Enterprise Risk Management (ERM)
A driving force for the insurance industry
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SCOR sustainable development policy

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GIVEN THE INCREASING COMPLEXITY and interdependency of risks, the concept of Enterprise Risk Management has become a core issue for the insurance industry.

This risk-oriented approach is essential for the management of identified risks and the anticipation of new exposures, so in June 2009 we brought together senior managers and senior Risk Management professionals at a client seminar we organized in Paris to share and discuss different points of view and visions in terms of what ERM is and should be.

In the current troubled environment, we cannot ignore the major macroeconomic issues at hand, especially those that may have a significant impact on our industry, such as inflation and deflation. Nor can we ignore their potential consequences for Risk Management, as highlighted in the presentation given by Denis Kessler.

On the operational side, our seminar dealt with ERM as applied to practical issues involving emerging risks as well as extreme risks such as terrorism, natural catastrophes or pandemic, and their related risk responses.

We hope that this publication, which is based on the presentations delivered and the debates we had during our client seminar will provide a consistent approach to ERM frameworks and will help to enhance the Enterprise Risk Management culture in our profession.
Inflation was a key concern for insurers and reinsurers until the early 90s when the world entered a phase of price stability or limited inflation. The financial and economic crisis that started mid 2007 has turned into a phase of deflation, where the prices of assets and of many goods and services is dropping. This phase is causing problems to insurers and reinsurers mainly on the asset side (and on their off balance sheet exposure). At the end of the deflation phase, it is likely – although debatable – that the world will enter a phase of re-inflation. The main argument in favour of this perspective lies in the huge monetary creation that has been done to fight against deflationary pressures and to avoid a liquidity crisis. The explosion of public deficits can also support the hypothesis of a return to a world with general inflation. This contribution will look at the trend of claims costs over the last decades and then analyse the consequences of the current deflationary environment for the insurance and reinsurance industry and will explore the consequences of the probable re-inflation phase that will follow deflation.

I. The cost of claims has historically increased more rapidly than Consumer Price Index

It seems that the elasticity of the cost of claims relative to the CPI has been higher than 1 over the past 20 years in the world’s major economies.

Focus on various different Lines of Business

- Health insurance costs have been increasing at an especially torrid pace over the past decade. At no time has the US growth rate for Health insurance costs fallen below the CPI growth rate. This is due to medical costs paid by insurers rising twice as fast as Medical CPI (drugs and medical services) because of volume effects. Another cause is the fact that medical CPI is continually rising at a higher rate than other CPI items, due to greater market power and lower productivity gains in the medical sector. This evolution is also linked to the inflated value of human life and suffering;
- Most segments of French Homeowner insurance costs have been increasing due to the combination of a volume effect (insurance costs are increasing compared to Home insurance CPI) and a price effect (Home insurance CPI is increasing compared to CPI);
• All segments of French Motor insurance costs have been growing due to a volume effect. Of course, severe bodily injuries are a major source of cost increases in Motor insurance. In the US, statistics point also to the driving role of motor services such as vehicle bodywork;

• In Liability insurance, US tort costs seem to be stabilizing, after having exploded during the 80s and at the beginning of the 2000s.

This inflationary claims gap, which is structural, requires specific management tools. Excluding coverage extensions, this is a general phenomenon affecting absolutely all lines of business worldwide. However, it more specifically affects those lines of business that are more or less compulsory (Health, Motor, Liability) or exposed to legal actions because it is deeply rooted in “institutions”. Moreover, it points to the specificities of insured goods and services as opposed to non-insured goods and services:

• Most of them are protected from international competition;
• Many of them are operating on a monopolistic or oligopolistic market;
• Many of them are indexed on the changing social value of life and suffering;
• Most of them concern services where productivity gains are limited.

This trend is partially attributable to problems of moral hazard and adverse selection. The “deep pocket” principle applied by the Courts states that as long as economic agents are made solvent by insurance guarantees, it is worthwhile for the Courts to extend their liability (judicial cost inflation). Furthermore, the ability of the producers of insured goods and services to increase prices, without being penalized by a consecutive fall in demand, allows them to potentially develop specific behaviours, which may be limited in scope but which help to explain the gap. Asymmetric information between the insurers and insureds reinforces this phenomenon.

Inflation Risk Management could be improved through the creation of databases that would list the prices of insured goods and services throughout the world. Given the current insufficient knowledge of insurers, more capital is required to cover this lack of data and quality time series because a better knowledge of the structural inflation would reduce uncertainty and hence allow (re)insurers to reduce ceteris paribus capital requirements. To complete this objective, we believe that competition standards do not oppose shared scientific empirical studies on prices. Joint investment by the industry is worthwhile: for us, future inflation is an Eco-Cat like global warming is a Nat-Cat. Consequently, aggregation of individual data into market data would produce positive externalities.

II. What are the consequences of the current deflation for (re)insurance and its capital management?

GDP forecasts have been continuously revised downwards since September 2008, inducing a downward revision of inflation estimates and inflation forecasts. The main impact of this current deflation phase for (re)insurance falls on the assets side. Nevertheless, since (re)insurance is a risk carrier with less “off balance sheet” exposure than banking, it is less impacted.

Financial revenues are negatively impacted by equity, corporate bond and structured product impairments required by IFRS and by the falling remuneration on reinvestments and new investments. Strategic and tactical asset allocations in favour of more secure investments accentuate these losses. Asset values are negatively impacted by rising credit spreads on corporate bonds, by falling stock prices and by dislocated markets for structured products.

How much asset write-down does the industry still face?

• According to the IMF: $270 billion already completed in the insurance sector, from a potential $300 billion worldwide + capital of more than $100 billion already infused (end of 2008);
• Some industry sources are less optimistic: potential of $500-600 billion in write-downs.

(Re)insurance liabilities are negatively impacted both on the Life and P&C sides but the impact is more limited and deflation may:

• Reduce claims costs on Health and P&C risks (such as business interruption);
• Decrease P&C reserves (which are not discounted under current IFRS standards);
• Lag in premium rate increases compared to claims payment changes.

Confronted with the crisis, market situations differ and major differences in the industry have been brought out:

• Differences by geography (source: World Economic Outlook of the IMF):
  - Europe = 25% of potential write-downs but 38% of premiums;
  - United States = 72% of potential write-downs but 30% of premiums;
  - Japan = 3% of potential write-downs but 10% of premiums.

• Differences by line of business:
  - Unit-linked saving products are the most exposed when they provide a financial floor;
  - Life insurance appears more exposed than P&C;
  - Reinsurance, whether Life or P&C, seems less exposed than primary insurance;
  - Worldwide financial markets are now significantly differentiating between Life insurance, P&C insurance and reinsurance.

• Differences by institution:
  - Conglomerates (Bancassurance) are more exposed than traditional (re)insurers because of their concentration on Life savings and financial products and their links with banking activities;
  - Private companies and mutuals may be under less stress from financial market pressures.

Capital management for addressing current deflation should be based on the use of the solvency margin. Capital management helps to anticipate extreme risks, but when risk materializes it is too late to change its standards. Consequently, optimal capital management may require the use of the solvency budget as a shock absorber. Indeed, requiring companies to rebuild depleted solvency margins at their normal time level is currently not only counterproductive but also macro-economically dangerous: if solvency margins cannot be used as shock absorbers during times of systemic or severe financial crisis, why are they there? A margin is to be used sometimes transitorily and the company should find the way after a few quarters to restore it. In the future, capital management should be adapted in order to take the underestimated risk of systemic crisis more into account:

• By allowing non-taxable equalization reserves? But how can the IASB be convinced to recognize them?
• By developing contingent capital? But how should counterparty risk be addressed?
• By developing cyclically adjusted capital requirement? But how to adjust for the cycle?
• By developing a new generation of more consistent Economic Scenarios Generators (ESG): Internal models failed because most ESGs in the banking sector failed to anticipate the probability of the current crisis. They must take dependencies and causalities between economic and financial variables more into account.

III. Will the end of the crisis be inflationary, and if so what will be the consequences for the (re)insurance industry and its capital management strategy?

The probability of an inflationary exit by 2012 is high because of:

• Massive creation of money around the world to cure deflation and avoid systemic risk;
• Exploding public debt, which is likely to be partially monetized (as in the US);
• Globalisation that no longer provides disinflation because of rising worldwide tensions behind current deflationary pressures: increasing wage pressures in emerging countries leading to higher import price levels and probable rebound of oil, raw material and commodity prices.

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Huge increase of central banks’ balance sheets

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Source: Ecowin

<table>
<thead>
<tr>
<th>Year</th>
<th>US Federal Reserve, Total assets or liabilities, dollars</th>
<th>Eurozone, Eurosystem, Total assets or liabilities, EUR</th>
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<td>2000</td>
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<tr>
<td>2005</td>
<td>2,000,000</td>
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<tr>
<td>2010</td>
<td>3,000,000</td>
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</table>

Source: Ecowin
The event that most affects reinsurance is the transition from deflation to an inflationary regime. Resurgent inflation will affect the value of existing assets and will give birth to a new yield structure for the flow of new investments. Concerning insurance claims and liabilities, it will impact the cost of losses but it may also affect, negatively or positively, the frequency of such losses. These phases of inflation regime change are up-setting (re)insurers’ strategies presenting three characteristics:

- Remuneration of existing bond portfolio is locked at interest rates based on obsolete market anticipations;
- Perception, by markets, of the implicit indexation of stocks on inflation is usually delayed by 2-3 years;
- Premiums are defined and collected in advance of claims, on the basis of cost estimations made obsolete by re-inflation.

In a steady state, premiums are adjusted to cover all the consequences of the new stable inflationary environment: when inflation rate stabilizes, premiums tend to grow at a constant rate but to adjust from the frequency changes. Unlike disinflation phases, the consequences of re-inflation phases are largely unfavourable to (re)insurance: re-inflation combined with rising real interest rates poses the immediate risk of increasing lapse rates, and re-inflation associated with declining real interest rates exhibits the risk of declining Life premiums.

The varying capacity to adjust premiums to the evolution of other Profit & Loss items, along with different behaviours, means that re-inflation is more damaging for long-tail lines of business:

- Short-tail lines of business can quickly adjust to an increase in the rate of inflation: based on annual contracts with few long-term commitments, they are able to adjust their premiums or commitments with a small lag between the inflation increase and its perception plus a limited technical lag, averaging 6 months, between new premiums or commitments and claims. Short-term lines of business financial revenues may increase rapidly with interest rates because their assets typically have a lower average duration and reinvestments and new investments tend to represent a higher share of existing assets. In P&C, lines of business such as Nat Cat, Motor or Home insurance are the most concerned. In Life, Health insurance that operates almost as a “pay as you go” system with limited reserves is the most exposed;
- Long-tail lines of business can only progressively adjust their business to resurgent inflation: they are unable to adjust most of their premiums or/and commitments either because they are based on multi-year or they contain long-term commitments cumulating any inflationary deviation over a long period of time. Their financial revenues are not able to increase rapidly with interest rates. In P&C, lines of business such as Construction and Workers’ Compensation would be impacted by the combination of falling asset values and increasing claims and reserves. Life business would also be impacted by the combination of falling asset values and rising lapse rates or reduced investment in contracts.

Experience demonstrates that inflationary pressures on the reinsurance industry are non-homogeneous:

- Inflation resurgence disproportionately affects insured goods and services compared to other goods and services: Inflation of insured goods and services is structurally above average with a small lag between the rise in inflation and the perception of inflation plus a limited technical lag, averaging 6 months, between new premiums or commitments and claims. Moreover, the elasticity of premiums to inflation is superior in industrialized countries over 1985-2007: in the short term, 1% more inflation induces an average 1.5% premium increase the following year among G7 countries (excluding Italy). In the long term, 1% increase in inflation induces a 1.3% increase of premium among G7 countries (excluding Italy).
- Some economies are more inflationary than others: Indeed, even if the consequences of exchange rate variations are limited by the (re)insurance principle of congruence, in practice, the prices of many insured goods and services fluctuate with exchange rates because they are imported. Their consolidated net income and net asset value will be affected depending on the currency in which financial reporting is conducted. This exchange rate risk may be hedged.

From now on, capital and other Risk Management tools must take the risk of inflation resurgence seriously into account. There are many ways in which to anticipate and address this substantial risk:

- Include resurgence of high inflation in the mapping of extreme risks: the risk can be isolated and addressed as such. The drawback of this method lies in considering that high inflation is no longer an extreme risk but a near-term risk;
- Implement contingent strategies:
  - Invest in inflation-linked bonds, stocks and real estate, and buy “caps” supplied by diversified counter-parts;
  - Introduce cover limits or adjust pricing rates according to inflation risk;
  - Introduce index clauses in non-proportional cover;
  - Increase “penalization” of Life contract lapses, of early termination.
- Adapt internal models, regulation and rating
  - Probability of high inflationary scenarios should
be revised upward in Economic Scenario Generators (ESG): the goal is to provide realistic scenarios of possible future behaviours and consistent estimates of risks in terms of both volatility and dependency; - Dependencies of liabilities on inflation should be better included in models; - Capital requirements should give credit to inflation-mitigating strategies; - Assessment of ERM should value flexible contingent strategies.

**CONCLUSION**

We are exactly in the case of decision making in times of uncertainty, with two hypotheses:

- return of inflation;
- no return of inflation.

The choice between protecting or not protecting the company against inflation is made through a rational evaluation of the cost of protection, which is a function of 3 variables:

- The probability distribution of the risk (x%);
- The net present value of the loss amount if the risk happens (L);
- The risk premium.

The values associated with the 3 parameters are dependant on the Group’s view of the economic environment. Strategy I is chosen if and only if the net present value of the costs of Strategy I, as anticipated by the company, is inferior to net present value of the costs of Strategy II or if these costs are bigger than allowed by the risk appetite of the company.

SCOR Group, having estimated the cost of not protecting as being higher than the cost of protecting, has therefore taken actions to minimize the effect, on both sides of the balance sheet.

The aim is not to determine what is going to happen but to know what are the potential states of the world, the two scenarios of the inflation happening or not happening, and to take the most beneficial strategy, I prepare/I don’t prepare, that is consistent with the company’s risk appetite.

Deflation is dangerous not because of falling prices but because of falling economic activity and declining purchasing power, and depressed financial markets. Inflation is much more unfavourable to (re)insurance, especially its phase of accelerating. It is very important for (re)insurers to protect themselves against re-inflation through updated capital management. For example they should:

- Detect inflation in claims sufficiently early with ad hoc databases at global industry level;
- Define accurate contingent strategies at the company level thanks to a new generation of ESGs;
- Adopt an asset management strategy hedging the re-inflation risk as much as possible.

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**SCOR’s position is to limit shareholders’ exposure to inflation risk**

<table>
<thead>
<tr>
<th>INFLATION</th>
<th>SCOR STRATEGY</th>
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<tr>
<td><strong>1: protect</strong></td>
<td><strong>2: do not protect</strong></td>
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<tr>
<td><strong>RISK HAPPENS</strong></td>
<td><strong>EXPECTED NPV</strong>&lt;sup&gt;1)&lt;/sup&gt; OF THE STRATEGY</td>
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<tr>
<td>Yes Probability of x%</td>
<td>Cost (€) related to:</td>
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<td>- Mitigating inflation impact</td>
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<tr>
<td></td>
<td>- Liabilities protected by surge of claims inflation</td>
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<tr>
<td></td>
<td>Loses (€) due to:</td>
</tr>
<tr>
<td></td>
<td>- Depreciation of existing portfolio of bonds with fixed remuneration</td>
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<tr>
<td></td>
<td>- Temporary depreciation of existing equity portfolio</td>
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<tr>
<td></td>
<td>- Claims and reserves inflation</td>
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<tr>
<td></td>
<td>- Delayed adjustments of premiums</td>
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<tr>
<td>No Probability of 1-x%</td>
<td>Cost (€) related to:</td>
</tr>
<tr>
<td></td>
<td>- Lower asset yield due to protection cost</td>
</tr>
<tr>
<td></td>
<td>- Higher profitability thanks to better pricing conditions</td>
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<tr>
<td></td>
<td>- Potential volume effect Cost of the protection</td>
</tr>
<tr>
<td></td>
<td>No Cost</td>
</tr>
</tbody>
</table>

1) Impact on shareholders’ equity

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**SCOR - October 2009 - 9**
Enterprise Risk Management aims to identify Risk, in the present and for the future, to measure its financial impact, to manage it and to control the performance of the management strategy adopted. Consequently, it is of paramount importance to determine, from a historical point of view, the reasons for the emergence of ERM and to be able to analyze its current situation. This will provide a better understanding of ERM and will help to set an adequate strategy for managing risks.

The following presentation will be split into three parts:

- The historical context, to discuss and understand the reasons for the emergence of ERM;
- The link and differences between insurance companies’ approaches, rating agencies’ requirements, market analysts’ main considerations and the regulation move from Solvency I to Solvency II;
- An overview of SCOR’s ERM organisation.

I. The historical context

To provide a short historical background, the reason for the emergence of ERM lies mainly in the fact that there have been a lot of catastrophic events in the past. Some examples:

- Natural catastrophes: Andrews, Lothar & Martin, Eastern Europe floods;
- Human-made catastrophes: Bhopal, Piper Alpha, AZF;
- International terrorism: London, WTC;
- Companies in distress: in the insurance industry, HIH in Australia, Independent in the UK, the monoliners in the USA, AIG, outside insurance, Enron;
- The U.S. Casualty crisis for underwriting years 1998-2002 or the crisis of IDI in France. Both of these were the result of under-pricing and dramatic under-reserving with a great deal of consequences that were not anticipated;

All these very severe events drove the fear of cumulating consequences of low probability events:

- a major hurricane or earthquake in 2001, just after the WTC event;
- a big earthquake in California or the big one (New Madrid-Missouri).

and have triggered a fear of a lack of reinsurance after the collapse of the reinsurance market.
It was the first time after September 11th that the possibility of a systematic risk for the insurance industry was mentioned. Indeed, systematic risk in the banking industry was very common, but according to different stakeholders’ usual positions towards the insurance industry, that systematic risk was excluded or very remote. The main question came from the accumulation of these events of low probability and high severity.

Eventually, many stakeholders came to the conclusion, especially some regulators and the IMF, that the insurance industry needed a capital increase but also a more efficient and effective Risk Management approach. This was the beginning, to some extent, of the official story of Risk Management in insurance.

