

## ENTERPRISE-WIDE RISK MANAGEMENT

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[See table of contents](#)

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Article abstract

The purpose of this paper is to provide an assessment of the impact of Enterprise-wide Risk Management (ERM) on the trading activities of financial institutions, with an emphasis on derivatives. This paper is divided into three parts. The first part looks at the evolution of ERM in terms of its impact on the culture of the organization, risk coverage, measurement methodologies, technology and performance measurement. The second part looks at the application of ERM as it relates to individual risk types such as market, credit, and business risks. The paper concludes with an overview of the key factors that are critical to the success of an ERM program.

# ENTERPRISE-WIDE RISK MANAGEMENT

by David Dougherty

## ABSTRACT

The purpose of this paper is to provide an assessment of the impact of Enterprise-wide Risk Management (ERM) on the trading activities of financial institutions, with an emphasis on derivatives. This paper is divided into three parts. The first part looks at the evolution of ERM in terms of its impact on the culture of the organization, risk coverage, measurement methodologies, technology and performance measurement. The second part looks at the application of ERM as it relates to individual risk types such as market, credit, and business risks. The paper concludes with an overview of the key factors that are critical to the success of an ERM program.

**Keywords:** Enterprise-wide risk management, financial institutions, derivatives, market risk, credit risk.

## RÉSUMÉ

*Le but de cet article est d'évaluer l'impact de l'élargissement du concept de gestion des risques d'entreprise sur les activités commerciales des institutions financières, en mettant l'emphase sur les produits dérivés. Il se divise en trois parties. La première examine l'évolution dudit concept au regard de son impact sur la culture de l'organisation, sur la couverture des risques, sur les méthodes de mesure, sur la technologie et sur les mesures de performance. La deuxième étudie l'application du concept se rapportant à des types de risque individuel, tels le risque de marché, le risque de crédit et les risques d'affaires. La conclusion propose une vue d'ensemble sur les facteurs clés considérés comme critiques dans le succès d'un programme d'élargissement du concept de gestion des risques d'entreprise.*

**Mots clés :** *Élargissement du concept de gestion des risques d'entreprise, institutions financières, produits dérivés, risque de marché, risque de crédit.*

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## INTRODUCTION

Rapid growth in the derivatives market has been accompanied by well-publicized losses that have underscored the need for sound risk management. According to Capital Market Risk Advisors, publicly reported derivative losses have totaled USD 24 billion in the last ten years. These losses have typically been sudden and dramatic in nature. In almost every case, the loss resulted from inadequate risk management practices. This fact has grabbed the attention of the media, regulators and market participants and has helped shape the evolution of the management of risk in derivative and other trading activities of financial institutions.

A number of industry and regulatory studies have articulated basic principles that provide the foundation for industry best practices in the management of derivative risks. The Group of 30 led the way in 1993 with its study entitled *Derivatives: Practices and Principles*. Regulators in most industrialized countries have followed suit with their own guidelines for managing these risks. This has been reinforced by the new BIS rules for the capital underpinning of market risk in trading activities that were implemented in 1998. These rules provide significant incentives for banks to introduce both qualitative and quantitative enhancements to the management of market risk.

Financial institutions have responded to this changing environment by re-engineering risk management processes and measures. Trading activities, which typically have a high derivatives content, are at the cutting edge of these changes. This has involved an evolution from the traditional approach that focussed on independently managed silos of market risk and credit risk. The new focus is on integrated measurement and strategic management of the full spectrum of risks across the financial institution. This can be referred to as enterprise-wide risk management or ERM.

The purpose of this paper is to provide an assessment of the impact of ERM on the trading activities of financial institutions, with an emphasis on derivatives. This paper is divided into three parts. The first part looks at the evolution of ERM in terms of its impact on the culture of the organization, risk coverage, measurement methodologies, technology and performance measurement. The second part looks at the application of ERM as it relates to individual risk types such as market, credit, and business risks. The paper concludes with an overview of the key factors that are critical to the success of an ERM program.

## THE EVOLUTION OF ERM

Risk management can be broadly defined as evaluating, monitoring and controlling the risks in a business. Over time the interpretation and implementation of this concept has expanded significantly in terms of scope and objectives.

