
Strategic risk management: Facilitating risk- based insurance decisions

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Introduction

Prior to the recent financial crisis a number of insurance companies had enterprise risk management functions that rating agencies considered "excellent" or "strong," and yet some of those companies required a sovereign bailout during the crisis to remain a going concern. Numerous commentators said in the immediate aftermath of the crisis that it was "unpredictable." However, books like Michael Lewis' bestselling *The Big Short* add considerable color around why such statements are not entirely accurate.¹ These books profile several astute observers who identified "weak signals" of a financial crisis well before the actual crisis developed and, significantly, also describe how these observers mitigated financial crisis risk in their portfolios at very favorable price levels.

Many enterprise risk functions do reasonably well identifying, modelling and mitigating more "knowable" risks such as some potential natural catastrophes, but they face a bigger challenge identifying, quantifying and mitigating more ambiguous threats that germinate as weak signals, such as financial crises. Based on our research and perspective many insurers did not have mechanisms in place to identify and track the weak signals of an impending financial crisis, and as a result they did not mitigate crisis risk prior to 2007. To prevent a recurrence of this experience, a more comprehensive risk management solution is required that specifically seeks to identify, track and mitigate potential *inflection points*. According to former Intel CEO Andy Grove:

- An inflection point occurs where the old strategic picture dissolves and gives way to the new, allowing the business to ascend to new heights. However, if you don't navigate your way through an inflection point, you go through a peak and after the peak the business declines. It is around such inflection points that managers puzzle and observe, "Things are different. Something has changed."²

Inflection points often germinate as weak signals that go unnoticed because people either do not look for them, or because they discount or otherwise ignore them. This is unfortunate because many inflection points and resulting business failures are foreseeable, and therefore can be considered "predictable surprises" not "black swans."³ According to Professor Michael Roberto:

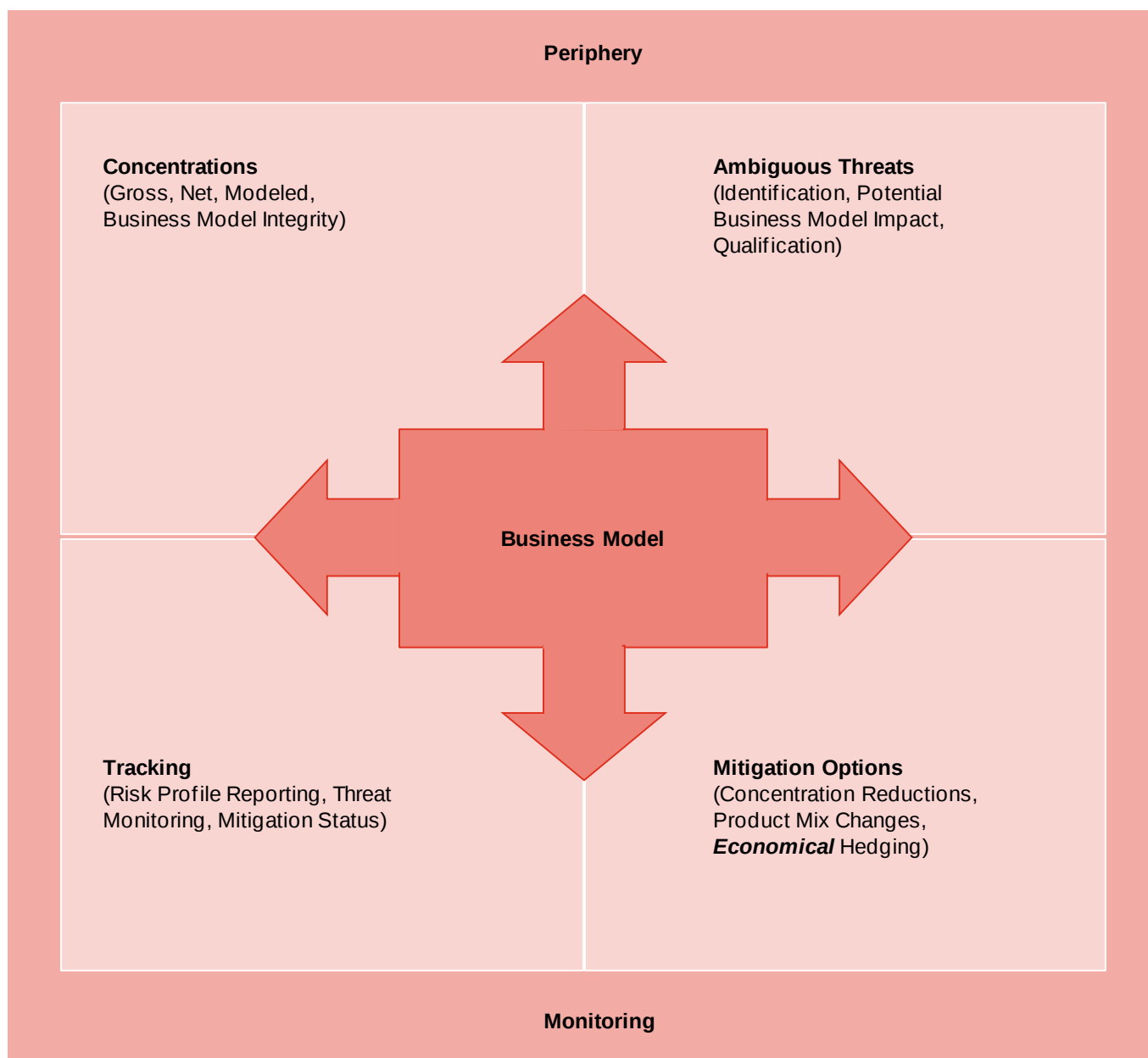
- Organizational breakdowns and collapses do not occur in a flash; they evolve over time. They begin with a series of small problems, a chain of errors that often stretches back many months or even years. As time passes, the small problems balloon into larger ones. Mistakes tend to compound over time; one small error triggers another. Once set in motion, the chain of events can be stopped. However, the more time passes, and the more momentum that builds, once seemingly minor issues can spiral out of control.⁴