From the regulatory point of view, when the NAIC set the RBC framework for regulation in the USA, they envisaged a second step based on scenario testing and dynamic models. Consequently, Dynamic Financial Analysis (DFA) was very fashionable in the P&C industry during this period but, due to the silo organisation of most of the companies and the lack of appropriate softwares, amongst other things, it did not prove very successful.

Furthermore, Cat models after hurricane Andrews met with success. All of these were implemented between 1990 and 1997. ERM now is benefiting from these first two approaches. But in reality, there were also big incentives, if we want to remain moderate, coming from investors, market analysts, rating agencies and, to a lesser extent, from the regulators.

Following the U.S. RBC framework, many countries in the world have moved to a more risk-orientated regulation:

- Canada, Australia, UK with FSA’s ICAS in 2004;
- Switzerland with the Swiss Solvency Test, which is already in place;
- The European Union solvency regulation, which is known today as Solvency I, does not consider the different risks and is based on global considerations which do not require a need for better Risk Management. The Basel II project launched in 1999, with its three-pillar approach for the banking industry regulation, led the launch of the insurance Solvency II project.

Rating agencies, like many companies, largely anticipated this phenomenon. For example, Standard and Poor’s officially promoted ERM in 2005 as a critical component of its rating methodology. It seemed to be a very important signal not to begin but to have a more industrialized and common view for the different companies. We are moving to a world with an internal model approach for the solvency capital requirements with more sophisticated modeling than the factor-based methodology.

This new approach is defined by different concepts:

- “risk appetite”;
- “risk tolerance”;
- diversification;
- evaluation of extreme scenarios;
- anticipation of emerging risks.

As far as the IFRS accounting rules are concerned, they have been adopted as the standard for European Union-based companies. They introduce higher profit volatility, and the notion of Best Estimate for the reserves is putting a lot of pressure on the tradition of a very prudent and conservative approach. It does not encompass the security margin, as was the case in the past, in the European Union or in continental Europe.

There were two consequences in the insurance industry:

- Apart from the UK, it has triggered the fear of a need for raised capital due to the tradition of prudence and a conservative approach, particularly on the P&C side, in the setting and the calculation of reserves in Continental Europe. So to some extent, due to the way that the IFRS considers the reserves, this level of prudence has disappeared or will disappear;
- Finally, there was also in continental Europe a certain scepticism about the fact that we need to increase the capital for the various companies because we have not experienced any real bankruptcy or big failure in the insurance industry in the past. Many stakeholders saw that Solvency I was not really adapted to the industry, but to some extent there were no real failures during this period. This stems mainly from the fact that there was some comfort in the reserves.
II. Main risks and regulatory requirements

On 26 March 2009, a compromise was adopted under the procedures of the European Union that would allow the Directive to go through at the end of 2009. This new regulation will drive significant modifications regarding the organisation of many companies. This is a key step in the process of managing risk and highlights some questions:

• What is the link, if any, between the positions of the companies, the position of the rating agencies, different stakeholders and regulators in terms of emergence of this ERM?
• Particularly, what is the move from this point of view from Solvency I to Solvency II, what are the schemes of the European regulations?

Main risks are defined as insurance risks, credit risks, market risks and operational risks. To measure and control them, an appropriate ERM program will use:

• An internal model associated with a holistic approach, the modeling of dependencies allowing the measurement of the diversification effect. This, to some extent, is the main benefit coming from this internal model approach: to measure these dependencies and the diversification effect;
• An internal control framework which allows the limitation of the operational risks and the reserving risks;
• An emerging risk framework which is in place to control and mitigate these risks;
• A reinsurance/retrocession program to limit the risk and an optimization issue will lead to the choice between traditional reinsurance markets and ILS markets.

Fig. 1: A three-pillar approach

With the Solvency II reform, the EU project is organised through three sets of regulatory requirements (pillars):

• Pillar 1 is largely based on, or parallels, the Basel II approach for banks. It is a calculation of the Solvency Capital Requirements (SCR), with a risk-based internal model and/or a standard formula. In the framework of this regulation, reinsurers will be obliged to apply the standard and will be able, according to their capacity and their willingness, to have an internal model. Nevertheless, during two years after approval by the regulators, they will be obliged to also run the standard rule;

• Pillar 2 is linked more to the other part of the ERM, with all that it entails: internal control requirements, Risk Management, governance, compliance and regular reports;

• Pillar 3 consists of the improvement of transparency and defines the obligations regarding the level of information and communication for the regulators and with the markets.

It is quite interesting to mention that there were some different approaches for these Solvency II rules, which are, at the end of the day, much more Anglo-Saxon than traditionally continental Europe orientated. They will trigger diverse reactions related to the different
European cultures. For Latin countries, some application problems or application issues will probably arise because these countries are used to having legal texts and playing with the legal aspects in the court. For Germans and Northern Europeans, it is also a challenge. So some adaptation is necessary to be able to fulfil the requirements.

After a long debate, it appears that these Solvency II rules are generally accepted. However, a relevant question for the future remains the one-year time horizon. Indeed, if you need to have a multi-year model, it is very complex because you also need to have a lot of hypotheses which makes the control of this modeling very difficult. The regulator has decided in Solvency II to have just a one-year time horizon. Consequently, it is supposed to calculate what will happen in one year, which is quite artificial for long-tail business. Indeed, the way in which you calculate the one-year time horizon does not consider the fact that, in real life, there is some monitoring of this type of long-tail business. The data cannot reflect the real volatility, but rather a volatility which is to some extent filtered.

III. The SCOR Global ERM organisation

SCOR as a Group is rated A by Fitch, Moody’s and Standard & Poor’s and A- by AM Best and its ERM organisation is at the core of the corporate structure.

This diagram below (Fig. 2) gives some answers to the following questions:

- What is the main picture for the Risk Management?
- Which committees do we have?
- How is ERM organised in terms of the different CROs and the different management of the group?

---

**Fig. 2: SCOR ERM organisation**

- **Board of Directors**
  - CEO
  - COMEX
  - Group Chief Risk Officer
  - Deputy Group CRO
  - Group Internal Audit

- **ERM Coordination Committee**
  - CRO SCOR Global Life
  - Group Risk Management (GRM)
  - CRO SCOR Global P&C

- **Risk Officer**
  - Asset Management
  - IT
  - Human Resources
This article, based on the presentation given during SCOR’s Campus Seminar in June 2009, sets out Standard & Poor’s view on ERM, explains the link between ERM and ratings, and gives an overview of the findings so far for EMEA insurers and reinsurers.

I. What is ERM?

What is ERM in Standard & Poor’s view? Managing risk is at the heart of what an insurance company must do, because it is its business. A good Risk Management program means that the company is able, first of all to identify, then to measure risks, to project, to set limits and to keep losses within these limits for all its major risks. So basically, Risk Management is a protection of the downside of the balance sheet, avoiding losses that are outside the tolerance of the company.

The difference between Risk Management and Enterprise Risk Management is the letter E, the word Enterprise. It means actually doing the same thing consistently across all the risks in the enterprise, using the same measures, using the same approach. The difference between Risk Management and Enterprise Risk Management is what constitutes a competitive advantage for the insurance company. A company that knows how to manage and measure its risks consistently can also choose the risks that bring better risk-adjusted return, putting itself in a better position when compared to other less advanced companies.

II. ERM and rating

How does ERM fit into the rating? S&P started explicitly looking at ERM in 2005. Before that time, S&P’s assessment of a company’s Risk Management was split across all the categories: capital adequacy, investments, market position, liquidity, earnings, financial flexibility and management strategy. Since 2005, Enterprise Risk Management is the eighth category of the analysis, and the findings in this category are included in the rating.

The relative weight that the ERM part has in the overall rating of the company depends very much on the risk profile of the company. There is a difference between the need of having a sophisticated, well-developed ERM program for a company that is a global multi-line insurer, compared to a niche player who does just one line of business and which is based only in one country. Obviously, the more complex and diversified the risks that the company underwrites, the more stringent the need for having a well-developed ERM program.

But there is also a direct link between Risk Management and capitalization. A company that has a significant excess of capital, measured for instance by the S&P capital model, can withstand losses that are outside its risk tolerance more than a company that runs on a very tight level of capitals. The latter will need to make sure that the losses will stay within its tolerance. In this way the importance of ERM is linked to the level of capital adequacy or excess capital that the company
holds. With this considered, S&P integrates the ERM assessment into the overall ratings.

S&P uses four levels of ERM quality classification: excellent, strong, adequate and weak, with “adequate” further split into three sub-classes. By contrast, the other rating categories mentioned above are scored from BB to AAA before combining them into an overall rating. S&P decided not to do so with ERM because it would be difficult to differentiate what is an ERM AAA or what is an ERM AA.

The major step is between adequate and strong, because the difference between Risk Management and Enterprise Risk Management is the ability to capitalize on the Risk Management to create a competitive advantage. So companies that have strong ERM have actually implemented tools to manage the business by looking at risk adjusted return, and so optimizing risk adjusted returns.

ERM components

The elements of ERM that S&P looks at can be depicted as a temple. At the bottom is the Risk Management culture, the pillars are Risk Control processes, Emerging Risk Management, and Risk & Economic Capital models. These three pillars support the overarching Strategic Risk Management, which is the ultimate point of arrival of a good ERM program.

Risk Management culture

Risk Management culture means that everybody who works in a company thinks about the risk that they are bringing into the company with their actions. It can be in pricing, it can be in reserving, it can be in underwriting. The concept of risk should be well spread across the company. Tools to achieve this target are a strong governance structure with a separate Risk Management function, and, ideally, a chief risk officer. There should be a risk committee on the Board and several risk committees that report to the Group Risk Committee.

In terms of lessons learnt from the current crisis, probably governance and risk culture is one of the things that did not work properly. Companies will have to realize that just having a chief risk officer does not mean much if he does not have the power to intervene, does not have access to the Board, does not have a strong enough position to point out transgression of risk tolerance.

Communicating about risk is part of risk governance, and this also needs to be improved in all companies. What sort of risk report, risk dashboard does the company produce and who sees them? If the CRO produces a risk dashboard or risk reports and then they do not go anywhere, what’s the point? There should be a flow of communication between the Chief Risk Officer, the management of the company and the Board. It is very important that the ultimate responsibility about risk tolerance, Risk Management and the ultimate overview should belong to the Board of Directors, to somebody that does not have direct P&L responsibilities.

Also part of Risk Management culture is that the company needs to be able to have and to state a clear risk tolerance that is tied to the risk limit and applies this to the business.

Risk Control processes

The first pillar of S&P’s “ERM temple” is Risk Control processes. A company has to identify all its main risks. It has to be able to measure them and have a forward view of its risk. The balance sheet does not give any information about the risk; it is just a measure of expo-
The company needs to be able to monitor risks and to keep them within the stated limits, with the objective obviously that not any of the risks produces losses that are outside the tolerance.

Control processes have to be applied to all the risks of the insurance company: financial risks like credit and market risk, the insurance risk, but also operational risk. The latter is another point that should be at the attention of the insurance companies these days.

Emerging Risk Management

The second pillar of S&P’s “ERM temple” is Emerging Risk Management. It refers to being prepared for the next unexpected risk, something that does not exist yet on the balance sheet, but may happen in the future. The most obvious example from the past is asbestosis. In terms of Emerging Risks now, current talk is about electromagnetic fields and terrorism. How does Emerging Risk Management work? Basically, the company has to be alert to what happens in the environment. The basis is to do environment test scanning to look at signals of any potential upcoming risk, but that alone is not enough, even though most companies stop there. That should only be the first stage. Once the emerging risk is identified, a company must check what the impact could be on the balance sheet if the risk materializes, the potential corrective measures and action needed to be identified. Stresses should be considered, as well as the impact on the liquidity of the company. There are a lot of actions that should be undertaken to prepare for the next coming risk. It is much more of an issue for reinsurers than it is for direct writers, and much more for P&C than for Life.

Risk and Economic Capital models

In the framework of the ERM assessment, S&P looks at a company’s models in general, such as cat models and reserving models. We try to understand what models the company uses and how, who manages them, what results are produced and how they are used. In this context, we also look at economic capital models. This started because of discussions we had with major insurance or reinsurance companies at the outset of the 2001/2002 financial crisis. There was disagreement about sufficient capitalization, and companies were pointing at their internal models as corroborating evidence. S&P’s position was that we wanted to be sure the model passed the use test (in Solvency II terms), before looking at it, because a perfect economic capital management that is not used to inform and drive the business makes it totally useless, and therefore not worth a review from us.

The most obvious use of an internal economic capital model is to define risk tolerance. One of the things that we are expecting to see when we look at Risk Management culture is a definition of risk tolerance or risk limits. Clearly articulated, risk appetite and tolerance translate into risk limits.

After looking at ERM for the last four years, we are at the point where we can actually start to look at the models, and we started to do so in June of last year for those companies that can prove that the model is used effectively to manage the business.

Also important, and one of the things that could probably have helped in avoiding some of the problems in the current crisis, is that the manager remuneration or compensation should be related to risks. You can bring business that gives very high return, but also very high risk and that should be discouraged. The best way to do so is to link the compensation of top management to some sort of risk-adjusted indicators.

Risk tolerance

Setting risk tolerance and limits is a process. There are risk preferences. Any company that has been in force for a number of years does not have to think about risk preferences anymore. It could be that the company’s expertise is in Life, so they do Life and these sorts of products; or the expertise is P&C; or they do not want to take a significant interest rate risk. These are the risk preferences expressed at some point, but now embedded in the business model of the company. These risk preferences need to translate into a statement of risk appetite. This could be something like “We want to maintain single A ratings” or “We do not want to have a negative net income over three or four years”, or “We want to have a certain excess of capital under S&P/Solvency I/Solvency II measures”. This qualitative definition of risk appetite will then be translated into a very quantitative statement of risk appetite that we call risk tolerance, and this will then be translated into risk limits. This is the way, in an ideal world, in which risk tolerance and risk limits should be set up.

At the beginning, economic capital was used to define the risk tolerance (for example, we want to hold capital in excess of 200% of our EC). But then companies realized that this approach meant managing to the tails of the distribution. Then the concept of risk tolerance moved a little bit more to the middle of distribution. Besides economic capital and surplus targets, risk toler-
ance is now generally expressed also in terms of earnings volatility or earnings at risk, e.g. saying “We do not want to lose more than 10% of the previous year’s economic income”.

There are several approaches to use the economic capital to define the risk tolerance and risk limit. The first one is economic capital by risk, equal limits by risk, e.g. having a certain amount of economic capital for equity risk, and this being the limit. Or limits can be expressed in other terms than economic capital, which are then checked against the economic capital and tolerance, and then adjusted. For example, a company might have had limits regarding exposure to credit risk. For years the company might have had a limit of 10% of investments in lower than A ratings. A limit that is expressed like this is not really directly linked to risk, but what the company can do is actually consider what it means in terms of economic capital, and then adjust the limit to look at the overall economic capital tolerance.

One can also test the risk position against economic capital and earnings, which is more or less the same thing; I have run my company this way so far, so I am quite happy with the risk position, but just let me check what is going on in terms of economic capital and maybe adjust the situation. For groups there are two possible approaches that we have seen. One is to give limits of overall economic capital by business units, for the overall economic capital that the business unit can consume over the next year. This is normally done during the planning project. The company has the freedom to deal with the risks in the portfolio, e.g. take more equity risk, or more P&C risk, as they stay within the economic capital limits.

The other approach is to give strict limits per risk, i.e. a value for the equity risk limit, for the mortality risk limit, and then to stay within them. It is about how to attribute diversification within the group. Both approaches exist in the market, although the trend now is more towards economic capital limits given during the planning project.

A fashionable and very pro-cyclical approach is return adjusted limits. If a higher return from next year in a particular line of business is expected, limits are increased, and limits are decreased in other lines of business for which a lower return is expected. This can be called “opportunistic limit setting”.

**Strategic Risk Management**

Another area Standard & Poor’s looks at when assigning ERM scores is Strategic Risk Management. This is really the upside of ERM. It is the ability to measure all risks with one unique measure, deciding on a measure of profitability, and then to compare every action or every risk with this measure of profitability or measure of risk so that the company can choose, for a given level of risk, the most profitable business or vice versa. So the objective is effectively to optimize risk adjusted return.

Even in Strategic Risk Management, economic capital models play a very important role because the company needs to have a consistent view across all its risks to be able to choose. The advantage of an economic capital model is effectively the fact that it takes all the myriad of risks of the company, it takes into account the diversification, dependencies, and it comes up with one figure that is, first of all, easily understandable, but also allows it to measure all the risk in a unique way. Once the company has the economic capital that does the risk measurement, the company can choose any measure of income of value, to then compare the risk adjusted return and make informed, strategic decisions.

What do we consider to be Strategic Risk Management practices? Besides risk appetite and risk tolerance, this encompasses optimization of the risk/reward results from a quantitative approach. Strategic asset allocation is a broadly-used concept, where the target assets are given, taking into account riskiness of the assets, the return on the assets, but also the overall risk profile of the company. Risk adjusted product pricing is quite sophisticated, because the economic capital model needs to be well established, very robust and needs to produce results granular enough to then be used to do
a risk adjusted product pricing, which is not well-established yet. Capital budgeting means allocating capital to activities or business units based on the expected risk returns and expected risk. Performance recognition and incentive compensation is another very important part of spreading the cultural risk throughout the company.

Overall, Strategic Risk Management is effectively the competitive advantage that comes out of an ERM program.

III. Findings for EMEA insurers

The following part is about the findings for EMEA insurers (Europe, Middle East & Africa).

Fig. 3: 2008 figures and distributional scores

As mentioned in Fig. 3, the “adequate” rating was divided into three subcategories because it was too wide and it incorporated many different approaches to Risk Management. 60% is adequate; the yellow section is adequate with strong risk controls; 13% is adequate plus, which means with a positive outlook.

The “adequate/adequate” are companies that just do the business and carry out Risk Management in an acceptable way. The companies with “adequate with strong risk controls” have a very sophisticated way of controlling their main risks, be it ALM, interest rate risk, equity risk, but they lack in Strategic Risk Management, possibly because they do not need an economic capital model because the risk profile is not very complex. They do not need to be able to assess risk adjusted return because they are probably mono-liners or they just underwrite P&C, and therefore they are quite happy doing what they are doing with these strong risk controls.