Until recently, the practice of risk management could be characterized as a defensive process. Its objective was to prevent losses and safeguard capital through layers of controls. The focus was largely on credit risk and market risk. These risks were generally managed in silos with one group managing credit risk policies and limits while a separate group managed policies and limits for market risk. This process was usually controlled at the business line level with limited aggregation of overall risks. It has come to be recognized that this approach gives an incomplete view of risk on an enterprise-wide basis.

ERM represents an evolution in thinking about how risks should be managed. It is based on the concept that risk should not only be managed at the business line level but also at the consolidated enterprise level. This more proactive approach seeks to identify all risks and to create a competitive advantage by creating an optimal balance of all risks across the enterprise. The risk management function works in partnership with the businesses to identify risks and to strategically manage these risks in order to enhance shareholder value. Enhancing of shareholder value results from the identification and management of the co-variances between risks in the various products and businesses. This enables the firm to take portfolio effects into account in the consolidation of risks and provides an enterprise-wide risk measure. This, in turn, provides a more efficient basis on which to allocate capital, price transactions and measure returns.

The influence of ERM at leading edge financial institutions is evidenced by certain common trends. These include: (1) establishing a strong risk management culture, (2) developing a comprehensive profile of risks, (3) implementing new risk measures which facilitate the aggregation of risk, (4) creating technology platforms to measure risks on an enterprise wide basis, and (5) ensuring that the measurement of results takes account of the risks involved.

### **Risk Management Culture**

A strong risk management culture is the cornerstone of effective ERM. It requires a top down approach with senior management

actively involved in establishing risk tolerance and overseeing the management of risk. This must be reinforced by a centralized risk oversight group that is independent of line businesses and yet works as their partner in managing risks strategically.

A strong risk oversight culture begins with the Board of Directors. Trading businesses, and derivative activities contained therein, must be conducted in a manner consistent with the overall risk policies and limits that are reviewed by the Board of Directors or an appropriately designated committee of the Board (i.e. authorizing body). The material elements of risk policies and limits should be reviewed on a regular basis by the authorizing body which should be kept up-to-date on significant developments and changes.

The central risk management function and supporting senior level committees must be responsible for formulating policies, limits and procedures which cover all major risks and must ensure that approved policies are implemented and limits enforced. These policies and limits should govern the purpose for which an activity is undertaken, approve the methodology for measuring and controlling the risks involved, and delegate authorities for undertaking transactions.

The consolidation of risk management into a central function is a key trend highlighted in a 1997 survey conducted by the Bank Administration Institute and Olson Research Associates Inc. The survey gathered data from 80 U.S. banking institutions, three fourths of whom said they were undertaking, or had completed, significant campaigns to centralize risk management functions. In addition to strengthening operating controls through independent oversight, the centralization of risk management functions provides greater consistency in the measurement and management of risks across the enterprise and reduces the chance of a key element of risk being overlooked.

This centralized risk management function complements but does not replace the vital role played by trading management at the local level. Senior management in each of the trading units must be held directly accountable for managing all risk positions on their books and for ensuring effective control. This involves the development of detailed operating policies and limits that guide day-to-day trading activities at the desk level. A 'middle office' group that is located on the floor of each of the major trading rooms typically carries out the development and ongoing monitoring of these policies and limits.

## Comprehensive Risk Profile

The development of a comprehensive risk framework that covers all risks is the next step in establishing a sound ERM process. Whereas traditional approaches to risk management in financial institutions typically focussed on market, credit and liquidity risks, ERM extends coverage to all risks by also including operating, technology, reputation and other risks. It provides a consistent framework that can be used to profile risks that are inherent in each business. ERM facilitates a more comprehensive evaluation of risks and will provide the basis for a more efficient allocation of resources and capital.

The risk framework used at Royal Bank Financial Group provides a good example of a comprehensive risk-profiling framework. It identifies ten primary risks that are defined in Figure I. These risks are grouped into three broad levels.

- *Level 1* risks include systemic risks involving a fundamental shift in the economic or political environment. Systemic risks can potentially affect all businesses in a significant manner. The collapse of Asian financial markets in late 1997 and 1998 is an example of systemic risk. This risk is more difficult to manage because it is beyond the direct control of the enterprise. Limiting excessive concentration and diversification across markets and products can help minimize systemic risk.