As we define it, *strategic risk management* (SRM) is the process of identifying, assessing and economically managing potentially enterprise-threatening losses over time; in other words, it is a way to mitigate evolving risks before they "spiral out of control." Below we identify and describe the functions comprising SRM, and we illustrate each by way of practical examples.

Strategic risk management

As Exhibit 1 shows, SRM encompasses six general considerations: exposure concentrations, periphery monitoring, ambiguous threat analysis, risk mitigation, risk tracking, and managing the integrity of the business model, each of which is discussed below.

Exhibit 1 - Strategic Risk Management Overview



Concentrations

SRM begins with the identification of significant exposure concentrations such as large counterparty, sector, geographical, and/or product exposures. An example of this is leverage; for example, a firm leveraged 44-to-1, like Lehman Brothers was in 2008, ⁵ is at a much higher risk of failure than more conservatively capitalized firms. While this seems straightforward, prior to the recent financial crisis some firms did not rigorously manage their balance sheets, which led to the existence of significant un-managed concentrations. For example, *The Big Short* recalls how, prior to the recent financial crisis, one of the profiled investors would “go to meetings with Wall Street CEOs and ask them the most basic questions about their balance sheets, 'They didn't know,' he said. 'They didn't know their own balance sheets.’” ⁶ This did not pertain to all of Wall Street; for example, in another popular book, one executive said “If you have got sixty, one hundred billion, or however many billions of something on your balance sheet, that is a *very* big number... I don't think you should ignore a big number, no matter what it is.”⁷

Concentration risk pertains to markets as well as balance sheets; for example, the London Market Excess of Loss (LMX) spiral in the late 1980s and early 1990s resulted from insurers and reinsurers within the London Insurance Market retroceding risks to other market participants, who in turn retroceded tranches of those risks to other reinsurers within the market, and so on. The risk premiums continued to shrink as a result of reinsurance brokerage commissions at each point of retrocession resulting in the reinsurer at the end of the chain having very large exposures at disproportionately low rates-on-line. This resulted in a number of reinsurance insolvencies in the London Market. To understand the cause of these failures consider that the aggregate amounts of cash changing hands in the form of claim payments and reinsurance recoveries for events such as Piper Alpha--a North Sea oil rig that exploded in 1988--Hurricane Hugo in 1989, and European windstorm Daria in 1990 all typically amounted to *ten or more times the original insured loss as a result of the spiral.*⁸

Insurers should assess exposure concentrations on both a gross and net (or after recovery) basis, *not* just on a net basis as there could be net-related concentrations within overall exposures that could put a full recovery at risk during times of distress. In other words, during an extreme event an actual recovery could wind up being less than 100 cents on the dollar and therefore could exacerbate a concentrated loss.

It is often more difficult to accumulate gross and net exposures than it may at first appear due to factors such as:

- The scope of analysis, which can be very wide and involve: (1) standard balance sheet items, (2) liquidity considerations (e.g., concentrated funding sources by counterparty and instrument), (3) customer segments, (4) product lines, (5) regions, (6) industries/sectors, etc.;
- Systems, data and process issues, which can complicate the accumulation of gross exposures;
- The potential inability to identify all of the counterparties involved; and
- Data integration issues, which can complicate netting efforts. For example, during the recent financial crisis, some institutions did not know which of their divisions put on a hedge.⁹

Business model

The genesis of a concentration can be just as important strategically as its size. For example, consider the case of the Reichmann-Soros Fund partnership of the mid-1990s, which involved a large-scale real estate development project in Mexico. The deal came under distress as a result of Peso volatility, which Soros' own currency traders mitigated; however, they did not share that information with the Reichmann-Soros Fund partnership. According to one account:

- Ironically, the Reichmann's partner [Soros] might have thrown a lifeline, if only its right hand had known what its left hand was doing. George Soros' canny hedge fund traders had long since sold their Peso holdings, believing the currency to be risky. But Soros' property arm had no such insight. It carried on as if everything was normal. No warning was sent to the Reichmann-Soros venture, which consequently had little sense of the ugly scenario that was about to unfold.¹⁰

This is just one example from a sector replete with silo-based business models that generate under-estimated cross-accumulation risks. Others examples can be found in the recent financial crisis.¹¹