The “adequate plus” covers companies that are getting there. They have put everything in place, the systems are strong and the risk controls are strong. But to embed the whole Risk Management is complicated, and moreover, to embed Strategic Risk Management. To embed the use of the models into the management of the business takes some time. Standard & Poor’s expects to see things more established before saying that they are strong.

The other companies are strong and excellent. This distribution has barely changed from last year. Most of the companies are adequate. There are not that many weak companies in Continental Europe; there are more in other markets. The excellent ones are both in Europe.

What does “weak” mean? Weak companies lack the basic controls for the main risk. A lot of companies in the Middle East fall into the weak category, simply because they seem to be overly exposed to equity risk without having the concept of risk tolerance and what sort of damage this may cause them. But these are companies that normally have a very large amount of capital, so it is probably less relevant. We also have a couple of cases in continental Europe of weak companies that showed significant failures, for example, the reserving process, and showed significant holes in the reserves.

Most of the companies that we see are adequate companies. They manage the risk in a very traditional way, silo-based, somebody does ALM, somebody does underwriting, and somebody does reserving. Often the management of risk is not very sophisticated.
For the “adequate/adequate” companies, there is no concept of risk appetite or risk tolerance; the limits are normally not risk related; economic capital models are non-existent and there is no optimization of risk adjusted return.

The “adequate with positive risk controls” companies look strong, but their Risk Management is too recent to be strong.

In “strong” companies there is strong risk governance, everybody in the company is risk aware or should be. They have a very clear statement of risk tolerance that is perfectly tied in with the risks. The risks are measured with several measures, not only one. They look at several measures to assess the risk. Economic capital measures have been in force for quite a while, up and running and robust. The company shows some ability to manage the business based on risk adjusted considerations.

The “excellent” companies are leading edge on everything that concerns risk controls; with much more established ERM programs, in place for longer with much less variation, more stable and less liable to changes: in sum a fully risk aware company. These are normally companies where you can see risk adjusted performance measurement, and they have had them for quite a long time.

Conclusion

How is ERM evolving? In Europe, Solvency II is definitely helping, although the pace of development that Standard & Poor’s would have expected to see in Europe did not materialize. Since Standard & Poor’s has started rating insurers’ ERM, the distribution has been the same. Standard & Poor’s would have expected to see a much more rapid move towards the “strong”, a much more rapid improvement of risk governance, improvement of risk modeling, much more embedded risk adjusted return consideration in the management of the business.

Today, in Europe, there is a lot of focus on models; everybody is trying to get their heads together on models, and less so on governance and management of risks. For the best players in the market, it all started with the models. In 2001 and 2003, companies needed the models to show Standard & Poor’s that they had sufficient capital. They had lost so much capital and surplus because for the first time they were hit on the liabilities and the assets side at the same time. Capital depletion was huge, so they needed to assess capital in a better way than could have been done with Solvency I or even rating agency models. So they started to build internal models, and actually Risk Management came down from the model, not the opposite. Companies started to build models and they used them to control the risk, to measure the risk and to limit the risk. Risk Management was built around the model. And this is the case with all these companies that are adequate. They are building the model. They are starting Solvency II, QIS IV, etc. They are looking at the model and assessing to which use they can put it.

We are at the risk measurement stage right now; and it is going to move towards strategic integration and probably a return optimization, but we are not quite there yet. For the time being, it is all about models and how this can be used for Risk Management.
I. Traditional Risk Management

Traditional Risk Management is often focused on risk identification, assessment, diversification and mitigation of predominantly operational risks. In traditional Risk Management, risk identification means looking at causes and consequences, but with a strong focus on management of specific risks, only. For instance, the legal department would deal with legal risks, and the underwriters would deal with treaty risks or contract risks, but without interaction between departments.

The risk assessment, in traditional Risk Management, often done with the help of risk maps as a visualisation tool, tended also to be silo based. The concept of correlations and dependencies between lines or units was not very well practiced.

Where internal models existed, e.g. for Life, Non-Life, credit risk, or asset risk, they were not combined into one group model. Creating an overarching model was partly also a challenge due to the insufficient level of hardware and software available ten years ago. As a consequence, only the diversification within particular silos could be modelled properly, and full benefits across the whole company could not be reaped. Likewise, the mitigation of risks – through hedging strategies, insurance, reinsurance and other means – was not coordinated across separate areas of business.
It is interesting to compare the differences between an industrial company and an insurance company from a traditional Risk Management perspective, and in particular how far their specific risks can be handled by traditional Risk Management.

Any industrial company, such as a food manufacturer or a pharmaceutical company, has strategic risks. A pharmaceutical company may face competitive pressure from companies producing generic drugs. A food manufacturer is dependent on food prices and their various drivers, such as oil prices. Also, these two types of companies are exposed to reputation risks, because they have an impact on the health of people. The legal risks depend on the range and quality of jurisdictions the company operates in. The main operational risks for an industrial company are within the business operations, e.g. a fire in the company, or natural catastrophes. Also, most industrial companies are very much dependent on the other companies in their supply chain, creating a major operational risk in case a supplier runs into difficulties.

On the credit risk side, the main risk for industrial companies is the fact that they supply goods in advance, and if the retailer has financial problems, the value of the goods provided might be lost. An insurance company needs to build up significant reserves to cover future claims and invests the majority of these reserves in bonds, a significant proportion of which are corporate bonds. This increases the exposure to credit risk.

A certain proportion of these reserves will also be invested in equities and property, which adds market risk to the insurer’s overall risk profile. On the other hand an industrial company tends to have a very strong, positive cash flow, does not build up reserves and does not need any major risk capital.

### Fig. 4: Industrial sector vs. insurance

<table>
<thead>
<tr>
<th>Industrial sector</th>
<th>Strategic</th>
<th>Reputation</th>
<th>Legal</th>
<th>Business operations</th>
<th>Credit</th>
<th>Market</th>
<th>Assumed insurance risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Risk Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After traditional Risk Management</td>
<td></td>
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A certain proportion of these reserves will also be invested in equities and property, which adds market risk to the insurer’s overall risk profile. On the other hand an industrial company tends to have a very strong, positive cash flow, does not build up reserves and does not need any major risk capital.
Industrial companies have mainly working capital, and no need to invest in the stock market or bonds to a large extent. Compared to an insurance company, an industrial company is, therefore, not exposed to substantial market risk. An additional risk category for insurance companies, not applicable to industrial companies, is the assumed insurance risk, particularly for companies that are composites or reinsurers. The more varied the portfolio, the wider the range of risks.

With traditional Risk Management, it is not possible to manage strategic risks properly and to answer questions about mergers and acquisitions, major hedging strategies or entering into new lines of business. This is due to the fact that traditional Risk Management tends to focus on the downside, whereas strategic Risk Management is about optimum capital deployment, i.e. about the upside as well.

An industrial company with traditional Risk Management will be able to mitigate reputation risk through very good internal controls and communication as well as legal support. Business operations cover prevention measures such as installing sprinklers in a factory, crisis management policies, and also insurance cover such as property insurance. An industrial company might mitigate client credit risk by purchasing credit insurance, although this does not completely eliminate credit risk, it creates another – albeit smaller – risk with the insurance issuer. Market risks can be reduced to a fairly safe level through good diversification and prudent investments.

On the insurance side the picture is similar. As far as business operations are concerned, there are some operational risks. The focus, however, is much more on market risks and assumed insurance risks, which are mitigated through derivatives, good diversification, or through reinsurance.

Although the industrial company and the insurance company seem to face broadly the same risks, actually behind the scene they are quite different. The fact that an insurance company has additionally assumed insurance risks means that there are even more combinations of different risks that can happen at the same time, and these combinations can either work in a positive way or a negative way. This is why a holistic view of things is needed. There are many yellow symbols in the diagram, but because of diversification some of them could turn green. For instance, on the Life side, writing longevity and mortality may, in certain circumstances, offset each other. Strategic risks are still not covered, so a method is needed to ensure that strategic risks are integrated into the operations. And that is a major step forward from traditional Risk Management.

Finally, since traditional risk managers work in separate silos, risks are not necessarily being dealt with at the same level of criticality. In some areas there is a lot of attention to detail, in others it is approximate. Therefore, it is extremely important that a company has a consistent culture of dealing with risks.

Strategic Risk Management, the holistic view and the risk culture are the differentiating factors between traditional Risk Management and ERM.

II. Influences on Risk Management

Traditional Risk Management dates back centuries, to the creation of Lloyd’s, and even back to the Ancient Greeks but very few people had heard of the term ERM even 20 years ago. However, the seeds of ERM i.e. risk culture, strategic Risk Management and holistic views have existed for quite some time.

There are many influences and driving forces in the move from Risk Management to ERM (Fig. 5).
On the culture side, Risk Management is based on a combination of ideas, governance principles and structures as well as the skills and experience of the people within the company.

Before William Sharp and Douglas Barlow introduced the concept of the “cost of risk”, risk had not been thought of as having a cost in the same way as a raw material has. Sharp’s use of the ratio of the expected value divided by the standard deviation, resulting in easy-to-understand risk and return graphs, changed risk culture significantly.

Another formative influence was the concept of “black swans”, or “unknown unknowns”. The financial crisis illustrated that events at the extreme tail of a probability distribution can actually happen and cost trillions of dollars for the world economy. Dealing with such issues is perhaps one of the greatest challenges of ERM and we may have to accept that there will always be some events that simply cannot be anticipated.

Most of the driving forces behind improved governance and Risk Management standards came from the efforts of controlling bodies to deal with ethical issues through strong corporate governance and to combat fraud and operational errors through internal control. The need to strengthen internal controls became even stronger after the deregulation of financial services in the 1980s.

COSO I internal controls were introduced in the 1990s and formed the basis for the implementation of SOX in the early 2000s. The internal controls were directed at the “human aspects” to address the fact that factors such as greed, overconfidence and arrogance need to be controlled.

COSO II was introduced in 2004 as an extension of internal control to ERM by integrating internal control with Risk Management and strategy.

A great deal of attention will be focused on these aspects going forward with Solvency II pillar two.

But no matter how many controls are put in place it will only be possible to achieve top-class ERM with knowledgeable, experienced people who have high ethical standards and who are able to systematically make appropriate risk-return decisions in the best interests of the company. It is not sufficient to have risk managers controlling all the risks taken – those responsible for taking the risks should own the risks and be

**Fig. 5: A historical perspective – Influences on Risk Management**
The massive advances in computer technology over the last 10 years have significantly increased capabilities in this area and enable the risk-return approach to be reflected consistently across the company in all key decisions such as M&A, hedging (including reinsurance), new products, pricing and capital allocation.

A further important aspect of strategic Risk Management is related to the tracking of emerging risks to anticipate major issues of the future and decisions taken to maintain these risks within the company's risk tolerances.

A holistic view

To ensure a holistic view is taken, all the actions from traditional Risk Management across the company are consolidated in a central area, in order to obtain an overall view of all risks in the company. As an example, extreme scenarios would take into account the exposures from all areas of the business. Also, the impact of a new business opportunity may be acceptable for the entity concluding the business but the additional exposure may accumulate with exposures from other parts of the Group so that the Group’s risk tolerance for a particular risk is exceeded. This approach should be applied to all risks including, in particular, reputation risks. Again, modern computing technology and data management have significantly improved companies’ ability to provide this holistic view.

September 11th is an example of how a single event could impact on many areas of insured business. A company writing several lines such as Life, Property, Aviation, and Workers’ Compensation would have been severely affected.

IV. Strategic Risk Management

Strategic Risk Management is mainly concerned with risk-return positioning (i.e. risk appetite) and risk-return optimisation.

The risk appetite of the company sets out how risk-adverse or how risk-seeking the company is, i.e. where the company is situated on the risk spectrum. The risk appetite is determined by the company’s Board, communicated to all stakeholders and used to determine risk tolerances for different areas of risk.

Risk-return optimisation refers to the management of the company at the strategic and operational levels in order to achieve:

- The optimal mix of business in line with the company’s profitability and risk appetite objectives;
- The respect of a range of constraints such as market, regulations, competition, and organisation.

V. ERM implementation and maintenance

Industry situation

ERM implementation is still a challenge for the insurance industry, although significant progress has been made, as studies from Pricewaterhouse Coopers show. In 2004, only 18% of companies interviewed strongly agreed that ERM was an important part of their interaction with regulators, rating agencies and investors. 19% strongly agreed that their organisation had clearly defined standards for risk taking activities and just 10% had a risk function in place for at least three years. Four years later, the picture had
changed. In 2008, 58% of companies interviewed considered ERM important, 35% had clearly defined standards for risk taking and 50% had a risk function in place for at least three years.

In a study by Towers Perrin Tillinghast in 2008, one of the key findings was that embedding ERM is proving to be a significant challenge. According to the study, large insurers are significantly more advanced in most ERM aspects. European insurance companies are better prepared than in North America and in the Asia/Pacific region. ERM is already influencing product design. Economic capital standards, such as Value at Risk, and market-consistent balance sheets, are emerging. But also at the same time, operational risk still remains a weak point: only 7% of the participants believe that they have reasonable measures of how to quantify it.

There are four objectives: Strategic, Operations, Reporting and Compliance.

Strategic objectives correspond to the high-level goals aligned with the company’s mission. Operational objectives ensure the right, effective and efficient use of resources in order to reach the chosen strategic objectives. Reporting objectives ensure that external reporting is reliable. Compliance objectives ensure that the company meets all its legal and regulatory obligations.

In the second dimension, there are eight Risk Management components. The internal environment deals with a number of aspects including the risk culture in the company, a clearly stipulated risk appetite, and risk tolerances. In the objective setting component, ERM is supposed to ensure that the chosen objectives are consistent with the risk appetite and risk tolerances as defined in the internal environment. The next component encompasses identification of internal and external events that could influence the success of the company’s activities to gain an understanding of the potential impact on the business.

**ERM implementation at SCOR**

The acquisition of Reviros and Converium brought many changes to SCOR, and this constituted a suitable moment to introduce a harmonised ERM framework, which is applicable for the entire newly formed SCOR. It was constructed with the combined experience of the three former entities, of the two engines Life and Non-Life and the Group functions.

SCOR decided to use an international standard, COSO, adapted to SCOR’s needs. COSO was initially an internal control standard, which was enlarged to Enterprise Risk Management in 2004 (COSO II). This underscores the links between SCOR’s internal control system and Enterprise Risk Management. Graphically, the framework is a cube with three dimensions: objectives, Risk Management components, and organisation (Fig. 6).

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**Fig. 6: ERM implementation and maintenance**

**COSO II – Categories of ERM Objectives**

This categorization of entity objectives allows a focus on separate aspects of Enterprise Risk Management.

- **Strategic** – high-level goals, aligned with and supporting its mission
- **Operations** – effective and efficient use of its resources
- **Reporting** – reliability of reporting
- **Compliance** – compliance with application laws and regulations
of risk events which might endanger the continued existence of the company. The assessment of the potential impact of identified risks and events follows naturally as the next step. This in turn triggers risk responses, such as whether to avoid a risk, accept it, reduce it, share it or transfer it. Mitigation actions are a very challenging part, including ensuring that assigned responses are actually carried out. The component of information and communication is concerned with accessibility and comprehensiveness of risk-related information and data throughout a company. Finally, the monitoring of the entire ERM system includes internal aspects, such as management discussions regarding weak points, and external aspects, e.g. from external surveys or internal audit.

The third dimension of the COSO ERM framework reflects the structure of the company, i.e. the divisions, subsidiaries, business units, etc.

SCOR uses the ERM framework to establish specific Risk Management mechanisms to deal with the range of risks. A gap analysis was performed for each mechanism. Consequently, projects were initiated where necessary, to close any identified gaps. To keep the system up-to-date, the framework is continuously monitored, maintained and enhanced.

The ERM framework:
- Provides transparency;
- Facilitates communication, within the company as well as with third parties, such as regulators and rating agencies;
- Provides a strategic overview of all Risk Management mechanisms within the company;
- Indicates the level of maturity of each Risk Management mechanism;
- Provides a bridge to ensure strategic goals and operational activities are aligned;
- Improves the risk culture. By using this framework, it is assured that a common language is applied. The framework is also the foundation for internal training and e-learning sessions.

Fig. 7: SCOR’s ERM Dashboard

SCOR’s ERM dashboard is basically a mapping of the Risk Management mechanisms within the ERM framework on two dimensions: Risk management components and objectives.
VI. Global processes

Central to SCOR’s ERM is the concept of ownership related to Global Processes and to Group Level Controls. The Global Process Owners, who are mostly at senior management level, play a very important role within the company. They are responsible for the identification, assessment and mitigation of risks in the processes for which they are accountable.

Their responsibilities include the maintenance of updated process documentations in their area, the nomination of local process owners who are responsible for either sub-processes or the use of the process in a geographical area. A thorough assessment of the process-related risks provides the basis for the implementation of key controls that require written evidence.

By means of regular cascading quality assurance letters Global Process Owners can:

- Supervise the status of risks and controls throughout the organisation;
- Conduct efficient issue management;
- Respond to their accountability for the effectiveness and efficiency of their processes.

The link to the ERM framework is ascertained through Group Level Controls which are defined for each Risk Management mechanism and usually closely related to specific Global Processes. Therefore, every Global Process Owner must define the appropriate Group Level Controls while taking into consideration strategic objectives and constraints. Group Level Control structures could, for instance, be in the form of reports, documents, guidelines, tools and policies.

VII. Implementation challenges

The implementation of a successful ERM is a challenging exercise. One sine qua non is the explicit commitment of the executive management. But senior management must also be closely involved. An ERM system must be comprehensive and consistent, meaning that no part of the company must lag behind. For instance, an excellent insurance Risk Management that is fully developed and integrated is of limited use if at the same time the asset Risk Management is not embedded into the group’s overall ERM framework. Since there are no off-the-shelf ERM systems that can easily be rolled out in a company, it must be developed by the company itself, based on needs, culture and resources. It is obvious that the installation of a well-functioning ERM framework is a major change management task.

Conclusion

Risk Management has been evolving rapidly in the last 10-20 years with many companies having taken it to the next stage – Enterprise Risk Management.