- *Level 2* risks include regulatory, competitive and reputation risks that can be influenced but not directly controlled. These risks are indirectly controlled through policies and strategies.

- *Level 3* risks include six major risks over which the enterprise should have direct control through policies, limits and strategies. These include market, credit, liquidity, operating, technology and people risks.

Written policies and limits should address each of these key risks. Moreover, they must be quantified in a consistent manner that allows comparability across products and businesses.

## Enhanced Risk Measures

In addition to quantifying the various risks at the business line level, there must be a capability to aggregate risks across business lines and products. This requires generic risk measures that, in addition to being comparable across products, take portfolio effects into account when added together. This has fostered the development of

**FIGURE I  
PRIMARY RISKS**

<b>Level 1 Risks</b>	
Systemic	Risks due to financial system disruption because of extraordinary economic, political, social or financial events.
<b>Level 2 Risks</b>	
Regulatory	Risk of changes in the regulatory environment impeding business activities.
Competitive	Risk of loss of competitive position in a given market or markets.
Reputation	Risk that an activity or employee impairs image that results in loss of business and/or legal action.
<b>Level 3 Risks</b>	
Market	Risk of adverse change in market value due to changes in interest rates, foreign exchange rates, equity prices or commodity prices.
Credit	Risk of loss due to a counterparty's inability to fulfil its payment obligations.
Liquidity	Risk of loss due to inability to meet cash or equivalent obligation in a timely and cost effective basis. Also covers the inability to transact at current market prices due to lack of market liquidity.
Technology	Risk of loss of efficiency or inability to provide accurate and timely information to manage the businesses.
People	Risk due to inadequacies in human capital such as lack of skills or rewards systems that fail to motivate desired behavior.
Operating	Risks due to inadequate practices, controls, or models.

a new array of measures that supplement the more traditional risk measures.

Traditional risk measures such as duration or present value of a basis point are product specific to fixed income and are of limited use in evaluating the risk of other products such as equities. A new measure, such as Value-at-Risk (VaR), introduces significant enhancements through the use of statistically based measures of

potential loss based on a common level of confidence (e.g. 99%) and a uniformly defined holding period (e.g. 1 day). These elements, which are lacking in the traditional risk measures, allow comparability of risks across products and businesses.

The other significant enhancement introduced by new risk measures is the ability to take portfolio or correlation effects into account when aggregating risks across products and businesses. Portfolio effects have become increasingly important in aggregating risks. This is the result of increased linkages associated with globalization, increased product complexities, and widespread use of legally enforceable credit netting.

At the same time, it must be recognized that strategic risk measures complement but do not replace the risk measures that are used at the trading desk level. Measures such as VaR that are used at the enterprise level are not as user friendly as the business specific measures which are used at the trading desk level. Traders will invariably revert to the more traditional measures with which they are comfortable such as limits on credit lines, caps on notional volume, duration limits and other product specific limits. VaR type measures must therefore be transparent and capable of being easily reconciled back to the desk level measures.

In an ideal world, these concepts would be applied to all risk categories. However, when we look at ERM applications in the next section of this paper, it becomes apparent that significant practical road blocks exist for certain types of risk such as operating risk.

## **Technology**

Enhanced risk measures require a technology platform which must lever off the mix of technology found in trading rooms. Historically, trading room technology has been driven by requirements at the business line level. Risk reporting was derived from a variety of different back and front office systems and tailored to individual business requirements associated with the real time management of risk positions. While this is a critical function at the individual desk level, it does not provide an adequate technology platform capable of compiling and aggregating risk across business and product lines.