Market pressures can also generate business model-related risks. For example, market pressures can cause firms to loosen product or investment standards incrementally, which over time can radically change a business model's risk profile without anyone acting to mitigate it. Consider Long-Term Capital Management (LTCM), which failed in 1998 and was rescued for systemic risk management reasons: it was formed to “trade spreads between *pairs* of bonds to either widen or contract” on a highly leveraged basis. However, “As the pressure to find suitable trades mounted, they increasingly strayed into more exotic tundra, [including] directional bets, abandoning (for a fraction of its portfolio [i.e., incrementally]) the cautious hedging strategy that had been its trademark.”¹²

We refer to the process of incremental product or investment standard deterioration as *normalizing strategic deviations*, which is the incremental expansion of a business model over time that results in a broader risk profile than what was originally intended.¹³ This can occur when business opportunities become increasingly limited at which times some executives begin to incrementally loosen or expand product offerings or investment standards. Over time, this expansion results in broader, more expansive risk profiles that are nevertheless viewed as “normal”-or consistent with a stated risk appetite--even though they are not. Because this expansion occurs incrementally it does not seem deviant; on the contrary, executives often believe their behavior conforms to their firm's strategic principles. One possible reason for this is that it is relatively easy to rationalize incremental deviations for profitability, diversification or assumed information advantage reasons that, when considered in isolation, seem strategically consistent.¹⁴ Whatever the reason(s), this phenomenon frequently results in outsized losses in volatile markets. In addition to the LTCM example cited above, a variety of books profiled the same phenomenon in a number of financial institutions prior to the 2007-2008 financial crisis.¹⁵ Furthermore, during a soft market many insurers allow their policy terms and conditions to expand or slip incrementally over time, which ultimately leads to significant underwriting losses, especially in concentrated product offerings.

A core insurance SRM activity is the intense monitoring of product offerings and investment strategies, including the concentrated exposures resulting from those activities, across an enterprise to ensure business model integrity. This is a subtle yet important point: many insurance companies have a silo structure where corporate underwriting functions monitor insurance risks such as premium rate inadequacy and terms and conditions slippage, ceded reinsurance departments monitor reinsurance risks such as related terms and conditions and credit risk, investment departments monitor investment risks such as interest rates and capital market performance, and actuarial departments perform various forms of risk modeling with little interaction between the four. Assessing business model risk requires fully integrated, cross-discipline analyses and governance.

Periphery monitoring

As noted above, many business failures evolve over time. Therefore, monitoring the risk of failure includes evaluating *peripheral information*, or information seemingly not core or pertinent to a firm's immediate business activities or risk profile, so that weak signals can be identified for analysis and tracking. As history has repeatedly shown, some peripheral risks develop over time, and some of those trigger concentrated losses.

Periphery monitoring involves all pertinent information sources--not just mainstream ones--because by the time information turns up in mainstream sources it is likely no longer peripheral. According to two Wharton scholars, assessing the periphery requires: "bringing different people with diverse views into the process and by using multiple methods or techniques. This is especially important because the periphery is inherently blurry and incomplete. The conflicts and differences in viewpoints, as well as multiple hypothesis, can help illuminate different parts of the picture. In this way, the organization can think creatively to 'connect the dots.'"¹⁶

Connecting the dots is a core SRM activity, but it is frequently difficult to perform. As noted above, prior to 2007-2008, many firms failed to connect the dots of the impending financial crisis. In the case of Lehman Brothers, LTCM collapsed ten years prior to its historic failure; according to *New York Times* reporter Andrew Ross Sorkin, "had they not saved Long-Term Capital, the next domino back in 1998 was clearly Lehman Brothers, which was suffering from a similar crisis of confidence."¹⁷ Notwithstanding that experience, Lehman significantly leveraged its balance sheet, which contributed to its historic failure.¹⁸

In retrospect, "the dots" from LTCM's failure to the 2007-2008 financial crisis can appear somewhat clear:

- In 1999, economist Peter Warburton published the first of three editions of a non-mainstream but highly influential book that forecast an impending credit crisis: *Debt & Delusion*.
- Highly leveraged, model-based derivatives strategies are very risky as Roger Lowenstein observed in his book on LTCM's failure: *When Genius Failed*.
- In 2002, Warren Buffett referred to derivatives as "financial weapons of mass destruction," and he used the LTCM case to support his comments.¹⁹
- A few years later, Nassim Nicholas Taleb published *Fooled by Randomness*, which referenced LTCM's failure and powerfully criticized both derivatives modelling and mainstream thinking on the frequency of extreme events like financial crises.
- In 2005-2006, mortgage quality deterioration was showing up in the data, even though it generally was ignored at the time (as Michael Lewis and Gregory Zuckerman profile in their bestselling books on the period).
- And, in February 2006, distressed debt expert and New York University Professor Edward Altman forecast that, "The economy once perking along now shows signs of a slowdown, and the forces for a 'perfect storm' are building on the horizon and are likely to batter the high-yield market in 2007 or 2008. Be careful. The markets are frothy."²⁰

Similarly, "the dots" or weak signals from the 1980s LMX spiral can appear fairly obvious: concentrated reinsurance purchases and inwards reinsurance writings within a relatively small market were pursued and aggressively facilitated by a few LMX brokers who had created the new market.