ERM enhances traditional Risk Management by ensuring that a holistic view of all the company’s risks is taken as opposed to a silo view. ERM also encompasses upside as well as downside issues thus ensuring that strategic and operational profitable opportunities (in relation to risk taken) are exploited. ERM also has a strong influence in encouraging a consistent and strong risk culture within the company where clear ownership of risks is assigned. The Risk Management function has moved away from a controlling role to one of a catalyst for change and coordinator of Risk Management initiatives, with risks being clearly owned by those responsible for taking risk-related decisions.
Risk identification and assessment are two important steps in the ERM cycle. Events that might have an influence on the objectives of a company have to be identified and evaluated, in order to decide on appropriate responses.

I. Risk identification and assessment techniques

The risk identification needs to be comprehensive, spanning all areas in which the company operates as well as various timescales. It is, therefore, appropriate to involve a broad range of people in this process, including management and subject matter specialists.

The outcome of this step is a list of events with a description of how and why they might impact on the company’s planned figures.

The risk assessment as a subsequent step requires at least a relative positioning of the identified risks, and ideally a quantitative statement about potential impact and probability of occurrence. Some events might be quantified based on distributions from models or market data; others might require scenario development or recourse to company databases. The outcome of this step is a list of events, sorted at least by “potential impact” and “probability of occurrence”.

At this stage, opportunities can be separated from threats, and subsequently treated in a different process, aimed at taking optimal advantage of the identified upsides.

Fig. 8: Risk identification process
Assessed risks have to be measured against the company's stated risk tolerance and risk appetite. For each risk exceeding pre-defined limits either with regard to the loss potential or the frequency of occurrence, responses will need to be implemented as a next step.

There is a broad range of possible identification and assessment techniques, a selection of which will be presented in this article. Many of them combine the two steps “identification” and “assessment”, so they will be treated together.

II. Risk enquiries

One valuable tool for gathering exposure information is risk enquiries, e.g. in the form of interviews executed by the independent risk controlling function. Interviewees are members of the senior management and subject matter experts throughout the company. Interviews should be done with a reasonably high frequency, e.g. semi-annually, to ensure regular information flow. During the meetings, identified risks are described in an easy-to-understand, comprehensive manner, avoiding technical terms, where possible. Risk drivers, correlations with other risks, and existing mitigation actions are included in the description.

Based on the interviewees’ experience and judgement, the risks are assessed with regard to loss potential, probability of occurrence, and current level of risk handling. Identified risks can be classified according to a suitable system, e.g. making use of the risk categories proposed in Solvency II. A more in-depth assessment with regard to thresholds based on the company’s risk bearing capacity can be done separately by the independent risk controlling function, when aggregating and analysing the findings later. For each identified relevant risk, ownership needs to be clearly assigned.

The objectives of the risk enquiry process are to identify, to describe, to quantify, to assess relevant risks, and to put them in relation to each other. This allows for a complete picture of the risk landscape which is useful in communication with internal stakeholders such as management, the Board, but also external stakeholders such as supervisors, rating agencies and investors. The regular nature of the process allows for trend analysis and risk tracking over several years, and the broad range of people involved allows for horizontal information and communication flow, fostering the company’s risk culture.

III. Ad-hoc notifications

In order to ensure the short-term reaction potential of a company, this one should operate a system that allows for significant short-term changes in the risk landscape to be notified to the management and to the independent risk controlling function on an ad-hoc basis. This could take the form of an internally published email address, or the use of existing reporting lines for Risk Management purposes, as well as informal systems that the company might want to use. Ideally, the ad-hoc system is embedded in the company’s risk culture so that it fosters a positive attitude towards risk identification. Notifying the management about threatening developments should be encouraged, so employees need not fear the “shoot the messenger” effect, where the bearer of unwelcome news is punished.

The ability to react at short notice to risk-related developments is an important aspect of a company’s ERM.
IV. Market intelligence

A comprehensive risk identification and assessment system will use internal as well as external sources, thus ensuring a neutral third-party view which results in a picture as comprehensive as possible. Information publicly available that can be used comes from sources such as specialised press, websites, published court rulings etc. To make the best use of this vast pool of unstructured data, an intelligent filtering system, possibly semi-automated with human supervision, is needed. Combined with a tool that actively provides specified and selected information to end-users, this system relieves the productive workforce of the time-consuming task of navigating their way through huge amounts of information. Productivity is enhanced, and the security of always being up-to-date in one’s field of interest increases confidence. Recent developments that might turn into risks for the company can be spotted against the backdrop of irrelevant data, and processed further in the risk assessment.

At SCOR, the full-time market intelligence team issues two products: daily news sent out electronically to all employees, and specific newsletters sent to registered subscribers.

Covered topics include:

• Catastrophe surveillance;
• Pandemic risks;
• Emerging risks and claims;
• ERM;
• Disability;
• Emerging markets, etc.

This comprehensive tracking of external sources complements other processes and ensures that all potential risks are spotted in a timely manner. It is especially suited for credit risk watch, identification of emerging risks, and of trends in international jurisdiction and supervision.

V. Emerging risks

Emerging risks or “known unknowns” are difficult to grasp, vague in their potential scope and impact, but dangerous insofar as they have the potential to quickly develop into large claims for insurance. Many companies already have experience with emerging risks that turned into major problems, such as asbestosis claims. The professional identification and assessment of emerging risks across the company is a central element of a sophisticated ERM, and one of the aspects that sets ERM apart from traditional Risk Management.

SCOR’s process for identifying emerging risks includes an intranet-based platform, where a range of observers throughout the entire group can contribute by submitting identified emerging risks to the website, which then can be commented on by other observers. The observer community consists of legal experts, claims specialists, underwriters, and risk managers. Beyond these internal sources, external publications like those from the World Economic Forum are used, and input from industry-wide expert groups in which SCOR plays a part. Finally, legal and insurance specific bulletins and publications are used to identify emerging risks.

All submissions are considered before the emerging risk steering committee, which convenes on a regular basis to filter and evaluate the emerging risks recently identified. The steering committee decides on how to deal with any given risk, e.g. by requesting a dedicated working group to be installed. At the end, recommendations are submitted to the Group CRO.

While the main purpose of an emerging risk process is to avoid unexpected losses and unforeseen developments, it can also be used to identify potential strategic opportunities linked to emerging risks.

VI. Extreme events

A well-developed extreme event process serves the purpose of identification and monitoring of the distribution tails of key risk drivers in various areas, such as underwriting, reserve setting, primary insurance business, retrocession, assets and operational risks. It aims to ensure that a company controls its exposures arising from outliers in the distribution of key risk drivers to within the stated risk tolerance limits. Results can be used for calibration of the internal model. Interconnections have to be examined for all main risks to which the company is exposed, and used to understand and manage business more effectively by risk-based allocation of capital to different lines of business.
Potential extreme events from a shortlist compiled taking into account the company’s specific situation need to be cross-checked regularly. This information can be combined with contributions from the other risk identification processes, such as the risk enquiries and the emerging risks process. Results are classified regarding their possible frequency and severity of impact. One possibility to structure the assessment of extreme events is the use of dedicated working groups, consisting not only of risk managers, but also of representatives of the markets, underwriters, asset managers, and others. These working groups are given the task of identification and description of the scenarios for specified return periods, taking into account the company’s specific exposure. They also produce an estimate of the net total cost for the company in all areas that would be affected. The independent risk controlling function which steers the per-event working groups can also ensure that there is co-ordination and extensive information exchange with the internal model team for calibration of the model. The reporting of the findings to the Group CRO should include recommendations for those scenarios where the estimated exposures approach or exceed group tolerance limits.

A professional management of extreme events links the ERM with the strategic management of the company and ensures that the risk tolerance is respected.

VII. Process risks

The internal control system of a company constitutes an important tool for a systematic risk identification and assessment in regard to process risks. The foundation of any internal control system is a good understanding of a company’s processes, including a process model. There is a distinction between governing processes and policies such as managing the company, or managing legal compliance; core processes such as claims payment, or financial accounting; and supporting processes such as managing investments and managing the IT infrastructure. Process experts identify the process-related risk controls which are documented in a risk-control matrix.

The efficient use of existing systems and processes for risk identification and assessment purposes ensures a broad input into the ERM system.

Through this approach, the Internal Control System plays an important role in the identification and mitigation of operational risks.

VIII. Credit risks

Triggered by the financial crisis, many companies have further enhanced their credit risk watch, leading to an increased quality of the risk identification and assessment in this area.

Credit risk exposure relates to different aspects in different areas of the company. Counterparty risk in corporate bonds or cash deposits and government bonds has gone beyond the theoretical nature sometimes considered in the past. A proper credit risk assessment includes not only credit and surety business on the P&C side, but also IFRS balance sheet items such as DAC and VOBA, mainly on the Life insurance/reinsurance side. In addition, reinsurance/retrocession recoverables, assets held by custodians, and many other types of credit-risk-sensitive contracts have to be tracked.

An approach introduced successfully at SCOR is based on the analysis of necessary triggers that have to happen before a risk materialises. Often, further events must be triggered in addition to an insured event and a counterparty insolvency.

Especially for credit risks, a 360 degree view is essential, so contributions from a multitude of sources should be integrated. As with all other important risks, the global analysis of the company’s main credit risk exposure needs to be compared to the company’s risk tolerance levels, and in the case of limits transgression, actions must be taken.

Conclusion

The best approach for a solid risk identification and assessment consists of a multi-component system. Built to fit the specific situation, exposure and resources of a company, the system can provide a comprehensive overview of the risks that the company is exposed to, as well as methods of dealing with them. At the same time, the process can serve as an important component of the company’s risk culture.
Over the past few years there has been a trend for companies to increasingly articulate more explicitly and formally their strategic willingness ("appetite") and limitations ("tolerance") to take on risks. Drivers behind this were a general trend towards incorporating ERM in strategic decision making as well as regulatory developments.

Examples include the “Individual Capital Assessment” (ICA) required by the British FSA, which started encouraging companies under their supervision to make a more formal statement about which risks they were willing to take on, and how much of those risks they considered they could bear and should bear. Switzerland introduced the “Swiss Solvency Test” (SST) and the “Swiss Quality Assessment” as part of the local regulatory regime. Germany enacted a comprehensive Risk Management regulation in 2009 (“Mindestanforderungen an das Risikomanagement in Versicherungsunternehmen”, MaRisk VA), regarding the minimum standards of Risk Management which German insurance companies have to comply with. It includes many elements taken from the Basel II framework, and also aims to be in line with pillar two of the Solvency II framework. Within the MaRisk VA, there is an explicit requirement to make clear statements about the risks a company is willing to undertake, about the ability of the company to bear risks and the limits to those possibilities. And last but not least the rating agencies have played an important role in the development of risk appetite and tolerance statements.

Risk appetite and tolerance are elements of a company’s risk strategy, and act as link between the corporate strategy of the company as a whole and the daily risk assumption. A clear statement on the willingness to take on risk and the tolerance to bear losses can give assurance to the stakeholders that the company has properly understood its risks, is clear and conscious in its risk taking, and equally in the limits it is imposing on them.

Stating one’s risk appetite is usually easier than stating one’s risk tolerance, because defining tolerance needs quantitative measures, which usually involve capital modeling or other inherently complex quantitative analysis. For the practical day-to-day use, risk tolerances then need to be translated into risk limits, which can also be a fairly onerous and complex task.

I. Examples for risk appetite and risk tolerance

Risk appetite means the amount and quality of risk which a company actively seeks and wants to take on. Tolerance, the other side of the coin, is the amount of risk that a company can take on without having to change course or strategy.

As an example(1), Japanese banks tend to have a fairly low risk appetite and are very selective in their risk undertaking. They have low thresholds, are not very aggressive risk takers, but they usually have a fairly

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(1) This example has been developed by Guy Carpenter.
high risk tolerance. In case of financial difficulties, Japanese banks tend to be quite tolerant and to continue to do the type of business they have been in without changing radically the way they operate. The contrary example are U.S. banks, particularly investment banks, which tend to be much more aggressive, much more willing to take on large risks which promise high returns. When risks materialise, U.S. banks tend to change course much more frequently. They easily shut down lines of business, fire people and look for other areas of growth or profit. In summary, they have a bigger risk appetite and a lower tolerance at the same time.

II. Features of risk appetite and tolerance statements

- An effective risk appetite and risk tolerance statement addresses all key stakeholders of the company, such as clients, policyholders, shareholders, regulators, rating agencies, employees, and brokers;
- The statement should be understandable, meaningful, and helpful for stakeholders in forming a view on the company;
- The risk appetite and risk tolerance statement should be set by the Board of Directors. This statement is a part of the corporate strategy, and a key part of the risk strategy of the company, so it needs to be discussed with the Board of Directors;
- The company’s Risk Committee should be involved in this discussion on an ongoing basis, and should formally endorse it.

III. Translating risk tolerance into limits

The risk appetite and risk tolerance statement needs to be translatable into risk limits, which are then cascaded down the organisation, e.g. by using economic capital models. Ideally, all limits at the operational level are, when aggregated, fully compliant and consistent with the risk tolerance which has been set at the very top level. In practice, other practical considerations will need to be taken into account, such as e.g. the availability of certain reinsurance covers. And even if the capital model may give a certain budget for a given line of business, the company might still decide to set a lower limit.

A limit system fully compliant with Solvency II will require a complex and elaborated process regarding resources, processes for planning, monitoring, reporting, validating, escalation procedures and comprehensive documentation.

IV. Addressees

Generally, risk tolerance statements can be categorised by the group of stakeholders they primarily address:

- Policyholder-focused risk tolerance statements usually take the form of a Value-at-Risk or Tail-Value-at-Risk measure, e.g. setting the target probability that the liabilities will be fully paid, or quantifying the average loss to policyholders at a target probability;
- Shareholder-focused statements usually have a wider degree of variability. They include earnings-related criteria, e.g. the probability of negative earnings. Other concepts are the potential reduction of dividends, or – as in the case of SCOR – the probability of the company having to be recapitalized;
- Other stakeholders can be addressed to the extent they are important and have an interest in the company; using for example rating downgrade probabilities or the probability of regulatory intervention.

V. Linking risk appetite and profitability

Most publically traded companies declare target profitability rates, either by reference to a risk free rate or as an absolute amount. Profitability targets and a risk appetite statement cannot be viewed in isolation; they have to be looked at in combination and need to be consistent with each other. For instance, it does not make much sense to define a very narrow risk tolerance and at the same time set an earnings target of...
15% risk free. The willingness to take on risks within a defined range leads to constraints on the achievable profitability. Large risks are often correlated with high expected (nominal) returns, but if risk tolerance requires a certain level of capital to be held against those risks, this may limit the achievable return on capital.

VI. Practical example: SCOR

SCOR’s risk tolerance statement takes the policyholder or client perspective, as it is the case for most insurance or reinsurance companies, and requires the company to hold capital at the 99% Tail-Value-at-Risk level. At the same time, the internal model allows SCOR to also quantify other measures which are given by the regulators and the rating agencies. Their perspective is covered in a basic way, by making sure that SCOR holds sufficient capital to cover rating and regulatory requirements.

The shareholder perspective is satisfied by holding an additional amount of capital, the so-called buffer capital. This is computed in a way that it ensures that according to the model the company does not have to be recapitalized more often than once every ten years. The total capital which SCOR is committed to hold, the “target capital”, is the sum of two items. The first one is the maximum of the internal capital, the rating capital and the regulatory capital, with the internal capital being computed at the 99% Tail-Value-at-Risk value. The second one is the buffer which serves for the purpose of avoiding recapitalizations above the defined frequency.

In addition, SCOR has set a couple of high-level risk limit statements, which are considered part of the risk tolerance declaration:

- No risk driver, e.g. line of business or asset class, must consume more than 5% of the available capital when looking at the 95% Tail-Value-at-Risk;
- No extreme scenario with a probability of higher or equal to 1 in 250 must result in a loss which exceeds 15% of the available capital.

SCOR’s target capital

SCOR calculates the required capital based on the internal model and the standard S&P model. In order to satisfy all stakeholders, the maximum of these values is taken, which currently is the rating capital requirement. To this required capital, a buffer is added, chosen on the basis of the 1:10 years quantile of the profit distribution. The absolute value of this buffer is about EUR 500 million. The sum of required capital and buffer yields SCOR’s target capital (Fig. 9), which is compared against the available capital. The difference between available and target capital is called excess capital.

![Fig. 9: SCOR’s target capital](image)

<table>
<thead>
<tr>
<th>Required Capital*</th>
<th>Buffer Capital</th>
<th>Target Capital</th>
<th>Available Capital**</th>
</tr>
</thead>
<tbody>
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<td>3.4</td>
<td>3.6</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>0.5</td>
<td></td>
<td>4.1</td>
<td>4.3</td>
</tr>
</tbody>
</table>

* Currently undergoing rating agency reviews.
** All capital is computed at t₁ with data at t₀.
SCOR’s capital buffer

The buffer, which is added to the required capital for computing the target capital, is needed to ensure that SCOR does not need to be recapitalised too often, thus avoiding a too strong dependency on capital market, but also to cover model uncertainty and non-modelled risks. It also serves as a general, prudent addition to capital.

The way the buffer capital is set should ensure that after a year of large losses, only with a frequency of a maximum of 1 in every 10 years, SCOR has to go to the shareholders and ask them to replenish the required capital. In this way, the 10% tail of the expected profit/loss distribution yields the buffer capital.

Reducing the recapitalization probability increases the buffer. On the other hand, when higher recapitalization probabilities are accepted, the buffer can be smaller, or even negative. Negative values are possible because on expectation the company will make profit.

SCOR ensures that the risk tolerance statement and the profitability expectation are consistent. This is gauged with the use of a function of the target return against the buffer capital which the company holds, measured by the recapitalization probability. The more buffers is held, the lower the return on equity becomes, since the interest earned on the extra capital is not enough to compensate for the loss in ROE. For SCOR, the profitability target of 900 basis points above risk free over the cycle and the buffer currently held for a 1:10 recapitalisation rate are actually consistent.

Fig. 10: SCOR’s capital buffer

Risk/Return trade-off

One objective of the buffer is to fulfil SCOR’s risk tolerance statement that extreme scenarios with the probability of 1 in 250 years or less should not consume more than 15% of the available capital. To this end, SCOR analysed a range of extreme scenarios and estimated their impact on the economic capital. In 2008, the available capital was around EUR 4.5 billion, so the limit of 15% translates into EUR 675 million.