The challenge faced by ERM is to implement an appropriate technology platform that will provide this information on an aggregated basis. The development of this technology platform is the most demanding and costly element of ERM. No single technology

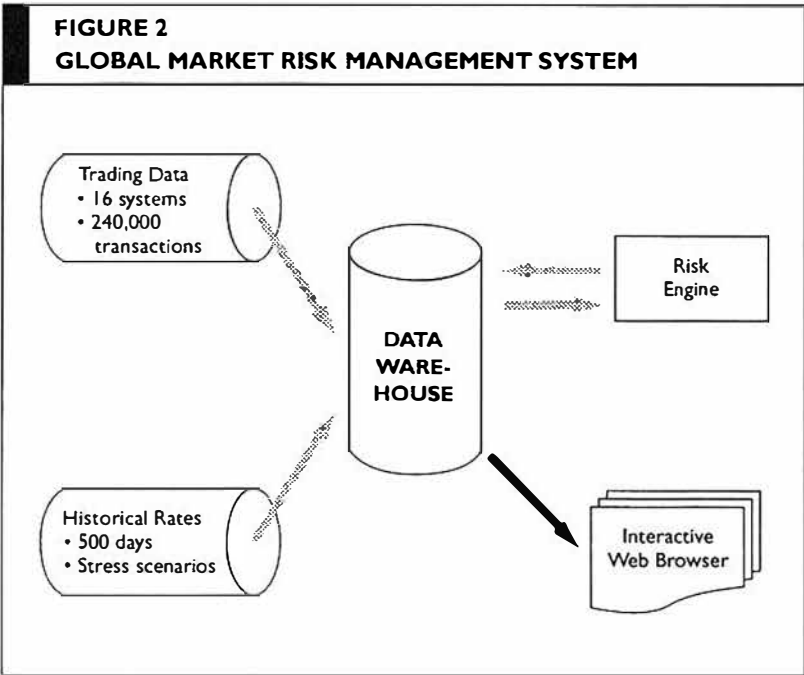


vendor provides a complete solution for a financial institution with complex trading activities. Therefore, most ERM technology platforms include a mix of vendor and internally developed solutions.

The steps involved are illustrated in Figure 2 which gives a high level overview of the technology platform used by Royal Bank Financial Group to aggregate the market risks in its trading book. This state of the art platform was developed over a two year period at a cost of about \$7 million. The platform incorporates three main components that are used to generate Value-at-Risk numbers on a daily basis.

– The data warehouse collects end of day data from all trading locations worldwide. It also collects market rates and stress scenarios for all major products. The data warehouse is the largest single cost element, accounting for approximately 70% of the total implementation costs. This results from the exacting requirements to build a data model and to map data from the various internal systems into the data warehouse.

– The second major component of the platform is the risk engine. The end of day risk positions and market rates are fed from the data warehouse into the risk engine which contains the pricing models use to calculate the VaR for the end of day.



– The third major component of the platform is an internal web site through which results are distributed to trading rooms around the world.

## **Performance Measurement**

The final element in an effective ERM process is ensuring that performance and resource allocation are evaluated on a risk adjusted basis. Financial institutions have traditionally managed the allocation of capital and priced products based on an assessment of the risks involved. Performance based compensation and narrowing spreads have reduced the margin for error. The measures of the past that gave rough approximations no longer suffice.

The end game of ERM is to develop superior risk information that can be used as a basis for allocating capital. By developing comparable measures of risk, ERM establishes a level playing field upon which to fairly allocate capital across businesses. Comparing returns on risk adjusted capital provides senior management with the critical information it requires for rationing capital, evaluating performance and optimizing returns.

## **ERM APPLICATIONS IN TRADING ACTIVITIES**

For most financial institutions, ERM is a work in progress. It is a dynamic process that continues to evolve in the face of rapid advances in products, risk measures and technology. When looking at the progress that is being made, it is useful distinguish between financial risks such as market risk and credit risk and business risks which includes operating, technology, people, reputation, regulatory and competitive risks. In general, financial institutions are more advanced in applying ERM to financial risks than to business risks, particularly in quantifying these risks.

### **Market Risk**

The most progress in terms of ERM has been made in the area of market risk. This is partially a result of regulatory pressures brought about by the introduction in 1998 of a models approach to calculating market risk capital for trading books. In looking at the measurement of market risk, it is useful to distinguish between what can be referred to as first order and second order risk. First

order risk refers to known risk positions which are readily transparent. Second order risks result from market risk positions that are not transparent and are generally not known to management.