Prospectively, however, it can be difficult to connect the dots because the information needed to do so is typically widely dispersed. Therefore, an information platform is needed to collect, integrate and synthesize external and internal forms of information--mainstream and unconventional alike. Such a platform is required not only for monitoring the periphery, but also for threat analysis because many of the threats that will be assessed (such as potential financial crises) are frequently ambiguous.

Ambiguous threats

Ambiguous threats are potential losses that seem highly uncertain due to an unexpected (and frequently non-linear) fact pattern that does not lead to obvious conclusions.²¹ As an example, consider the threat of a financial crisis in late 2006/early 2007, which was ambiguous. However, and as we note above, Peter Warburton's book *Debt & Delusion* provided a vivid analysis of risks that, if manifest, could evolve into a crisis. Other peripheral information sources made similar claims (for example, Peter Schiff, *Crash Proof*), which if consulted and analyzed could have been used to track the evolution of the risk of a financial crisis.

Ambiguous threats are everywhere so a key challenge is to prioritize the threats that could be more strategically significant from the others. One way to accomplish this is to focus on threats that could trigger a concentrated loss and/or impact a business model, and then to track those threats over time using peripheral information sources and integrative forms of analysis.* If, for instance, these capabilities existed in the case of the Reichmann-Soros Fund mentioned above, they could have been used to alert Soros' real estate arm of the currency volatility Soros' traders had mitigated. Soros' real estate risk managers would then have had an opportunity to formulate risk mitigation strategies that could possibly have saved the deal in a timely manner.²² This is an illustrative example that is applicable to insurance companies given their siloed approach to managing underwriting, reinsurance, investment, and actuarial departments.²³

Contrast the experiences of Reichmann-Soros Fund with that of hedge fund manager Seth Klarman who in January of 2006--well before the onset of the financial crisis--"warned in a letter to shareholders about 'tremendous leverage,' 'untested' products such as credit derivatives, low interest rates and 'a housing bubble that is starting to burst.'"²⁴ Significantly, Mr. Klarman did not just write down, disclose, and then bury these insights in an internal report; instead, he acted on them to mitigate the effects of a potential crisis and to profit from one if it developed.²⁵ This is a lesson that all insurers can readily benefit from, as hedging far too frequently occurs after a volatile event occurs, instead of before.

* PwC research suggests that firms with these capabilities have an "information advantage" over their competitors. While a full description of information advantage is beyond the scope of this paper, Appendix 1 provides a high-level overview of the capability.

Risk mitigation

There are a number of ways to mitigate significant exposure concentrations at-risk of an ambiguous threat, for example:

- A concentration can be managed down to a given risk appetite. For example, in the case of a large trade credit concentration, a firm could manage it down by refusing to grant further credit until the exposure is below a given threshold by a specific time. One way to facilitate this is to negotiate a concentration reduction at a discount to the nominal value.
- An alternative is to factor off (or transfer) the concentration; in other words, selling all or a portion of the exposure to a third party. For example, catastrophe bonds are now commonly used as a tool to transfer insurance risk to the capital markets, which in turn consider this asset class to be largely uncorrelated to global stock markets.
- Product mix changes also can mitigate a concentration. For example, when product profitability begins deteriorating due to market conditions firms can reduce their exposure to those products by offering others.
- Hedging can also mitigate a concentration, but it can be costly. However, hedging is frequently a function of pricing models that, at times, can dramatically under-price risk.²⁶

For example, as the threat of a financial crisis developed into 2007, spreads continued to narrow.²⁷ However, that divergence from economic reality was a clear red flag that a select few picked up and acted on to mitigate crisis risk. As noted above, one of those was hedge fund manager Seth Klarman who commented that he bought "put options and credit-default swaps, which he calls 'cheap insurance,' to protect Baupost [his investment firm] against risks such as a steep fall in the stock market or a surge in inflation... In an October 2008 letter to shareholders, the firm said it benefited from credit-default swaps, without saying what the swaps were meant to protect against."²⁸ According to *The Big Short*, Mr. Klarman was one of the few investors who purchased favorably priced credit default swaps during the boom that preceded the crisis.²⁹

Many firms do not take advantage of favorable hedge pricing; in fact, many start to hedge only after widening spreads or increasing volatility cause prices to spike.³⁰ Strategic hedging should take place before--not after--spreads widen or volatility spikes. While this can be difficult for firms that manage their business to analyst expectations, the market can positively view missing an earnings expectation by pennies (or even more) per share if the shortcoming results from risk mitigation that is consistent with corporate disclosures and Management's Discussion and Analysis commentary.

Risk mitigation also can involve business model changes; for instance, when market conditions deteriorate, instead of incrementally expanding a product offering or investment criteria specific decisions can be made on exiting and entering specific products, lines and investment categories. Prior to the implosion of the LMX market, for example, a number of astute London Market players identified the threat of a spiral and chose to retrocede material tranches of their risks outside of the London Market, and contemporaneously ceased to write inwards retrocessional reinsurance business.