None of the events of probability higher than 1 in 250 listed and analysed exceeded this limit. Only the scenario of a global pandemic came very close to the limit, and for this reason, SCOR took out a mortality swap in order to keep the risk within the stated limits.

Of course, events that come close to SCOR’s risk tolerance are monitored particularly closely.

Conclusion

An articulate set of risk tolerance and risk appetite guidelines is an essential building block for developing a consistent risk culture in the company. It is also a good way to keep the level of diversification of risks acceptable, and to favour interaction between the different business units of the company by sharing the same principles.

Of vital importance is that the profitability targets of the company are in line with the company’s risk tolerance and risk appetite.
Internal models are fast becoming indispensable instruments for the management of the insurance and reinsurance industry. And yet, for many years, the companies in this sector have existed and thrived without such models. We therefore need to ask ourselves what, over the last few years, has led to their development and generalization.

I. The development of internal models

There are several reasons why internal models have developed:

• The first reason is the fact that peak risks in insurance have grown. There are now more risks, occurring simultaneously and across a wider range.
• Furthermore, stakeholders, particularly the companies’ shareholders, have become much more demanding in their attitude towards insurance companies and financial institutions. The increase of importance of other players, such as the rating agencies or supervisors, has strengthened this demand:
  - financial stability has become an essential and decisive criterion for the insured;
  - the regulators are looking at insurance again (SST, Solvency II);
  - investors are better informed (return on equity, new accounting regulations).
• Considerable demographic changes characterized by four phenomena in particular:
  - an increase in the population;
  - its urbanization;
  - its concentration in high-risk zones;
  - greater populations mobility, increasing, for example, the risks of a pandemic (AIDS, SARS, swine flu).
• Important political and social changes: changes to legislation, improved living standards, political instability in certain regions leading to fears of new geopolitical risks, the emergence of international terrorism;
• New technologies: nanotechnologies, new drugs (VIOXX) etc. whose emergence we must anticipate;
• The multiplication of new financial products, derivatives, structured products, in particular in life insurance and credit sectors.

This concern for greater openness now advocated by all those involved requires that we use models to help us assess, calibrate and estimate risks. Finally, the integration of the financial market standards by all banking analysts will push insurers towards a much more effective management of their capital. Moreover, better mathematical and financial techniques for measuring and assessing the risks are now available for practitioners to use. For instance, Extreme Value Theory methods developed by mathematicians in the early 1980’s are now commonly used by Risk Management models, particularly in reinsurance.

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Together these different facts have led to an evolution in risk analysis models and a strengthening of the methods used to deal with these risks. In Figure 11, we illustrate the evolution of risk modeling to get to what we call the risk models of the fourth generation. The mortality tables introduced by Life actuaries, already during the 19th century, in order to try and calculate and measure risks are probably the best example of the first generation of risk models. These attempts concentrated on modeling quantitatively specific risks without caring for their surroundings. Later, the portfolio theory by Markovitz and even earlier by the Italian actuary de Finetti, appeared and we began to group risks together; this approach lasted from the 1960s until the 1980s. Then in 1993, J.P. Morgan made public their quantitative approach to Risk Management and popularized Value-at-Risk (VaR) as a risk measurement tool. It was at this time that attempts began to be made to consider and assess the overall risk of the portfolio.

Fig. 11: Evolution of risk models

Today, we have reached a form of modeling that is not only interested in the tail of the distribution, but in the whole of the distribution, with the aim not only of identifying the risk, but also of managing the portfolio. The objective now is to model the distribution in the centre as well as in the tail to be able to answer questions such as: how likely is it that the plan defined at the beginning of the year will be reached by the end of the year?
II. Designing the model

What do we want out of a model?

• The first reason to develop a model is to provide a method of evaluating the capital required to cover the risk taken by a firm. This is obviously a requirement for the company’s top management, but also for all the stakeholders: financial analysts, investors, rating agencies, supervisors;
• The second reason is to create a unified way of communicating on risk within the company itself and with the other parties involved (rating agencies, investors). Within the company, the capital becomes, in a way, the currency or raw material with which it will work to generate profits.

Once these two initial objectives have been met (determination of the capital and communication on the risks taken), and by encompassing the whole range of risks, the company will be able to take decisions and make strategic choices. What it must do is find the trade-off point between the risks undertaken and the returns expected. I have often used the image of the flight simulator to illustrate the role of the internal model: if you model the conditions of a crash, you will be better equipped to avoid it happening in real life. A flight simulator helps you learn to land smoothly, which in the case of a firm is the way to develop its strategy.

All the information collected can then be used to optimize the company’s underwriting policy. This will involve diversification, both in geographical terms as well as in types of risks, and the measurement of economic performance. An internal model does not solve the conundrum, but it will make it possible to take account of a certain number of data necessary to the solution. What this means is that an internal model can help give us a unified overview of the various risks facing an insurance company:

• Underwriting risks;
• Market risks;
• Credit risks;
• Operational risks.

Treatment using a common methodology also enables comparisons to be made. In particular, we will be able to treat the dependencies between the different risks. Indeed, one of the major causes of the current crisis lies precisely in ignorance or at least the massive underestimation of the dependencies between the risks in time of stress.

The treatment is also more coherent, as the overall risk landscape is measured using specific, common standards:

• In risk assessment: Value-at-Risk, Tail Value-at-Risk;
• The use of risk simulations (Monte Carlo);
• The use of nonlinear dependencies: copulas.

This advanced method of analysis, using homogeneous parameters, in fact enables the implementation of a rational approach to risk. It is an approach that attempts to use and take into account all the information available in order to adjust to the company’s specific situation, and particularly the type of business involved. Hence the idea that there is a need to develop an internal model on top of a standard formula like Solvency II for example.
Figure 12 illustrates the various uses of the model:

- Compliance with the solvency rules by computing the required capital;
- Use of this material to identify, manage and protect against peak risks in the portfolio, for example, by organizing reinsurance cover on the liabilities or using hedging methods on the assets;
- Similarly, models are becoming a basic planning tool: if we wish to launch a new product, we need to be able to measure its performance and the capital it will require;
- Finally, a fourth advantage, especially in the life insurance and reinsurance fields, is that this is an instrument that allows ALM strategies to be developed, that is to say, strategies to invest the reserve portfolio in a way which is coherent with the company’s liabilities in order to optimize the risk/reward of the entire portfolio.

In actual fact, most models are a synthesis of these three types. Deterministic models are very efficient in terms of response time but may turn out to be dangerous, given that the factors used need to be updated regularly to take account of changes in the risk exposure. The sole use of probabilistic models can be effective in calculation terms but scenario-based models are more flexible and intuitive and can help uncover dependences. Using scenario-based models enables us to test the quality of internal models. It is very hard to test stochastic models, particularly in the tails due to the lack of data. Scenario-based results can be used as plausibility checks. Conversely, stochastic models enable us to check the quality of scenario results by comparing the results obtained with the model’s predictions of its probability of occurrence. It is then a matter of determining whether the model is relevant or not by taking into account the probability of the event in question according to the experts: if there is too great a difference between the two opinions on the probability of the event, it means that the model is either over or under-estimating the risks.

The company’s management can therefore be based on its internal model

Basically, there are three types of model:

- Deterministic models: a certain number of factors are evaluated and applied to essentially volume measures like premium or net asset value of the investments. These measures are assumed to be a good proxy for the exposure of the company. The rating agencies’ model and Solvency I are examples of factor-based models;

- Probabilistic models: these are based on probability distributions for different risks which are then aggregated together. For this purpose, they usually use Monte Carlo simulations;

- Scenario-based models: A (frequently large) number of scenarios is generated to value the company in various states around the world.
III. Meeting the requirements of different stakeholders: how to find a satisfactory model?

In fact, there are several points of view as regards the company, as well as several risk assessment models. The rating agencies or supervisors lay down a certain number of principles and standards which the models must meet. Does this mean that we should build a model geared towards the supervisors? The answer is no: the company’s internal model must be built to suit its own requirements and, as a priority, with a view to managing its portfolio.

There are differences between the points of view of, for example, the supervisors and the company management:

- The supervisors confine themselves to the survival of the company over one year. If we consider the Non-Life reserve triangles (Fig. 13), what they are interested in is the variability of this diagonal;
- However, what interests the management of a company is what line of business to develop. In other words, their analysis will not include the variability of the reserves. It is the last column, the development of the triangle to ultimate, that is interesting to examine when choosing what line of business to work on.

The model must provide a response to the requirements of all the stakeholders.

As part of the discussions on Solvency II, the question has also been raised, not without some controversy, of what measurement of risk will be appropriate for these models:

- From the company’s shareholders’ standpoint, it is clearly the Value-at-Risk: for them, bankruptcy must be avoided to limit their own losses and there is no value left beyond bankruptcy.
- On the other hand, for the supervisors and the policy holders, what counts is knowing what the chance is that they will recover their money. A Tail Value-at-Risk, beyond the 1% quantile is important and for them, this measurement constitutes a better criterion.
- Finally, for the company’s management, what is important is to be able to allocate the capital to the different risks in a coherent way. In other words, once the capital has been allocated, residual capital should be non-existent. From a mathematical point of view, this requires a coherent measurement of risk, in other words one that considers the Tail Value-at-Risk.

In figure 14 below, we present some simulations on natural disaster risks.

![Fig. 14: Simulation results for a natural catastrophe model](image)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Hurricane</th>
<th>Earthquake</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected</td>
<td>62</td>
<td>16</td>
<td>78</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>84</td>
<td>60</td>
<td>104</td>
</tr>
<tr>
<td>VaR (1%)</td>
<td>418</td>
<td>332</td>
<td>544</td>
</tr>
<tr>
<td>VaR (0.4%)</td>
<td>596</td>
<td>478</td>
<td>690</td>
</tr>
<tr>
<td>tVaR (1%)</td>
<td>575</td>
<td>500</td>
<td>678</td>
</tr>
<tr>
<td>tVaR (0.4%)</td>
<td>700</td>
<td>598</td>
<td>770</td>
</tr>
</tbody>
</table>

Over this particular portfolio, the mathematical expectation refers to the average losses. For earthquakes, this value is very low, but looked at from a Value-at-Risk at 1% or a Value-at-Risk at 0.4%, the phenomenon becomes much more significant. If we look at the portfolio across the board, the Value-at-Risk at 0.4% and the Tail-Value-at-Risk at 1% are more or less equal. The distribution allows us to calculate both, but when allocating capital, it is better to use the Tail-Value-at-Risk.

- For the insured and the regulators, the risk for an insurance company is that it will not be able to meet...
its payment obligations. The risk-based capital approach concerns the survival of the company for at least one year. What is important in this case is therefore that the TVaR of my capital should be positive one year later. The risk-based capital may therefore be written as follows:

$$\text{RCBs} = \text{tVaR}_{\alpha}(C_1) > 0$$

Where $\alpha$ is the threshold and $C_1$ the capital after 1 year.

• The investors’ point of view is different in that an investment in the company is made in expectation of a certain yield. The uncertainty for an investor is not whether or not the company goes bankrupt, but whether the company will reach the mathematical expectation of the yield. He will build up his portfolio based on the Sharpe ratio, that is to say the mathematical expectation of the yield over the risk. This therefore means the expectation of a profit minus the Tail-Value-at-Risk. In other words, for investors, the risk is that the company will not achieve its ROE objectives. The decision to invest in a company is in fact always conditioned by the expected return on the investment. The risk-based capital is written therefore as follows:

$$\text{RBC} = \mathbb{E}[P_1] - \text{tVar}_R^\alpha \mathbb{E}[P_1] = \mathbb{E}[C_1] - \text{tVaR}[C_1]$$

Where the profit $P_1 = C_1 - C_0$ and $C_0$ is the capital at the beginning of the year.

The two definitions differ by the profit expected for the next year. Thus, the capital required by the investors is greater than that expected by the regulators.

SCOR Switzerland, formerly Converium, has had an internal model since 2003. This model was based on lines of business (LoB) and products, rather than on legal entities. Problems arose, however, when the model needed to be adapted to the solvency rules. In fact, the supervisors are interested in what happens in the different countries. For them, what is important is therefore the legal entities (in France, Switzerland, Singapore etc.) and not the lines of business.

The model gave us the risk-based capital, RBC, for the underwriting year. We are interested in the development of the risks until the “ultimate”, and therefore in the uncertainty of the ultimate reserves. The regulators and the supervisors, for their part, are interested in the risk over one year, which once again required changes to the model. From the regulatory point of view, the risk-based capital should be computed on the fluctuations in the reserves for one year only and not on the ultimate losses.

Introducing such changes in the model, we obtain a model which meets both the solvency requirements as well as the requirements of the company’s Risk Management. The model is the same, but the points of view, the way of looking at the risks are different. We are then obliged to face the fact that the model has become more complex. Whereas in 2003, the sources of risk were no more than twenty, we now have a model with more than 500 sources.

The internal model therefore constitutes an effective means of controlling the risks, for it meets:

• The transparency requirements: for example, all the risks entered into the model must first be checked by the actuaries who introduce them;
• A concern for homogeneity from a security point of view.

The structured model also meets the regulators’ requirements:

• Approaches in terms of RBC;
• Coherence with Solvency II:
  - Standard formulas
  - Internal models

Finally, it is also in line with the rating agencies’ approach:

• Interest in the results of the internal model;
• Interest in developing similar rating models.

The rating agencies are interested in the results of our models for they want to be able to check them against their own model.

The model’s results therefore become a central factor in Risk Management.

IV. Calibrating the model

Before discussing calibration, it is necessary to spend a little time looking at the generic structure of these models (Fig. 15). The company’s strategy will command a certain model and imply a series of risk factors. From that starting point, it is necessary to develop a generator of these factors, which will need to be calibrated so that it can be adapted to the company’s model.

Once the generator has been calibrated, we can introduce the risks, simulate scenarios and obtain results. On the other hand, the mathematical formulas obtained will require translation and analysis in order to obtain operational presentations for the company’s management. From these results we can design better strategies. In fact, we cannot mathematically optimize strategies since we cannot model all the range of possibilities.
This work also requires, as well as complex techniques and software, skilled staff and in the final analysis this is what seems to be the key success factor to a good internal model. Skill means not only providing performance, but also the ability to communicate with senior management.

The SCOR model consists essentially of four basic components. There is a model for Life insurance; a model for Non-Life and a model for investment, and to these three models, we then apply economic scenarios. It is a model for generating these economic scenarios in a consistent way. This model allows us to decide on different hypotheses:

- Inflation hypotheses;
- Stock Exchange growth hypotheses;
- Interest rate hypotheses.

This last model cuts across the other three for all of them use the same economical hypotheses. The final stage is the production of an internal report.

In this model, the idea of dependency is retained. Indeed, we have mentioned 500 sources of risk. If they were all independent, there would be an extraordinary diversification in the model. Now, this is not the case and we therefore have to consider the relationships of dependency between these different risks. The number of variables must be reduced if we are to model this dependency.

### Fig. 15: Generic components of an internal model

![Generic components of an internal model](image1)

**Generic structure of current DFA systems (vendor – independent).**

Note: the internal model is actually a combination of software, methods, processes and skills; skilled people are the most important ingredient.

### Fig. 16: Schematic view of a hierarchical dependency tree

**Non-Life Liability baskets of the model: hierarchical dependence structure**

![Schematic view of a hierarchical dependency tree](image2)
SCOR has decided to use hierarchical dependency trees. In figure 16, the contracts appear at the lowest level. They are then grouped into lines of business, or legal entities. The grouping will enable the dependencies to be determined between a contract 1 and the other contracts in the same line of business. At the higher level, the dependence between various lines of business or legal entities is considered in order to obtain the aggregated portfolio. In this figure, we only show two levels of aggregation. In reality, we have around seven levels in the hierarchical tree.

Each risk is identified within the line of business. The basic hypothesis is that there is no dependency between, for example, an aviation contract and a natural disaster or earthquake contract. Once these different lines of business have been developed, we can look more closely at dependencies: for example credit and surety with aviation, or natural disasters with life. Finally, we arrive at the portfolio, that is to say a hierarchical dependency tree. This enables us to have different levels of expertise and reflection on the dependencies. From a mathematical point of view, we have reduced the quadratic dimension of the parameters to a linear dimension.

Besides the structure of the dependencies, it is important to reflect on the form of these dependencies. Most people model them with correlations, here the rank correlation for example. In figure 17, we show the result of an experiment carried out by SCOR on stress tests: we generate a sample in which the diversification benefit is 8%. This sample is modelled using different dependency models. When we use a rank correlation model for fitting the data, the diversification obtained is 30%, whereas it is 8% in the available data. There is a strong over-estimation of the diversification, and this was one of the problems with the rating agencies’ credit risk models that came out with a very good rating for structured products, which are now virtually in default.

**Fig. 17: Results of stress tests with various models of dependencies**

<table>
<thead>
<tr>
<th>Model</th>
<th>Correlation</th>
<th>Sample Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayton $\odot = 2$</td>
<td></td>
<td>Div. Benefit: 8.2%</td>
</tr>
<tr>
<td>Gumbel $\odot = 2.07$</td>
<td></td>
<td>Div. Benefit: 11.7%</td>
</tr>
<tr>
<td>Student’s $T \ r = 0.71; n = 6$</td>
<td></td>
<td>Div. Benefit: 25.4%</td>
</tr>
<tr>
<td>Rank Correlation $r = 0.7$</td>
<td></td>
<td>Div. Benefit: 30.7%</td>
</tr>
</tbody>
</table>

The difference lies in the fact that in the rank correlation the dependency is the same everywhere, whereas in reality the dependency changes with the size of the risk. We model such dependency behaviour using Archimedean copulas (Clayton or Gumbel).

Furthermore, there is also a wealth of dependencies between the economy and the company’s liabilities. In most of the models, earthquakes, for example, do not have any effect on the economy. However, in extreme situations, such events may have important consequences on the economy. For instance, September 11th accelerated the decline of the stock market and the fall in interest rates. Conversely, an economy in difficulties or with weaknesses has an effect on insurance companies’ commitments. To operate in this type of situation, it is important for the insurance company to have a reliable model of these dependencies.
The relationships between assets and liabilities cannot only be read in an accounting context, which could be summarised by: the premiums received are invested, then when there is a claim event, they are withdrawn to pay for the consequences of this event. In actual fact, the economy will influence our investments as well as certain lines of business. For example, in aviation, in a period of falling GDP, the number of people travelling falls and therefore the amount of received premiums on aviation policies will also fall. The risk of accidents, however, does not really fall. Thus the loss ratio will deteriorate.