Losses from first order market risks are the result of the controlled position taking that is a normal part of trading activities. In other words, management knowingly takes a risk position that is adversely affected by a move in market rates or prices. In recent years, financial institutions have significantly enhanced the reporting of market risk exposures arising from controlled position taking. This is reflected in the VaR numbers that are now regularly disclosed by most large banks. VaR indicates the maximum expected loss over a given time period at a given confidence level under normal market conditions. VaR exposures vary considerably among financial institutions. Among other things, it depends on the size of the financial institutions' capital base and its appetite for risk.

Figure 3 provides selected financial institutions average daily trading revenues relative to their average daily VaR positions and capital base. Over time, one would expect higher levels of market risk to generate higher levels of trading revenues, albeit with higher volatility.

**FIGURE 3**  
**VaR AT MAJOR US AND CANADIAN BANKS**  
**FISCAL 1997 (USD MILLIONS)**

	VaR	Equity Capital	Avg. Daily Trading Revenues
<b>US Commercial Banks</b>			
Citibank	65.2	19,293	8.1
J.P. Morgan	32.6	10,710	12.5
Bank of America	29.1	19,086	3.9
Chase	28.5	19,907	7.8
Bankers Trust	26.4	5,050	6.3
<b>Canadian Banks</b>			
Royal Bank of Canada	10.7	6,147	2.2
Bank of Nova Scotia	6.4	5,664	0.6
<b>Notes:</b>			
1. Canadian banks based on year ended October 31, 1997			
2. VaR numbers have been normalized to 99% C.I. and 1-day holding period			
3. Source: Annual Reports			

Losses due to second order market risks occur from a variety of reasons such as extreme stress events associated with systemic shocks or business risks such as model failure and certain types of fraud. These risks lurk beneath the surface like the base of an iceberg beneath the water. They are not transparent and are not captured by conventional VaR measures. Losses due to second order market risk are a growing cause of concern due to the rise in systemic risk as well as the rise in business risks such as model risk which is examined later in this presentation.

The importance of assessing exposure to systemic risk was reinforced by the financial meltdown in Asia in 1997 which spread to other emerging markets in 1998. Conventional VaR measures that are calibrated to the 99% confidence level do not highlight the extreme events of systemic shocks that lie beyond this confidence level. Most banks use stress tests to assess these risks. However, the basic assumptions under which stress tests were developed are being rethought in light of recent events. This is a result of the sea change in financial markets where previously held paradigms have broken down. Alan Greenspan, Chairman of the Federal Reserve Board highlighted this fact in a recent speech where he stated that global financial markets “have developed a capability of transmitting mistakes at a far faster pace throughout the financial system in ways that were unknown a generation ago.”

The negative impact of these systemic shocks on trading revenue was readily apparent in the fourth quarter of fiscal 1997 when 3 out of the 8 largest US commercial banks lost money in their trading activities according to figures compiled by the US Comptroller of the Currency. Preliminary evidence indicates that similar poor results will be recorded in the third quarter of 1998. As a result, stress tests need to be re-evaluated to ensure that they reflect the potential systemic shocks that seem to be transmitted more rapidly than ever before.

## **Credit Risk**

Measures of credit risk have also evolved in recent years, although not to the same extent as advances in the measurement of market risk. There are significant differences among financial institutions in the level of sophistication that is applied to credit measurement for derivative products. The differences largely relate to the calculation of potential future exposure and the extent to which netting and other portfolio effects are taken into consideration.

The first attempts to measure credit risk on derivatives were transaction based. This involved the calculation of current exposure of the contract plus an added amount for potential future exposure. Current exposure picks up the credit loss that would result if the counterparty were to default today. Potential exposure identifies the future credit exposure that could result from a movement in market rates over the remaining life of the contract. The added amount for potential exposure was calculated as a fixed percentage of the notional amounts. There was no allowance for portfolio effects since there was no netting of exposures to the same counterparty. This approach followed the initial regulatory framework that was outlined in the 1988 Basle Capital Accord.