Risk tracking

An executive risk committee should regularly (e.g., monthly, quarterly) track identified risks and ambiguous threats, their mitigation, and other SRM activities against a formalized *risk appetite*, which generally is a statement of risks a firm will and will not accept, as well as the amount of potential loss that it will accept in executing a strategy.

A *risk appetite* is the amount of risk an organization is willing to accept in the pursuit of greater returns. In overall terms, a risk appetite articulates--through a series of risk statements, limits or tolerances--the willingness of an organization to accept specified levels of exposure to each category of risk in order to achieve its strategic objectives. For example, an insurance company might be prepared to lose a maximum of 20% of its capital following a 1-in-100 year natural catastrophe on the grounds that it would still be able to operate effectively given the likely extent of impairment of its competitors at this level of loss.

Management sets, and Boards of Director approve, risk appetites that take into account capital and liquidity levels, as well as regulatory and rating agency requirements. Risk appetite scope can be very broad. For example, for insurance companies, there typically are separate risk appetite statements/limits/tolerances for: (1) underwriting (including natural catastrophe) risk; (2) reserving risk; (3) credit or counterparty risk; (4) market or investment risk; (5) liquidity risk; (6) group/contagion risk; (7) reputational risk; (8) regulatory risk; and (9) legal risk.

Defining a specific yet pragmatic risk appetite is generally an intensive and iterative exercise. The main aim is to protect the viability of a firm by establishing a common understanding of risk desirability across the organization (i.e., which risks and why and then how many of these risks the firm can actively take on). At the same time, in order to avoid an adverse impact on its risk-adjusted return on capital, a firm needs to ensure it is not taking on too *little risk*.

Risk appetites provide a framework for, and limitations on, all business activities within a firm. The framework should be part of a comprehensive risk tracking process through which a firm views its risks holistically and dynamically--rather than in silos and statically--from the perspective of assessing risk and reward. Accordingly, a risk appetite can serve as an important input in strategizing, business planning, performance measurement/management, and in determining the level of capital to support the business.

Firms should regularly review risk appetites to inform decision-making on business opportunities as and when they arise. For example, following a major Gulf of Mexico windstorm and a rapid hardening of reinsurance rates, a reinsurance company can be strategically positioned to increase its natural catastrophe exposure in the region (assuming, of course, it has the expertise to successfully execute that strategy).³¹

It is imperative that firms regularly measure risk exposures against risk limits, and have early warning indicators that highlight closeness to and actual breaches of risk limits. In the event a risk appetite is exceeded in any given area, mitigating actions will need to occur promptly in order to return the exposure to acceptable levels. Internal Audit and compliance functions play a key role in ensuring adherence to risk mitigation policies, and that internal controls are working correctly.

In essence, risk tracking covers all noteworthy SRM developments over a given time frame via a common reporting and dashboard structure. The focus of tracking is the potential impact that a variety of risks can have on a business model *and* how to economically mitigate those risks over time. To optimize this activity for decision-making, risk reports should be based on integrated analyses that provide enterprise-wide findings and recommendations. For example, Exhibit 2 profiles the six SRM capabilities we discuss above in the context of risk governance considerations, key metrics and analytical information points.

Exhibit 2 - Risk Tracking

	Concentration	Ambiguous Threats	Mitigation	Tracking
Governance	• Risk Appetites • Executive Risk Committee(s)	• Process Controls • Business Owner Oversight/Contribution	• Concentration Reduction Protocols • Product Mix Changes • Hedging Strategy	• Risk Profile • Exception Processes • Audits (Process & Technical)
Metrics / Analyses	• Gross • Net • Strategic Discipline/Deviation • Top Concentrations • Cross-concentrations • Modeled Loss • Stressed Loss	• Qualification (Business Model Impact) • Quantification • Scenarios & Development Patterns • Key Milestones	• Pricing • Volatility • Product Specifications & Tracking • Per Share Impact • Capital Impact • Liquidity Impact	• Internal Information • External Information • Lessons Learned • Knowledge Management
	Peripheral Activity Monitoring the periphery to mitigate the risk of a concentrated loss being triggered from an ambiguous threat that was neither mitigated nor tracked			