In figure 19, we present the allocation of SCOR’s capital for 2008 to illustrate the diversification benefit:

<table>
<thead>
<tr>
<th>Risk-Based Capital, SCOR Group</th>
<th>RBC Diversified</th>
<th>Share of RBC excl. op. risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Life new business (UW year 2008), net</td>
<td>800</td>
<td>26%</td>
</tr>
<tr>
<td>Non-Life reserves (incl. unnamed in 2007), net</td>
<td>1,200</td>
<td>38%</td>
</tr>
<tr>
<td>Life (incl. Life credit risk, market value margin)</td>
<td>700</td>
<td>22%</td>
</tr>
<tr>
<td>Market risk</td>
<td>400</td>
<td>13%</td>
</tr>
<tr>
<td>Credit (excl. Life credit exposure)</td>
<td>15</td>
<td>1%</td>
</tr>
<tr>
<td>Operational risk</td>
<td>210</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total RBC after diversification</strong></td>
<td><strong>3,325</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td>Total RBC stand alone</td>
<td>6,170</td>
<td></td>
</tr>
<tr>
<td>Diversification effect</td>
<td>46%</td>
<td></td>
</tr>
</tbody>
</table>

The model estimates total risks at EUR 3.3 billion. If we add up the standalone total of the risks, that is to say as if we ran the company only on Non-life, only on Life or only as a “hedge fund” for the risks, the total would be 6 billion. The diversification effect here is considerable, 46%.

The technical results are then used to determine the optimum portfolio balance between Life and Non-life. For SCOR, it is situated around 50%. The diversification of the portfolio is beneficial: the risks first decrease by adding P&C business to Life due to diversification and then increase with Non-life, but the yield also increases. The optimum is found where the line giving the price of risk in terms of return meets the efficient frontier as shown in figure 20.
We should never lose sight of the fact that the risk-based capital remains a theoretical estimation. Models are tools that insurers can use, but they must be aware of their limitations. It is often impossible to verify the model statistically. How many 1/100 year events do we have to check the statistical reliability of our tail estimates? Nevertheless, we should test it to make sure that it is a reasonable model. Here are few ways of doing this:

- Sensitivity test: variation in the parameters to see if the results have meaning;
- Prediction test: do the predictions come true?
- Developing independent scenarios to check the model outcomes against them.

Conclusion

These models can considerably improve transparency and Risk Management. They enable us to assess the performance of different risks in relative terms. They facilitate informed discussion at management level: decisions that go against the model are of course possible but, insofar as the model exists, will require justification.

Models are therefore going to play an ever greater role in the insurance decision-making process, as long as they continue to be developed, and we manage to produce more dynamic models which also integrate the strategies of the company’s management.

Debate

Can we say that each company has its own model?

Mr Dacorogna replied that yes we can. Each company should have its own model, but obviously the methods used must be the same. It is a question of adapting the model to the company, mainly to take account of its complexity and sophistication. Mr Dacorogna considers that it is absurd to begin with a very complex model, if people are not ready to take on board or comprehend the results of this model or are not capable of recognizing its limits and questioning it.

Another participant emphasized the fact that there are risks that we can avoid, others that we can transfer and others that we can diversify. But what should we do about inevitable risks? How do we measure them? How can we allocate assets and capital to them?

Mr Dacorogna pointed out that this was a pertinent question. In fact, the company chooses to have, on top of the capital calculated by the model, a “protection” or “buffer” capital. There are three reasons for this. The first is the uncertainty of the model. The second is that we do not wish to be entirely dependent on the investors, constantly going back to them every couple of years to increase the company’s capital. Thirdly, this buffer capital is justified by the possibility of an important crisis occurring. The other possibility is to set very strict, absolutely clear limits and define the level of risk covered, going beyond the model, which as we have said, we know to be inadequate in certain situations.
Controlling risk in an insurance company is a singular activity as risk represents the core business. The insurer’s job is to take on risks, to retain them in the insurance company’s balance sheet, manage them until all the guarantees have been extended and to generate profit through this activity.

I. The transformation of the insurance “business model”

So the insurer’s aim is not to eliminate the risks, but rather to select them.

AXA works from this perspective (Fig. 21), selecting and managing risks: the company has a highly sophisticated system of controlling risk, enabling it to offer

---

**Fig. 21: Risk selection**

**Attitudes towards risk are often ambivalent:**

<table>
<thead>
<tr>
<th>Threat perception</th>
<th>Opportunity realization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety-oriented attitude</td>
<td>Innovation-oriented attitude</td>
</tr>
<tr>
<td>Survival-driven</td>
<td>Incentive driven</td>
</tr>
<tr>
<td>Risk in opportunity</td>
<td>Focus on potential profit</td>
</tr>
</tbody>
</table>

Danger and opportunity

Ambiguous risk acceptance

min max
advanced Risk Management and to be awarded with the “excellent” Enterprise Risk Management score from the S&P rating agency. However, AXA’s aim is not merely to keep a comfortable AA rating or to have a capital base capable of coping with all eventualities, but as well to cover itself against extreme risks. To do this, five years ago AXA decided to create a Risk Management department at group level, so that risk is no longer managed only at operational level.

There are three reasons for this:

- The first is a “bottom up” issue. AXA is a rather decentralized company, and so the risk resides in the eventuality of the same type of risk being taken everywhere at the same time. It is therefore necessary to measure and limit the overall exposure and peaks in exposure by means of consolidated reporting on all types of risks: financial, insurance and operational risks;
- The second is a “top down” issue. Certain concepts can and should only be developed at group level, then being disseminated to the operational entities;
- The final reason results from the lessons learned from the previous crisis in 2001-2003: the downturn in the market at that time turned out to be beneficial to the whole insurance sector, as it led to substantially improving its level of Risk Management. In fact, the 2001-2003 crisis revealed a number of things:
  - the costs of insurance products were often being miscalculated because insurers were focusing too much on equity returns;
  - insurers lacked sufficient knowledge of the risk accumulated in their balance sheets;
  - their ALM (Asset and Liability Management) could not stand up to a market shock;
  - Since then, changes were made to bring in more dynamic Risk Management.

The current crisis (2008-2009) shows just how far the insurance industry has come in terms of Risk Management. Indeed, in spite of the losses recorded – the buffer in the capital base is much lower today than it was a year ago – the insurance sector has so far come through the crisis rather well.

Industry changes are increasingly acknowledged by rating agencies that now include these new Risk Management criteria in their analyses. Similarly, some local regulators, with the Swiss Solvency Test or ICA/ICG in the United Kingdom, give value to better Risk Management and encourage the right behavior.

Nevertheless, in spite of these advances, the Solvency I system, which remains applicable until 2012, continues to keep European insurers in the “old world”:
- There is no differentiation of the risks;
- ALM is not considered;
- The approach to converting debt into capital remains conservative, and insurers find themselves at a disadvantage compared to the banks;
- Diversification and advanced risk transfer techniques are not recognized;
- Finally, there is no harmonization within Europe. Pressure from market, analysts, the rating agencies and the lessons learnt from the 2003 crisis have led the sector to improve its Risk Management and work towards the adoption of Solvency II.
II. Risk Management at AXA

AXA Risk Management team consists of about 350 people, of which 70 people at Group level (Fig. 22). The central team develops the risk framework in terms of risk limits, standards or processes, and oversees the operating entities’ adherence to the framework, supported by the local Risk Management teams.

- A financial risk team is working to define an ALM approach at group level and to coordinate ALM in each of the companies;
- A P&C risk team is responsible for auditing the reserves, fixing indicators and metrics for measuring P&C performance, defining the group’s reinsurance policy, monitoring new products and emerging risks;
- Its equivalent for the Life risk;
- A smaller team on Operational Risk that coordinates the introduction of an internal operational risk model for the Group;
- Finally, there is a specialized team that concentrates on calculation, as well as working on internal economic capital models.

Risk Management also requires a suitable system of governance, allowing effective decisions to be taken at all levels in the company. At AXA for example, decisions on limits and Risk appetite go through committees chaired by members of the Management Board, to cover financial, insurance and other risks, in particular operational risks.

These committees discuss and vote on the decisions, although final approval is given at Management Board level. Risk Management is therefore based on the principle of subsidiarity.

Risk Management therefore involves three steps (Fig. 23):

- Measuring the risks;
- Understanding those risks and their sensitivity to a variety of factors: this means building databases, performing sensitivity analyses, finding ways of actively managing risks (reinsurance, securitization, derivatives) and permanently anticipating by implementing action plans. It also means working with plausible scenarios;
- The final step consists of developing, disseminating and maintaining a risk culture in the company, so that all its staff feel concerned by Risk Management and are aware of their responsibility to control it and protect the company. This multiplies the levels at which control occurs and most risks, especially operational risks, can be avoided. Finally, the dissemination of the risk culture will include the running of seminars and the provision of risk training.
III. The reality of Risk Management

Financial risks

The overview of AXA’s balance sheet (Fig. 24) shows the distribution of its EUR 400 billion of assets, including virtually 80% in fixed income (split between corporate bonds and government risks). The rest is divided between different classes of assets. It is worth noting that equity exposure is quite low.

![Fig. 24: 2008 Asset allocation](image)

2008 Asset allocation (€390 bn GA assets)

- Real Estate: 36%
- Equities: 3%
- Govies: 3%
- Corporate bonds: 3%
- ABS: 4%
- Mortgage loans: 4%
- Alternative investments: 3%
- Policy loans: 3%
- Cash: 8%

The Solvency I model defines a relationship between equity and return on equity in which the greater the exposure, the more profitable it is. Indeed in this model, capital requirement is seen simply as a function of the volume of premiums and the risk is not treated. The new Solvency II model traces out an efficient frontier so that the optimum equity exposure (including the cost of capital, i.e. remuneration of the capital at the rate of return expected by the shareholder), would be below one digit shares.
At the beginning 2008, AXA held 10% shares and was therefore at the maximum limit defined by its model. In May 2008, fears were growing due to the troubled economic outlook, and so the study was redone, which revealed that the group's exposure was probably too high. The results were presented to the Management Board along with a recommendation to dramatically reduce the exposure. The decision was not an easy one for the environment was uncertain, and care had to be taken to avoid losing the benefit of a possible rebound. After some debate, a proposal emerged, which was to buy a put spread that is to say to buy options that would protect the group in the event of a fall in the market, but which would not force it to sell the equity shares. By selling out-of-the-money calls to finance the puts, the cost for AXA was very limited. Today we can see that this decision was a wise one as it has protected AXA and even generated a gain of over 2 billion Euros in capital and value.

This example shows that the important decisions are the fruit of a process, of a system of governance: AXA is organizing itself to be able to take this type of decisions. Nonetheless, not all such decisions will be relevant: for example, at the beginning of 2008, the threat of inflation encouraged the group to simulate an extreme hyperinflation scenario (over 6%). The ensuing discussion led to buy inflation caps. Despite inflation is now very low and these caps are useless, this was a good decision from a Risk Management point of view. This is an illustration of how not all risks come to pass.

Sensitive asset classes are systematically monitored for rates, shares, inflation, mortality, etc. The approach is always the same:

- Study of the nature of the risk;
- Presentation of this risk;
- Comparison with the group's risk appetite;
- If the risk exceeds the limits fixed, action is taken.

Risk Management is above all a matter of decision making.

Insurance risks

AXA's Risk Management rests on five pillars:

- Product Approval Process (PAP);
- Risk appetite;
- Reinsurance and retention policy;
- Independent review of the reserves;
- Long-term vision of emerging risks.

Although the decision to launch a new product is taken locally, it must be the result of a documented approval process that complies with local governance practices and AXA Group standards. The Product Approval Process sets out 4 objectives:

- To measure value creation by an analysis of the risk covering the main requirements: components of the product, price, profitability;
- To guarantee coherence within the group, in terms of operational Risk Management, sensitivity analysis, as well as legal documentation;
- To improve the ratification procedure;
- The launch of accumulation products such as “variable annuity” products with death guarantee, sold all over the world, requires the Group Management Board’s approval.

This PAP is applied to all new products. But, it is a fact that in insurance, and all the more in P&C, we do not often launch new products. We apply this procedure to our in-force portfolio in order to review the products at least every four years. Finally, there is always the possibility, when there is problem with a product, of requesting a PAP specific to this product.

Risk appetite aims to ensure that risks are limited and their consequences on all dimensions understood (earnings, value, solvency, liquidity). In particular, it ensures that appropriate governance, limits and decision processes have been set up to drive Risk Management decisions.

Another tool complements risk appetite: the stress scenarios. No internal model, even a highly sophisticated one, is entirely satisfactory, and it is always necessary to remain vigilant and bear in mind that the model’s results will be dependent on the input assumptions. To overcome these inadequacies, AXA uses stress scenarios whose probability of occurrence is unknown, but which we know are plausible (e.g. liquidity crisis, pandemic, hyperinflation). The objectives are two-fold:

- To analyze the consequences of extreme events for the group:
  - At liabilities level;
  - But also assets level (e.g. a major pandemic will have consequences: certain sectors of the economy such as travel and leisure business will suffer, whereas other sectors, such as the pharmaceutical industry, will benefit from the crisis);
  - Finally, at operational level (e.g. home working in case of a pandemic).
- To define alert levels and action plans, in order to detect a crisis at the first signs and mitigate the impacts.
IV. The lessons of the crisis

The current crisis is unprecedented and generalized:

- Drop in share prices;
- Fall in corporate bond spreads;
- Extremely high rise in volatility;
- Low interest rates.

All these events occurred simultaneously.

In this context, the ability to identify the company’s exposure is essential and will require a degree of reactivity. Thus, AXA has weathered this crisis rather well, thanks to:

- A high level of diversification: AXA is one of the most diversified insurance companies; and thus acquired a natural form of protection;
- Concentration on the core business: insurance and assets management;
- Disciplined and regular control of its exposure in different asset classes.

In the end, this confirms the validity of active Risk Management through:

- Dynamic management of the equity portfolio, in line with the risk appetite;
- Emergency liquidity plans: these have not been needed for the time being, but they are tested every six months. These are preventive measures, enabling us to anticipate future crises, even if they do not cover every base;
- Inflation hedging.

Four lessons have therefore been learnt from the crisis:

- Clearly identify and report the risks - we cannot allow ourselves to take on gross exposures for very high amounts knowing that we are able to obtain coverage from reinsurers or banks to reduce the net exposure (e.g. Lehman default);
- Have a stated risk appetite, to ensure that appropriate governance, limits and decision processes have been set up to drive Risk Management decisions;
- Understand that Risk Management involves more than just the model – extreme events (i.e. tails of distribution) can arise. This reinforces the role of preventive Risk Management, through use test and scenario testing;
- The need for Solvency II and to share experiences: this means promoting best practices in Risk Management everywhere in the world.
For the last 30 years, the threat of terrorism has not stopped growing. The consequences of the acts of terrorism have grown worse due, in particular, to technological progress. The marketplace and the insurance business are adapting to this situation. Following the WTC bombings in September 2001, the reinsurance community adopted a strict policy with regard to these risks and, whenever possible, imposed terrorism coverage exclusions on the largest risks.

In order to assess its maximum exposure, SCOR has identified three scenarios:

- A conventional attack: a 2 tonne bomb/aircraft impact followed by fire with 100% damage;
- A wave of 4 large-scale simultaneous bombings;
- A single nuclear attack based on a Hiroshima-sized fission atomic bomb of 10KT.

These scenarios are applicable to any major critical urban or industrial concentration such as:

- USA (New York for the nuclear event);
- France (Paris-La Défense for the nuclear event);
- North Sea for the offshore business.

Experts from SCOR’s various fields study the scenarios in order to put an estimate on the cost of possible losses. A table showing the potential loss per line of business for each scenario is created. The total loss amount is calculated based on the “worst-case-assumption” that all the effects are combined to cause the biggest possible loss. These amounts are compared with stated risk tolerance levels to ensure that SCOR is not over-exposed to terrorism taking account of both severity and frequency.
The word pandemic comes from the Greek words “πάν” and “δῆμος”, literally meaning “everywhere in the population”. A pandemic is the last step in a series of increasing incidence rates: the “endemic” state refers to the baseline incidence rate, which can develop into a localised “outbreak”, in turn leading to an “epidemic” when one or several countries show increased incidence, and ending as a “pandemic”, when the impact is global.

The term pandemic is usually reserved for communicable or infectious diseases, although it is sometimes applied to non-infectious diseases or conditions as well, such as in “obesity epidemic”.

Infectious diseases can be classified into two categories: common source, and “host to host” or propagated diseases. Transmission of pathogens can take various forms, such as inhalation of infectious particles (e.g. influenza), physical contact with infected individuals (e.g. Human Papilloma Virus), intake of contaminated food or water (e.g. Salmonellosis), or vector-borne spread (e.g. Leishmaniasis).

Although common source infections can cause outbreaks, their source is usually quickly identified and eliminated, so they usually do not develop into a pandemic. The pandemic potential in propagated diseases depends on the contact rate between carriers, and on the disease’s virulence.

HISTORIC EVENTS

Pandemics in recent history were mostly triggered by influenza. The Spanish Flu from 1918 comes to most peoples’ minds when talking about historic pandemics, and in total there have been between 10 and 13 influenza pandemics with new virus forms since the 18th century. This is the reason why influenza-triggered pandemics are currently the main subject of concern for companies and countries dealing with emergency preparations. The picture was very different in the past, with many major events caused by other infectious agents. For instance, the “Black Death” (probably caused by Yersinia pestis) wiped out a third of the European population in the 14th century. The Roman Empire was victim to the Antonine plague (probably
smallpox or measles) in the 2nd century, where total deaths have been estimated at five million. Also, many indigenous populations coming into contact with “civilisation” suffered a horrendous death toll from imported infectious diseases that were deemed harmless in their countries of origin, such as measles.

