party's hope is that this paper will act as a primer on the subject of Operational Risk for general insurance actuaries. We also feel that there is considerable scope for a subsequent working party to expand on this year's work.

For example, we have discussed a definition of Operational Risk within a wider risk classification framework, but also highlighted the fact that a number of definitions and frameworks are being used within the literature and different practice areas.

Operational Risk is a young and rapidly evolving area of study and practice, with particular importance at the moment due to Basel II and, closer to home, the FSA's work on the Integrated Prudential Sourcebook. Therefore the debate on the definition of Operational Risk and what this means for Insurance Companies, Banks and other corporations will continue to develop.

One particular aspect that we have not had time to include in this paper is the work on developing an Event/Line of Business matrix. Significant work on this has been done by the Basel committee, with particular reference to the banking industry. We hope to have completed our version of this aimed at the Insurance Industry by the GIRO conference.

We have reviewed some standard methodologies and data sources used in the modelling of Operational Risk. The development and use of data sources and, in particular, loss databases is a key element of Basel II. We recommend further work on reviewing existing progress on developing loss databases, and exploring the possibility of the Institute involvement in the development of loss databases, possibly in conjunction with other industry bodies such as the ABI and the BBA.

We have discussed the scope for actuarial involvement in the field of Operational Risk, and have concluded that there is definitely a role for us to play. We recommend further work on this, for example identifying specific areas of research that could be commissioned by the Institute.

Finally we have provided a brief list of references and links to some sources of information on Operational Risk. A useful task for the next working party would be to review these and other sources of information in more detail, to keep GIRO participants fully abreast of current thinking and practice.

## 6 References & Sources of Information

### 6.1 References

- Basel Committee on Banking Supervision (BCBS). 2001. Working Paper on the Regulatory Treatment of Operational Risk. Bank for International Settlements. Available from [http://www.bis.org/publ/bcbs\\_wp8.htm](http://www.bis.org/publ/bcbs_wp8.htm).
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## 6.2 *Useful Web Links*

Arthur Andersen article on operational risk

[http://www.arthurandersen.com/resource2.nsf/vAttachLU/AA\\_Industries\\_FSI\\_Base1/\\$File/Basel risk.pdf](http://www.arthurandersen.com/resource2.nsf/vAttachLU/AA_Industries_FSI_Base1/$File/Basel%20risk.pdf)

BBA response to Basel committee papers

<http://www.bba.org.uk/html/2410.html>

BBA Operational Risk Section

<http://www.bba.org.uk/html/1154.html>

Future and Options Association Operational Risk Section

<http://www.foa.co.uk/operational/risk.jsp>

Global Association of Risk Professionals

<http://www.garp.com/index.htm>

International Association of Financial Engineers committee on operational risk

[http://www.iafe.org/committees/risk/Report\\_of\\_Risk\\_Committee.html](http://www.iafe.org/committees/risk/Report_of_Risk_Committee.html)

International Financial Risk Institute

<http://newrisk.ifci.ch/>

ISDA response to Basel committee papers, and other articles

[http://www.isda.org/c\\_and\\_a/risk\\_manage.html](http://www.isda.org/c_and_a/risk_manage.html)

PWC survey of Operational Risk in conjunction with ISDA, BBA and Robert Morris Associates

<http://www.pwcglobal.com/extweb/ncsurvres.nsf/DocID/D80DC0B600E555E98525682A005AF9D8>

Risk Management Association

<http://www.rmahq.org/>