Conclusion

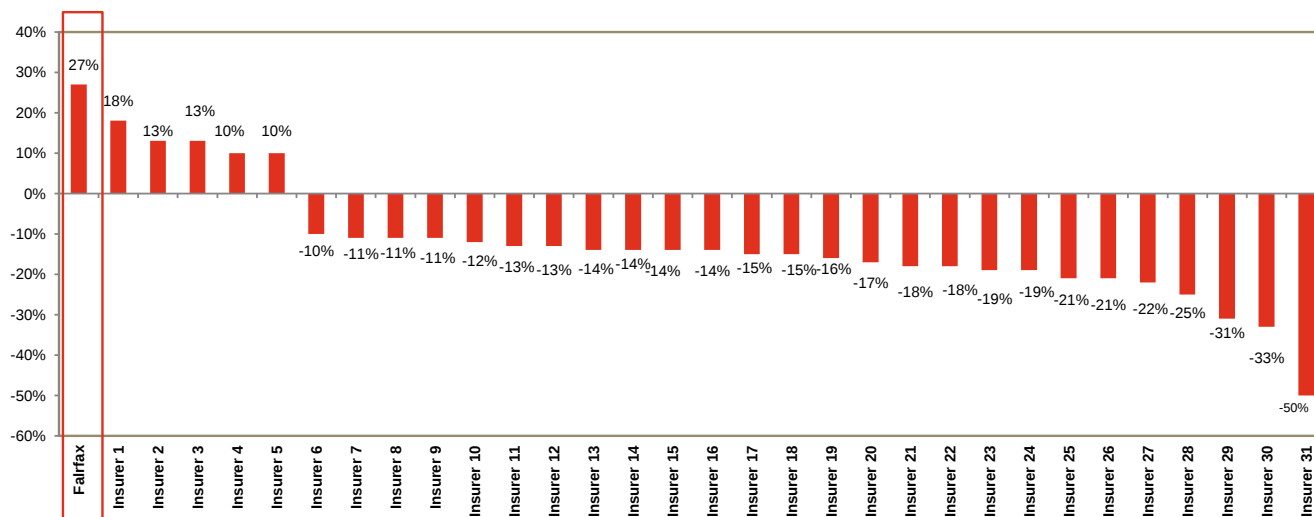
In our introduction we stated that, prior to the recent financial crisis, many insurers did not have mechanisms in place to identify and track the weak signals of an impending crisis, and that as a result they could not efficiently mitigate crisis risk. One insurer, however, apparently did have such mechanisms in place.

In April of 2007, Prem Watsa--the Chairman and CEO of Fairfax Financial Holdings--forecast a financial crisis stating, in part, that: "There's a possibility of a one-in-50- or a one-in-100-year storm coming." According to one widely reported account:

- Near the end of July [2007] came one of the first signs of the storm Watsa had predicted: the Dow had its first mini-meltdown, losing about 400 points in one day. Watsa had already protected himself. He'd moved the bulk of his company's \$16-billion (U.S.) portfolio out of the stock market and into relatively recession-proof treasury bonds and cash. Although he hadn't participated in the market's champagne swilling, he was determined to avoid the brutal hangover. In addition to moving his investments to higher ground, he used credit default swaps to wager that the U.S. credit market would go belly up. His bet: \$341 million. His take-home when the house of cards came tumbling down: more than \$2 billion.³²

To illustrate the relative impact of the above risk mitigation efforts consider Exhibit 3, which profiles 10% or greater changes in insurer performance in the third quarter of 2007.

Exhibit 3 - Third Quarter 2007 Insurance Company Performance (10%+/- changes)



The names of the remaining 31 insurers are available from the data source: Dowling & Partners, *IBNR Weekly* #39, October 5, 2007, p. 8.

In closing, we note that the objectives of this paper are three-fold: First, we try to show that certain extreme events are *not* "black swans," as is commonly argued but rather are "predictable surprises," and thus candidates for risk identification, tracking and mitigation activities.

Second, we attempt to demonstrate the utility of a strategic function that seeks to identify and track the weak signals of ambiguous threats using both internal (e.g., concentrations data and related information) and external sources of information--including peripheral information. Of course, there is no guarantee that such a function will identify the weak signals of the next crisis--and there is always a next crisis--but it is a virtual certainty those signals will be missed without such a function.³³

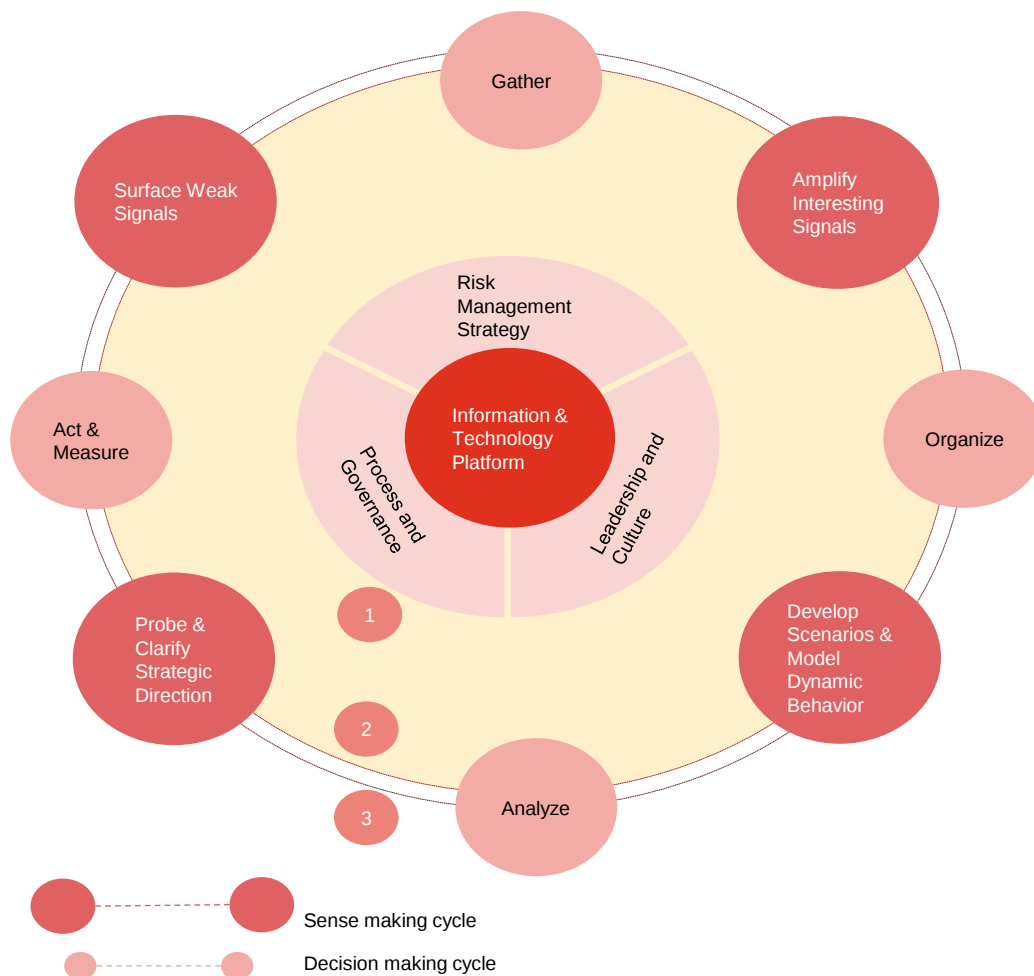
Third, while many insurance companies have processes that facilitate the efficient use of reinsurance to mitigate a wide variety of insurance risks, most do not hedge either investment risks and/or enterprise-wide risks anywhere nearly as efficient. This is clearly illustrated in Exhibit 3.