Comment: possibly insert table based on following data, made up nicely in SCOR style:

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Death toll</th>
<th>Subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asiatic or Russian Flu</td>
<td>1889-1890</td>
<td>1 million</td>
<td>H2N2 (not confirmed)</td>
</tr>
<tr>
<td>Spanish Flu</td>
<td>1918-1920</td>
<td>20 - 50 million</td>
<td>H1N1</td>
</tr>
<tr>
<td>Asian Flu</td>
<td>1957-1958</td>
<td>1 - 1.5 million</td>
<td>H2N2</td>
</tr>
<tr>
<td>Hong Kong Flu</td>
<td>1968-1969</td>
<td>0.75 - 1 million</td>
<td>H3N2</td>
</tr>
</tbody>
</table>

MODELING

In order to assess the potential development of a disease, and from this the impact on a company’s insured portfolio, a standard epidemiological model for infectious diseases called the “SIR” model can be used, which allows transitions between the states “Susceptible”, “Infected” and “Recovered/Removed”. Parameters for a full model are Population, Number infected, Contact rate, Transmission efficiency, Mortality rate, and Recovery rate.

A simpler approach is to only model extra mortality. Historic data can be used as a starting point, but needs to be adapted to take into account positive factors such as changes in medical progress as well as exacerbating factors, for example increased international travel. Excess mortality can be estimated either as a relative increase, e.g. a doubling in mortality, or as absolute loading, e.g. 1‰ extra mortality for a 1:200 event. Guidance for estimating the impact of an extreme pandemic can be taken from international bodies, like the CEIOPS in their advice on the calibration of SCR and MCR in the Quantitative Impact Studies (“QIS”). The QIS4 calibration of the mortality and disability catastrophe risk uses an estimate for excess mortality within an insurance portfolio between the states 1 and 1.5 deaths per 1000 lives in most developed countries for a pandemic with a level of severity expected once every 200 years.

Generally, excess mortality is a function of return periods. SCOR uses a Pareto distribution for this purpose. Sophisticated modeling also includes morbidity and mortality assumptions per age (group) and per status of insured.

EXPOSURE

In Life and health insurance, all products will be impacted, albeit in varying degrees. For the extreme scenario calculation, SCOR analyzed the sum at risk under life covers by country, by age and by gender. The gross impact was reduced by natural hedges, e.g. from existing disability and Long Term Care claims, and by mitigation measures such as the mortality swap.

The repercussions of a pandemic would also be felt in Non-life insurance, but generally to a lesser extent. In extreme scenarios, an impact on Credit & Surety, Casualty, Medical Malpractice, Marine and Energy amongst others should be analyzed. Natural hedges such as reduced claims under Motor and Aviation lines will act as a counterbalance.

On the asset side, financial markets and economies react very strongly to a pandemic. Equity and corporate bonds may lose value due to the pandemic affecting entire economies, with sectors such as leisure and transport hit harder than others. Default rates on corporate bonds from the vulnerable sectors will increase.

Long-term interest rates are expected to fall, generating an impact on the economic capital that depends on a company’s duration matching. Business operations will be negatively affected, with cost of disruption due to absenteeism of staff. Temporary reasons include employees being directly affected by the disease, caring for a sick family member, caring for children when schools are closed, or being unable to reach the workplace due to break-down or restrictions of public transport. Permanent absence of employees as fatalities from the pandemic has to be taken into account as well. When planning business continuity and deciding about critical core processes, temporary unavailability of infrastructure has to be modelled, on a first level (water, electricity) as well as on a second level (intranet, telephone, postal services).

CONCLUSION

A holistic extreme scenario for a pandemic will allow a company to decide on mitigation measures to install upfront, such as reinsurance and a well-rehearsed BCP. But it will also allow the company to actively steer through the crisis, and thus enable the company to reap the benefits of a strong ERM.

Although the progress of medicine, pharmaceutical research and prevention might make a severe pandemic less likely, complacency would be dangerous. The production of drugs and vaccines are limited and highly localized, with drug distribution a huge logistical effort, and the evolutionary arms race between humans and pathogens means that the best we can do is to be one step ahead.
EMERGING RISKS

Emerging risks include new unknown risks and also changing risks that are already known but evolving; they are marked by high uncertainty and by being difficult to quantify.

In order to avoid unexpected losses or unforeseen claims developments and take advantage of potential strategic opportunities, SCOR’s Emerging Risks Governance & Process unit has created an observers’ community across the whole Group, as well as designing an emerging risk identification system (the so-called EchO, Emerging or Changing Hazards’ Observatory) that enables the observers to share and discuss their perceived emerging risks.

The observers are expected to develop their own networks in order to gather (local or global) early risk indicators that they believe could lead to adverse events or opportunities. While it is important to keep an eye on scientific developments, the main focus is on new laws and regulations and on court rulings, which could ultimately have a negative impact on claims. For each risk, it is important to link the adverse event or trend with the potential impact on the portfolio currently in runoff or in force, as well as on new business.

After the perceived risks have been collected, a dedicated Steering Committee for the assessment & control of such emerging risks meets on a monthly basis to:

• analyze the emerging risks that have been identified,
• sort them,
• enable the Risk Management department to sort the emerging risks and propose responses to executive management.

• ELECTROMAGNETIC FIELDS

DOMINIQUE FORT, Risk Management - Underwriting Audit - SCOR Global P&C SE
FABIEN GANDRILLE, Group Risk Management - SCOR SE
RALF ROESCH, Practice Leader Casualty Treaty - SCOR Global P&C SE

Even though there is no conclusive technological or scientific proof of any causal link, electromagnetic fields (“EMF”) are suspected of causing diseases and provoking fear, concern and discomfort amongst the public. There is a risk that the pressure of interest groups, including the media, will promote a gradual transition from liability based on fault to liability based on presumption or suspicion.

In a preliminary report on the effects of EMF on human health dated December 19th 2008, the European Parliament emphasizes that insurance companies tend to exclude cover for risks linked to EMF from their public liability policies, i.e. that European insurers are already acting on the principle of precaution. This behaviour is also justified by more and more convictions being based on alleged biological injury, despite the lack of evidence of any link to electromagnetic fields. EMF potential claims characteristics are defined by a potentially very large number of claimants worldwide and by latent effects. Consequently, they could spread across numerous contracts. Deep pockets are needed but it remains extremely difficult to assess exposure in monetary terms.

In the light of some recent French case law decisions, the EMF were elected as an Emerging risk early in 2009 and have been analysed by a task force of four experts from different areas (Treaty and Facultative, Risk Management at Corporate and SGPC levels). The team has been supported by the SGPC CEO, Victor Peignet, and all the Business Unit Managers throughout the world. Active research was conducted using SGPC’s global network as well as SCOR’s IT resources, in order to track the exposures from the active portfolio. This research supplied significant documentation, which was discussed during 15 Group meetings from January
to May 2009. The conclusions were set against underwriting capacity in order to define two scenarios: a realistic one and a worst-case one. Both scenarios were assessed and quantified in terms of financial impact and probability of occurrence. It turned out that the manufacturers and operators of mobile phones, electricity producers and suppliers and railway companies were the companies most exposed by EMF.

**SCENARIO 1 – REALISTIC CASE:**

**Environment**
- **Science:** no evidence, contradicting studies, various diseases alleged;
- **Law:** courts apply doctrine of causal link based on objective evidence and unchanged legal base, in particular class actions are not widely applied outside US;
- **Society:** unchanged social security, discussions ongoing, national health authorities deny evidence or consider very weakly some NGO activity; majority of society not aware and/or in favour of technical comfort provided.

**Assessment**
- Limited increased EMF litigation and insurance-relevance but fully within current environment;
- Some claims but few claims are successful (namely in US and France); no successful class action in the US;
- Past and in-force book concerned;
- Top–down evaluation: we assume a number of claims per year (observation period = 16 years) and per country. We estimate an amount per claim including the legal costs and the probability of claims success. Amounts obtained per country are aggregated and the total provides a worldwide estimate (excluding USA) against which the SCOR market share is applied.

**SCENARIO 2 – WORST CASE:**

**Environment**
- **Science:** evidence at least for some EMF disease specified: leukaemia in children (power lines), brain cancers (mobile);
- **Law:** awards regularly made against industry, successful class actions wherever legally possible;
- **Society:** unchanged social security, national health authorities admit certain negative impacts, majority of society against effects that are especially dangerous for children (power lines, mobile phones), class actions against leading mobile phone companies, operators, power lines.

**Assessment**
- Strong changes in all relevant areas (science, legal, etc.) except social security;
- Claims frequency considerably increased in all countries, all lines of business and all activities considered;
- Legal costs substantially increased due to class actions, compensation per person is also increased;
- Deep pockets, large corporates like tobacco companies are sued, which could also be extreme;
- Bottom-up valuation: we consider our respective exposure per type of policy and our book exposed to the major insurers active in the industries mentioned above. We retain the main aggregate limit per year of the period of reference (16 years) per country and amounts are aggregated with all lines of business combined worldwide (excluding USA).

**CONCLUSION - RECOMMENDATIONS**

The extent of policy coverage has generally been contractually restricted through a specific EMF exclusion or by introducing specific limits of liability, especially for critical occupancies. Moreover, proper monitoring and good aggregate control of EMF exposures must be implemented.
Cyber attacks are steadily increasing and becoming more sophisticated. However, the level of expertise and the cost required to launch such attacks is in steady decline. Although SCOR does not provide any online payment services, its geographic exposure is high with its 6 hubs, 52 locations on 5 continents all connected to each other.

Consequently, the maintenance and monitoring of Networks and Systems require global processes, particularly to coordinate the requests and to share the information. Emergency response teams have been set up to alert and quickly react all over the world when such attacks occur. The recording of all incidents in a global database helps to improve the organisation’s readiness.

The major concern in such situations is to protect the data or to initiate appropriate disaster recovery procedures. Centralization increases the efficiency in identifying and responding to incidents, and in providing a global view of the risks. This has to be combined with a regular assessment of new and emerging threats by means of an IT Risks Intelligence watch. A specific tool is used by SCOR to record key IT risks and security governance best practices in order to comply with the best standards. The general IT security policy is quite standard and high-level, but on the detailed security policies it is important to take into account changes the technology, changes in the tools, and changes in the architectures in place.

SCOR’s specialized IT staff aim to provide the strategic business areas with secure, accurate and timely information. According to these requirements, SCOR’s IT internal control framework has been revised to be based on a process, risk and control approach. SCOR has identified 12 major risks, either coming from outside or inside the organisation.

The framework covers the four ERM domains:
• Strategic: definition of the strategy taking into account all the financial aspects, definition of the budget and Risk Management aspects. Acquisition and implementation of new systems and applications have to take into account security considerations;
• Operations: to manage all IT operation activities with security and continuity in mind;
• Reporting: monitoring and evaluation to check compliance with objectives, the strategy of the company, and the regulatory obligations;
• Compliance: SCOR formalized a general IT security policy, compliant with Best Practices and also in line with ISO 2700X international standards, which sets the minimum level of security required, and constantly monitors compliance to this policy.

Companies are responsible for Risk Management, even when they have outsourced parts of their operations. The challenge lies in choosing the right solutions, the right systems, and the right processes. Obviously, a residual risk remains: new attack methods keep appearing, for instance the imminent rise of cyber terrorism which aims to bring a whole company or a whole country down. Hence, you have to stay vigilant and always be prepared!
With the aim of respecting its risk tolerance and the limits attached to it, and in order to satisfy its profitability objectives, the SCOR group has implemented various different solutions relating to the risks it takes on. A few examples of these are set out below:

- **The Atlas V cat bond**, designed to protect the North American portfolios with regard to earthquakes and wind perils, has enabled SCOR to renew the portfolio inherited from Converium within the Group’s defined risk appetite as shown below, whilst ensuring the greatest level of diversification in both inward and outward reinsurance and strengthening the teams’ know-how with regard to securitization solutions.

- **Compliance** is a key area and is particularly complex for an international company subject to many legal and regulatory requirements in a large number of countries. The emphasis herein is on anti-fraud policy and the requirements of competition law.

- In order to limit the impact of a possible extreme pandemic, the SCOR group has decided to cover its mortality risk exposure through **mortality bonds and swaps** with a well-known banking firm. The risk modeling of this exposure requires strong genuine know-how, paying particular attention to be paid to foreign exchange risk and counterparty risk.

- The former Converium **US Cat business** has been renewed under specific conditions. The pricing level we experienced for this exposure led to an excellent expected return on allocated economic capital. According to the internal model there was only a limited additional capital need, in view of the enhanced book diversification achieved with this portfolio addition. In order to address the Board’s request not to change the risk profile, an additional protection to Atlas V was purchased. The occurrence of extremely severe hurricane Ike confirmed the validity of the assumptions and calculations that were made.

- **Financial crisis management**: in a challenging financial market environment, a cautious investment approach is paramount. At a very early stage, the SCOR Group Investment Committee decided to favour a liquidity accumulation strategy regarding cash and short-term investments, aiming for maximum liquidity and a minimal counterparty risk. We have rigorously monitored counterparty risk, on a virtually permanent basis, modifying the limits allocated for each bank across the World and country for government bonds in accordance with the information available at the time. Temporarily, and to the benefit of its crisis avoidance strategy, the strategic asset allocation policy set out in the strategic plan Dynamic Lift was no longer the main focus. This consistent and pragmatic policy has significantly limited the impact of the crisis for SCOR.
In February 2009, SCOR launched its Cat Bond “Atlas V” to provide extra cover for US exposures, and to a lesser extent Porto Rico, for hurricanes and earthquakes. It was the seventh time that SCOR had used financial markets to cover a part of its risks. Indeed, SCOR’s retrocession scheme highlights the fact that a third of the whole capacity comes from financial markets, this solution being especially used for extreme risks. The trigger on “Atlas V” is an industry loss warranty, based on state-level Property Claims Services (PCS) insured industry loss estimates, further distributed to county level by modeling firm AIR Worldwide. The USD 200 million Cat Bond is divided into three series of notes: USD 50 million Series 1 (rated B+ by Standard & Poor’s), USD 100 million Series 2 (B+) and USD 50 million Series 3 (B) and is structured to run over three years from 20 February 2009 to 19 February 2012.

SCOR’s motivations:

• To secure a source of multi-year retrocessional capacity from the capital markets;
• To obtain fully collateralised protection to complement SCOR Global SE’s retrocession program as the available market has been shrinking;
• To provide SCOR with alternative capacity as a cycle management tool;
• Investors in Cat Bonds require transparency in the underlying risks which they are taking, and therefore SCOR agrees to carry some basis risks as the “trade-off” for accessing their capacities. Some basis risk, even if only very small, is inherent to any synthetic cover. The principle was to maintain the risk level in SCOR’s risk appetite. The goal, however, is to minimize this basis risk under 1%: the LAZR methodology gives the best possible compromise (PCS loss distributed by AIR from state to county level).

Indeed, the context was particularly unfavourable, after the Lehman Brothers collapse, and investors’ trust was to be restored. Consequently, SCOR decided to set up a strict and innovative Collateral Management structure to limit credit risks and improve transparency and security standards for investors:

• Improvements in managing counterparty risk for SCOR and investors by employing a much-enhanced total return swap structure;
• Full and permanent transparency regarding the asset development of the collateral for investors; following an event, the AIR model will make available an illustrative range of potential losses to the Notional Portfolio(s), based on their ALERT service technology;
• The permitted investments to be deposited in each collateral account could only include cash, US Treasury Securities, FDIC-Guaranteed Bank Debt, German, French or Australian government guaranteed Debt or US treasury money market funds;
• US-government-backed debt obligations as the underlying securities;
• Top-up “margining” facility by the total return swap counterparty of Deutsche Bank that guarantees that the collateral will constantly be replenished in the case of a drop (under 97.5% of the collateralised amount) in the underlying security.

The key drivers requiring that Atlas V be recognised as a derivative lie in the fact that there is not a perfect correlation between the potential loss and recovery: under certain events, SCOR has the possibility of recovering more than the amounts paid out in insurance losses. Moreover, the absence of an Ultimate Net Loss (UNL) clause is also a key determinant in defining the structure as a derivative.

The “Atlas V” notes were placed with institutional investors around the world, the investment having been significantly over-subscribed. This success entailed the reopening of the cat bonds market: since February 2009, nine securitizations have been launched on capital markets.
As a response to meeting increased and tightened regulations and compliance requirements, SCOR has implemented various compliance initiatives to strengthen the compliance culture and framework.

In order to achieve this goal a new position of a Group Compliance Officer has been created and compliance functions were embedded in the Hubs to monitor changes in the compliance environment and to implement necessary measures. Besides these organisational measures increased efforts have been made to raise awareness amongst staff on compliance risks and obligations by using multiple channels such as quarterly legal and compliance newsletters, e-learning and training seminars. Finally, a new online platform was implemented to ensure easy access to Group and Hub compliance policies, news and compliance resources.

Given the financial and economic crisis, increased vigilance needs to be given to the following key compliance risks, amongst others, as highlighted in several recent surveys:

**IMPROPER PAYMENTS**
The World Bank estimates that around USD 1000 billion a year is paid in bribes and a recent Ernst & Young study* amongst 1 200 major companies in 33 countries revealed that 23% of respondents knew someone in their company who had been approached to pay a bribe to win or retain business. Over a third of respondents felt that the problem of bribery and corrupt business practices is getting worse and 41% of respondents stated that corrupt practices are prevalent within the insurance sector. This risk situation requires the strengthening of a zero-tolerance stance on bribery and appropriate awareness raising.

**COMBATING MONEY LAUNDERING AND TERRORISM FINANCING**
The International Monetary Fund estimated that the amount laundered worldwide each year is in the range of 2 - 5% of the global Gross Domestic Product. The Financial Action Task Force, an international organisation focusing on combating money laundering and terrorism financing, stressed in one of their reports that a number of experts view an emerging trend of money laundering through the (re-)insurance industry. Those experts state that money launderers appear to be moving money to this sector to take advantage of its unregulated or less regulated status. Appropriate risk responses of insurers and reinsurers require a vulnerability assessment to money laundering risks taking into account the products and services offered, business exposure to high risk countries and distribution channels used. Based on this analysis adequate “Know-your-Customer” processes, training, systems and controls need to be established and maintained and a designated function needs to be in charge of anti-money laundering measures.