Hedging is not the only form of risk mitigation, however. Another, perhaps even more important, form is safeguarding the integrity of a business model by ensuring that: (1) product terms and conditions do not unintentionally slip over time, and (2) that product mix changes are based on explicit strategic decisions rather than through incremental deviations in response to current market conditions. Such considerations are crucial in the current soft insurance market, and its persistently stressed global macro-economy.

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Appendix 1. Information advantage

Insurers that have an information advantage are well positioned to pick up and monitor ambiguous threats and weak signals on the periphery. Typically, these insurers excel in four areas: (1) sense making, (2) holistic decision-making, (3) an efficient information platform, and (4) a governance process to help executives raise awareness, connect the dots, and then economically act on their insights. Components (1) - (3) are profiled below:



- 1 Information Advantage Platform:** These capabilities are supported by a robust strategy, integrated processes and governance, leadership and culture that foster cross-functional collaboration and decision-making, as well as an information and technology platform that is comprehensive, flexible and robust.
- 2 Decision-Making Cycle:** Effective decision-making is dependent on gathering, organizing, and analyzing a broad array of information to generate insights and facilitate practical, strategically-consistent actions.
- 3 Sense-Making Cycle:** Sense-making involves actively surfacing, amplifying, probing, clarifying, and tracking "weak signals."

Notes

- ¹ See also Andrew Redleaf and Richard Vigilante, *Panic* (NY: Vigilante, 2010) and Gregory Zuckerman, *The Greatest Trade Ever* (NY: Broadway, 2009).
- ² Andy Grove, *Only the Paranoid Survive* (NY: Random House, 1999 [1996]), pp. 32-33.
- ³ A "black swan" is an event that is not, and cannot be, expected beforehand (Nassim Taleb, *The Black Swan* (NY: Random House, 2007)). In contrast, many extreme events can be expected beforehand and thus are more aptly described as "predictable surprises" (Max Bazerman and Michael Watkins, *Predictable Surprises* (Boston, MA: HBS, 2004)).
- ⁴ Michael Roberto, *Know What You Don't Know* (Upper Saddle River, NJ: Pearson, 2009), p. xviii.
- ⁵ Lawrence McDonald and Patrick Robinson, *A Colossal Failure of Common Sense* (NY: Crown, 2009), p. 287.
- ⁶ Michael Lewis, *The Big Short* (NY: Norton, 2010), p. 174.
- ⁷ Gillian Tett, *Fool's Gold* (NY: Free Press, 2010 [2009]), p. 64.
- ⁸ For more information see, for example, Adam Raphael, *Ultimate Risk* (NY: 4 Walls 8 Windows, 1995), Ch. 9.
- ⁹ One representative experience was profiled by Greg Farrell, *Crash of the Titans* (NY: Crown, 2010), p. 66.
- ¹⁰ Ron Dembo and Andrew Freeman, *Seeing Tomorrow: Rewriting the Rules of Risk* (NY: Wiley, 1998), p. 17.
- ¹¹ See, for example, Roddy Boyd, *Fatal Risk* (Hoboken, NJ: Wiley, 2011).
- ¹² Roger Lowenstein, *When Genius Failed* (NY: Random House, 2000), pp. 26, 127-128.
- ¹³ Inspired by Diane Vaughan, *The Challenger Launch Decision* (Chicago, IL: Chicago, 1997 [1996]).
- ¹⁴ John Garvey, Miles Everson, Miles Kennedy, Richard Barfield, Rick Heathcote, Tim Pagett, and James Chang, "Risky Business: Why Managing the Risks of Evolving Business Models is the Key to Avoiding the Next Financial Crisis," *PwC Financial Services Institute*, January 2011, <http://www.pwc.com/us/en/financial-services/publications/viewpoints/assets/viewpoint-risky-business.pdf>, pp. 12-18, and Joseph Calandro, Jr., "A Systems Accident Approach to Systemic Financial Risk," *University of Connecticut Working Paper*, 2011.
- ¹⁵ See, for example, Boyd (2011) and Viral Acharya, et al., *Guaranteed to Fail* (Princeton, NJ: Princeton, 2011).
- ¹⁶ George Day and Paul Schoemaker, *Peripheral Vision* (Boston, MA, HBS Press, 2006), pp. 196-170. Note also George Day, Paul Schoemaker and Robert Gunther, *Managing Emerging Technologies* (Hoboken, NJ: Wiley, 2000).
- ¹⁷ Andrew Ross Sorkin, *Too Big to Fail* (NY: Viking, 2009), p. 301.
- ¹⁸ McDonald and Robinson (2009).
- ¹⁹ <http://www.berkshirehathaway.com/letters/2002pdf.pdf>, pp. 14-15.
- ²⁰ Edward Altman, "Credit Risk and the Link between Default and Recovery Rates" in Rodney Sullivan, Ed., *Global Perspectives on Investment Management* (Charlottesville, VA: CFA Inst., 2006), p. 279.