**FAIR COMPETITION**
Training and other efforts need to be considered to reduce the risk of employees being tempted in light of the difficult market environment to enter into anti-competitive arrangements with competitors instead of competing with them. Group-wide policy and training need to highlight risks related to illegal arrangements and proper business conduct required. Fines for anti-competitive conducts are increasing. The European Commission imposed fines of EUR 5.6 billion for cartels in 2007/2008 (compared to EUR 2.6 billion in 2005/2006).

*Ernst & Young corruption or compliance: weighing the costs.*
One of the main threats to Life insurance and reinsurance are pandemics. Extreme mortality bonds and swaps are alternative ways to mitigate this risk in addition to the traditional reinsurance and retrocession market. Whilst there have been six extreme mortality bond issuances up to mid-2009 (Swiss Re (3), Scottish Re, AXA, Munich Re), SCOR is the only reinsurance company that has entered into an extreme mortality swap transaction so far.

The core feature of a mortality bond or swap is the calculation of the contingent claim payments that the “reinsured” is entitled to receive. They are defined by the chosen mortality index, trigger and exhaustion level: once the calculated index value exceeds the predefined trigger level, the “reinsured” starts to receive payments. These increase linearly between the trigger level and exhaustion level in proportion to the mortality index value in excess of the trigger level up to the full face amount of the swap. The mortality index itself is usually defined as a weighted two year rolling average of age, gender and country mortality rates from publicly available sources (e.g. INSEE in France, CDC in US) as a percentage of a predefined base mortality.

In order to minimize the basis risk, setting the weights of the mortality index definition for a given transaction requires a detailed knowledge of the “reinsured’s” life portfolio to ensure the best possible correlation to the population-based mortality index. However, changes in the portfolio structure and to the expected population mortality rates (e.g. mortality improvements) during the risk period of the transaction are difficult to anticipate.

One major advantage of a mortality swap structure compared with a bond is its simplicity (especially from a legal point of view). It is usually a bilateral transaction in which the premiums (the fixed amounts) payable by the “reinsured” are swapped to the contingent claim payments (the floating amounts). Consequently a swap structure involves a lot fewer structuring efforts compared with a full bond issuance. In order to mitigate the credit risk toward the swap counterparty, the contingent loss payments are usually collateralized in a collateral account which is pledged to the “reinsured”.

**Fig. 25: Structuring basics – A typical extreme mortality bond structure**

**Fig. 26: Structuring Basics – Contingent Claim Payments**
The decision to develop the US Cat portfolio at SCOR was taken after an indepth analysis of the portfolio and its impact on the Group’s risk landscape. The responsible managers who joined the company from Converium were asked to prepare a business case highlighting the value proposition of their business. As per ERM processes the business case had to be presented to the SCOR Global P&C management and subsequently to the Group’s Executive Committee and Board Risk Committee.

The document had to address important ERM aspects such as:

- Impact on diversification and expected profitability: The pricing level of the business led to an excellent expected return on allocated economic capital with according to the internal model a limited additional capital need considering the greater diversification of the book achieved with this portfolio addition.
- Established platform and experienced team: the underwriters were writing this business successfully for many years out of Zurich. They were applying high quality standards and processes. This significantly reduced the operational risks involved when writing this business which was new to SCOR.

In order to reduce the volatility of the portfolio and to protect the Group’s capital SCOR used traditional and innovative solutions, such as the Atlas V cat bond which is designed to protect the North American portfolios with regard to earthquakes and wind perils.

The implementation of ERM processes at a reinsurance company can however only be successful if best practices and common sense are applied in day to day underwriting.

Cat underwriting already included for many years Risk Management techniques, long before ERM was born. However, despite all the efforts, cat type events were one of the primary reasons for the default of reinsurance companies in the past, principally because of the failure in accumulation control resulting in over exposing the balance sheet.

The task in catastrophe underwriting is to maximize the portfolio return by optimizing the diversification by peril and region. In addition the client diversification and also the product density by client, i.e. cross selling with other lines of business, should be targeted. All this has to happen in an ERM framework.

What are the main ERM issues when writing Cat business?

- Data quality (underwriters have to understand and quantify the exposure);
- Accumulation Control (for Cat type events, per Risk, and for Terrorism);
- Checks and balances (four eyes principle to minimize the risk of mistakes);
- Client security (what is the financial stability of the client; will he be able to offer business continuity to pay-back after major losses?);
- Client concentration (avoid dependency for a single client);
- Channel concentration (avoid dependency from a broker);
- Anti money laundry considerations;
- Adherence to Underwriting Guidelines;
- etc.

Cat accumulation control is one of the most important ERM and underwriting tasks in the underwriting process. In order to minimize the dependency on the accuracy of a single cat model SCOR is practicing where reasonable a multi model approach by using two vendor models. In a further step we eliminate as much as possible the risk of a critical model mis-assessment by tracking our nominal commitments and limits by peril zone.

We are fully aware of the fact that by doing all of the above we still have other risks to address and to manage, such as:

- Climate change;
- Model uncertainty;
- Model changes;
- Unmodeled perils;
- Unknown correlations;
- Regulatory risks.

This clearly illustrates that ERM in cat underwriting is a continuous process and there will be always new topics we have to address and to include in the ERM framework.
In spite of an unprecedented turbulent context, SCOR has anticipated and successfully weathered the financial storm through three successive periods:

• Cautious asset management: the strategic asset allocation followed a strict and conservative ALM Process combined with a conservative fixed income portfolio and limited exposure to sub-prime and monoliners;

• Cash accumulation: the anticipation of the crisis led to accumulate cash, shorten duration and restrict equity exposure. Bonds maturing were reinvested in cash to cut the liquidity threat and protect the value of the portfolio;

• Crisis management: bank exposure was drastically reduced and closely monitored. Weekly meetings of the Group Investment Committee were established for counterparty risk reviews.

During the financial crisis, two constraints were to be managed:

• Deviation from strict ALM strategic asset allocation by cash accumulation and close monitoring of the bank exposure (SCOR was over exposed due to cash accumulation). Consequently and very quickly, the Investment Committee decided to protect the assets by moving from the riskiest banks to T-Bills. The remaining banks were very carefully selected.

• Focus on credit quality: the key question in this context was: who’s next? Consequently, anticipation of default risk on corporate and financial issuers was monitored via Moody’s KMV tool. Early monitoring of state credit worthiness also enabled us to sell government bonds before rating agencies’ downgrades (Greece, Spain, and Ireland). Investments were guided to explicit state guarantee rather than implicit ones. Finally, reactivity enabled us to quickly check SCOR’s exposure to the main news: SCOR was not exposed to Madoff or Standford, and had little exposure to bank hybrid debt.

In spite of a material cost regarding asset profitability, the portfolio allowed for the preservation of SCOR’s wealth. Indeed, very close Risk Management and strong reactivity enabled SCOR to successfully manage the heart of the crisis. The aim of such management really lies in balancing and optimizing the risk/return profile.

SCOR Global Investments will further enhance internal control and ERM of assets under management. This structure presents the advantage of a strong regulation with strict procedures to follow and reinforce controls. At any time, the regulator must be able to identify the risks, to know how to manage them and to assess their compliance with the client’s risk appetite.

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**Fig. 27: Macro calendar of the crisis**
Whilst we are being told that the world economy has become global, the least we can see and say is that there is still a long way to go before worldwide standards may be governing business, companies or institutions and these can be assessed and ranked according to worldwide accepted gauges.

Despite this real situation where local or specific (whether it be national or cross-borders lobbied) rules and values are still very much alive and powerful, there are a few concepts that have gained international recognition and Enterprise Risk Management (ERM) is one of them.

Of course, this does not mean that ERM is being uniformly applied worldwide but:

• there are indeed signs that it is having a more and more significant impact on the behaviours of all stakeholders internationally, and
• the unprecedented crisis the world is suffering from is acting as a catalyst to promote it and accelerate its establishment as one of the key drivers, in particular for financial services (which insurance and reinsurance belong to).

ERM may be seen as the end result of a progressive evolution of the governance of companies, from Management to Risk Management and from Risk Management to Enterprise Risk Management. It has also to be seen as an achievement that is unstable and in danger by nature and that may not last long enough to produce all its benefits unless its maintenance and refinement or enhancement are being continuously taken care of with all due and required consideration. For it to be efficient, it must be kept as dynamic and evolving as the risks themselves, both known and or yet emerging. Since ERM takes time to be put in place, to become routine, to produce its effects and to be proven by being tested, it is not compatible with ever-changing organisations and business models.

The transformations of a company towards being Enterprise Risk Managed are not given and can only be obtained by the means of a major effort by the entire organisation. It implies a strong steering from the top management and an efficient top-down communication to mobilize energies, create the degree of appropriation of the objectives and the initiatives at all levels and generate the bottom-up contributions and behaviours that are the conditions of its success. When the decision is made to deploy ERM, it has to materialize as a major project for (and carried by) the company and it has to be handled as such, including in terms of priorities, not to lose momentum. Otherwise it has the risk of not being bought internally, facing inertia and delays and ultimately failing at a substantial cost, which goes beyond large amounts of money having been wasted.

**Conclusion**

ENTREPRISE RISK MANAGEMENT: A MANAGED CULTURAL TRANSFORMATION AT THE CORE OF OUR INDUSTRY

VICTOR PEIGNET,
Chief Executive Officer of SCOR Global P&C SE

NORBERT PYHEL,
Deputy Chief Executive Officer of SCOR Global Life SE
As well as being a project, it must not be the project of a team of specialists, and one of the greatest difficulties is to combine an efficient run of the project (within budget and deadlines) with the direct involvement of all the operations and functions of the company. This is even more true as the first phase of an ERM project implementation is a tedious and cumbersome process that takes the best operational and functional expertise partly out of their business priorities.

The number one requirement for such direct participations in the project is to manage the changes of culture whereby the three words “Enterprise”, “Risk” and “Management” can be individually and collectively understood and accepted.

As for the path and the pace of the transformations, history shows that, whether it be the step to Risk Management or to Enterprise Risk Management, such in-depth changes are in most of the cases forced through as consequences of major problems at the level of the company itself or at the larger scales of a sector of the economy and the entire world economy. The “learning by suffering” experience of SCOR is a living example of such a two-step transformation. Whist the first step had very much to be a top-down, fast-tracked change under pressure and was felt as an unfair sanction by those functions and business units that did not contribute to the problems of 2002-03, the second has indeed been positively valued because, being coupled with the implementation of the internal model, it has involved a lot of self-assessment exercises and it has opened up the views to the global picture of the company, its drivers, its high-level objectives and its key performance indicators.

Not only does the ERM project serve its main purpose of educating and securing all the decision-making processes but it solidifies the links between all the entities of the company by increasing their awareness of their respective contributions and by pooling them around common thought processes and goals. It also implies openness to human errors, and, in particular to those errors that did not give rise to losses and used not to be disclosed, so that the entire organisation can learn from the near misses and progress. Such a project is an integrator as well as a big push towards longevity in business, sustainable development and best-in-class performance.

SCOR believes that its investments in ERM are beneficial to its clients too. It views this first seminar dedicated to ERM as an opportunity to communicate and obtain feedback in order to improve and adapt its management of changes.
Guest speakers

LAURA SANTORI  
*Senior Director, Head of ERM Europe – Standard & Poor’s*

Laura Santori is a Senior Director at Standard & Poor’s Financial Institutions Ratings Europe. Laura is the head of the Paris and Milan insurance teams and, since May 2005, head of Enterprise Risk Management Europe. Laura joined in February 2001 from Bacon & Woodrow, an actuarial consultancy firm based in London. She is a qualified actuary specialised in life insurance. Before joining Standard & Poor’s, Laura spent four years with Generali, three of which in Hong Kong, and three years Bacon & Woodrow, an actuarial consultancy, in London.

JEAN-CHRISTOPHE MENIOUX  
*AXA Group Chief Risk Officer*

Jean-Christophe Menioux is Chief Risk Officer for the AXA group, in charge of Risk Management for P&C and Life risks, financial and operational risks, and capital management as well. The Group Risk Management area has approximately 70 people centrally, covering a broad range of areas including asset liability management, the reserving process, application of the product approval process, risk monitoring, operational risk, economic capital and Risk Management systems. Previously he was Director of Financing and group Treasurer. His responsibilities involved the centralized financing of the AXA group, including all types of Capital markets solutions such as securitizations, subordinated debt or rights’ issues. Prior to joining AXA in 2001, Jean-Christophe started his career in 1992 in HSBC France (former Crédit Commercial de France) as head of trading on Interest rate derivatives and then as Chief Risk Officer for market risks. Jean-Christophe holds a M.Sc. in Economics from École Centrale Paris, and followed an Executive Development Program in INSEAD. Jean-Christophe was also professor of International finance in La Sorbonne University.
SCOR speakers

DENIS KESSLER
Chairman and Chief Executive Officer of SCOR SE

Denis Kessler is a graduate of HEC business school (École des Hautes Études Commerciales) and holds a PhD in economics as well as advanced degrees in economics and social science. He has been Chairman of the Fédération Française des Sociétés d’Assurance (FFSA), CEO and Executive Committee member of the AXA Group and Executive Vice-President of the MEDEF (Mouvement des Entreprises de France). He joined SCOR as Group Chairman and Chief Executive Officer on 4 November 2002.

JEAN-LUC BESSON
Group Chief Risk Officer - SCOR SE

Jean-Luc Besson, Fellow of the Institut des Actuaires (France), holds a PhD in Mathematics and has served as a University Professor of Mathematics and as Senior Vice President of Research, Statistics and Information Systems at the FFSA (Fédération Française des Sociétés d’Assurance - Federation of French Insurance Companies). He was appointed Chief Reserving Actuary and Member of the Executive Committee of the SCOR Group in January 2003 and has been Group Chief Risk Officer since 1 July 2004.

VICTOR PEIGNET
Chief Executive Officer of SCOR Global P&C SE

Victor Peignet, a Marine Engineer and graduate of the École Nationale Supérieure des Techniques Avancées (ENSTA), joined the Facultative Department of SCOR in 1984 from the offshore oil sector. From 1984 to 2001, he held various positions in the underwriting of Energy and Marine Transport risks at SCOR, first as an underwriter and then as Branch Director. He has led the Group’s Business Solutions (facultative) division since it was created in 2000, as both Deputy Chief Executive Officer and then as Chief Executive Officer since April 2004. On 5 July 2005, Victor Peignet was appointed manager of all Property & Casualty Reinsurance operations at SCOR Global P&C SE. He is currently Chief Executive Officer of SCOR Global P&C SE.

NORBERT PYHEL
Deputy Chief Executive Officer of SCOR Global Life SE

Norbert Pyhel serves as Deputy CEO of SCOR Global Life Group and is a member of the SCOR Group Comex. He joined the group in 2006 with the take-over of Revios, which was an off-spring of former Gerling Global Re, where he started his reinsurance career in 1981 as a marketing actuary and member of the German Actuarial Association. Over time he has been involved in business in all leading life reinsurance markets in the world and the expansion of the global network of local representations herein. Today his immediate focus is again on the development of SCOR Global Life’s franchise structured by the four market units and extended over 6 hubs with 27 local offices serving the clients in more than 80 countries around the globe.
MICHEL DACOROGNA
Head of Financial Analysis and Risk Modeling, Group Risk Control - SCOR SE

Michel Dacorogna is a member of senior management of SCOR SE and heading the group Financial Analysis and Risk Management modeling team. His main responsibilities are to develop the Asset and Liability Management models for the group and on this basis to assess the risk-based capital of the company and determine the best strategic asset allocation. The coauthor of: “An Introduction to High Frequency Finance”, he has also published numerous articles in scientific journals. He is an associate editor of Quantitative Finance. He received his Habilitation, Ph.D. and M.Sc. In Physics from the University of Geneva in Switzerland.

FRIEDER KNÜPLING
Deputy Group Chief Risk Officer - SCOR SE

Frieder Knüpling holds degrees in Mathematics and Physics from the Universities of Göttingen and Freiburg. He worked as a lecturer and research assistant until he received a Ph.D. in Economics from the University of Freiburg based on research into the econometric modeling of macroeconomic and financial data. From 1999-2002 he worked for Gerling-Konzern Globale Rückversicherungs-AG and the former Reviøs group on group-wide actuarial and financial topics. Since 2007 he has been heading the Corporate Actuarial Department at SCOR. In December 2008 he was appointed Deputy Group CRO of SCOR. Frieder Knüpling is a fellow of the Deutsche Aktuarvereinigung (DAV).

BERND LANGER
Chief Risk Officer - SCOR Global P&C SE

Bernd Langer is a graduate of the University of Applied Science, Cologne, where he studied business economics (subject: insurance). He began his reinsurance career in 1996 at Gerling Global Re as an underwriter for non-life reinsurance. From 2000 to 2002 he worked as risk controller and internal auditor for Gerling Group. Bernd joined Converium Ltd., Zurich, in 2003 as internal auditor. In 2005/2006 he was in charge of Converium’s Sarbanes-Oxley project as Head of Internal Control. In 2007 he lead Converium’s SAP FS-RI implementation project. He was appointed Chief Risk Officer of SCOR Global P&C in October 2007.

WAYNE RATCLIFFE
Director Group Risk Management - SCOR SE

Wayne Ratcliffe is a Fellow of the Institute of Actuaries (UK) and graduate of the University of Cambridge, where he studied mathematics and operations research. He began his insurance career in 1981 in Life & Pensions (Equity & Law then Prudential), as a product development and marketing actuary. In 1994 he set up the London office of SCOR Vie before moving to the Actuarial department in Paris in 1998 as Head of anglo-saxon markets and subsequently as Deputy Actuarial Director. After a brief spell at XL Re in 2006 he returned to SCOR in 2007 as Head of Group Risk Management.

FRANK SÄMER
Chief Risk Officer – SCOR Global Life SE

Frank Sämer is a graduate of the University of Cologne, where he studied Mathematics. He began his reinsurance career in 1995 at the Life & Health department of Gerling-Konzern Globale Rückversicherungs-AG, Cologne. After a number of years as Executive Director in charge of a market unit profit centre at the company (which became Reviøs Re in 2003 and SCOR Global Life in 2006) he was head of Strategic Development and Risk Management at Reviøs as of 2004. He was appointed Chief Risk Officer of SCOR Global Life in November 2007.
SCOR Group Enterprise Risk Management is rated “Strong” by Standard & Poor’s.