²¹ Michael Roberto, Richard Bohmer and Any Edmondson, "Facing Ambiguous Threats," *Harvard Business Review*, November 2006, pp. 2-8.

²² The deal came under distress in 1994, and was renegotiated with a key partner four years later. For more information see Dembo and Freeman (1998), pp. 18-19. Note also relevant comments about Mexico in Harry Underwood, "Paul Reichmann loses Canary Wharf for the second time," *The Week with The First Post*, September 22, 2009, <http://www.theweek.co.uk/politics/19691/paul-reichmann-loses-canary-wharf-second-time#ixzz1jf677hFC>"

²³ For an insurance-specific example see Boyd (2011). For further information see Mark Purowitz and Joseph Calandro, Jr., "Insurance Underwriting & Information Advantage," *PwC White Paper*, forthcoming.

²⁴ Charles Stein, "Klarman Tops Griffin as Hedge-Fund Investors Hunt for 'Margin of Safety,'" *Bloomberg*, June 11, 2010, <http://www.bloomberg.com/news/2010-06-11/klarman-tops-griffin-as-hedge-fund-investors-hunt-for-margin-of-safety-.html>

²⁵ According to Lewis (2010), Mr. Klarman was one of the few investors who shrewdly purchased favorably priced credit default swaps during the boom that preceded the 2007-2008 credit crisis (p. 105).

²⁶ Risk mitigation also can involve restructuring (e.g., the financial institutions that successfully raised capital during the recent financial crisis), reengineering (such as in the face of a "rogue trader"), and alternative risk transfer vehicles, which are subjects beyond the scope of this paper. For more information see, for example, Lisa Meulbroek, "The Promise and Challenge of Integrated Risk Management," *Risk Management & Insurance Review*, Vol. 5, No. 1 (2002), pp. 55-66.

²⁷ A "spread" is simply the difference between a low yielding government security and a more risky and thus higher-yielding security.

²⁸ Charles Stein, "Klarman tops Griffin as hedge-fund investors hunt for 'margin of safety,'" *Bloomberg*, June 11, 2010, <http://www.bloomberg.com/news/2010-06-11/klarman-tops-griffin-as-hedge-fund-investors-hunt-for-margin-of-safety-.html>

²⁹ Lewis (2010), p. 105

³⁰ Joseph Calandro, Jr., "The margin of safety principle and corporate strategy," *Strategy & Leadership*, Vol. 39, No. 5 (2011), pp. 39-40. For information on the causes of this behaviour see, for example, Daniel Kahneman, *Thinking Fast and Slow* (NY: FSG, 2011), p. 137.

³¹ For further information see Immy Pandor and Richard Barfield, "Risk: Getting appetite right," *The Journal*, May (2009), pp. 2-6. Risk appetite is an important topic that seems to be taken for granted; for example, according to a recent article, 86% of insurance companies reported they had formal risk appetites, but A.M. Best's Supplemental Rating Questionnaire "found that at least 90 percent of [risk appetite] responses were too broad or general." Source: Caroline McDonald, "ERM Lagging With Some Insurers, A.M. Best Says," *Property Casualty 360.com*, September 27 (2011), <http://www.propertycasualty360.com/2011/09/27/erm-lagging-with-some-insurers-am-best-says>

³² "The Two-Billion Dollar Man," *Toronto Life*, April 2009, <http://www.torontolife.com/features/2-billion-man/?pageno=1>

³³ This is also not to suggest that the firms that mitigated the risk of prior crises will necessarily mitigate the risk of future ones. Each crisis is different and thus some may fall in a firm's "blind spot," which further supports the argument for a dedicated strategic risk management function.

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