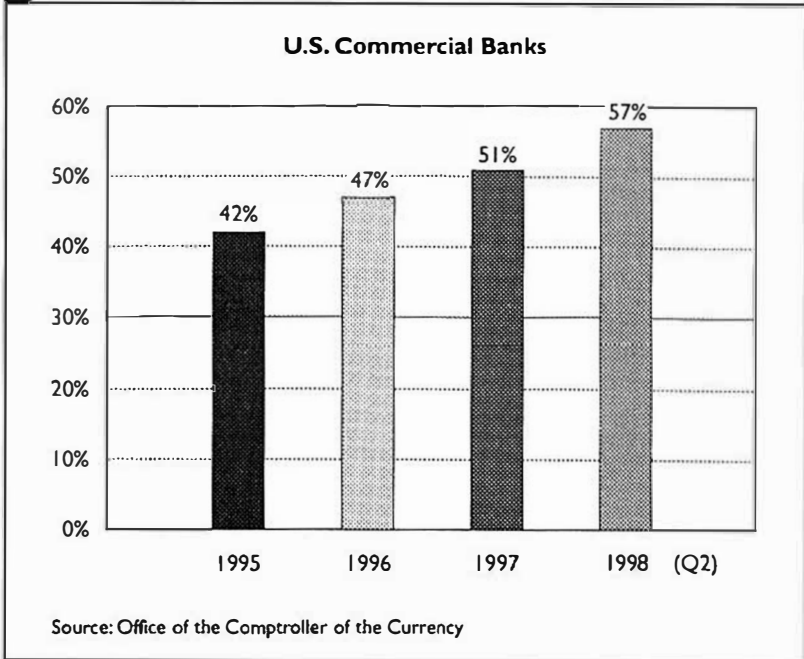
While some financial institutions continue to follow the initial regulatory approach, most leading institutions have, or are in the process of, moving to a models based approach. The major enhancements involve netting, refinement of the potential exposure calculation and incorporating portfolio effects.

The introduction of netting allows assumes that “in the money” and “out of the money” contracts of a defaulting counterparty can be settled on a net basis. Netting was initially limited to individual products and is now being extended on a multi-product basis. Recognition of netting in the measurement of derivative credit risk has been driven by the standardization of documentation, the 1995 amendment to the Basle Capital Accord that recognized legally enforceable netting and legislative changes that have put netting agreements on a more solid footing. Figure 4 provides an indication of the progress that US commercial banks have made by significantly reducing their exposure on derivative contracts through netting.

The second major enhancement has been in the calculation of potential exposure. The regulatory approach in the calculation of the potential exposure gives limited recognition to the volatility of the underlying instrument. For example, the add on factor for foreign exchange contracts with a maturity of one to five years is 5% of the notional amount of the contract, with no differentiation based on the relative volatility of currencies involved. More advanced applications use simulation techniques which take this into account.

Finally, we in the very early stages of development of models that look at the correlation of risks among a portfolio of counterparties. This goes well beyond the current regulatory framework for credit measurement that implicitly assumes perfect correlation. The current models look at correlation across the entire enterprise, incorporating trading books as well as the other banking businesses.

**FIGURE 4**  
**BILATERAL NETTING BENEFIT:**  
**AMOUNT OF GROSS EXPOSURE ELIMINATED**



## Business Risks

Business risk covers a broad spectrum of risks including competitive, reputation, regulatory, operating, technology and people risks. Business risks are generally seen to be as significant as market risk and credit risk, particularly for trading type activities. A 1997 survey of British banks that was jointly conducted by the British Bankers Association and Coopers and Lybrand found that 47% of respondents viewed Trading type products as the most likely area to suffer losses due to business type risks.

The payback from managing business risks is readily apparent when one considers the underlying causes of some the recent derivative and trading losses. Most of the losses were a byproduct of a failure to manage business risk such as model risk or rogue traders. This is shown in Figure 5.

The business risks in derivatives and trading activities are increasingly important because of the transformation of credit and market risk into business risk. The most obvious place where this

**FIGURE 5  
SELECTED 1997 DERIVATIVE DISASTERS**

<b>Who?</b>	<b>How Much?</b>	<b>Why?</b>
UBS	USD 240	Model failure
IBJ	USD 127	Model failure
NatWest	USD 123	Rogue/Pricing
Bear Stearns	USD 100	Legal
Tokyo-Mitsui	USD 83	Model failure
JP Morgan	USD 20	Model failure

occurs is in the netting of counterparty credit exposure on derivative contracts. While this reduces the amount of credit risk, it increases legal risk associated with the enforceability of netting. Similarly, other credit mitigation techniques involving forms of collateralization typically reduce the credit risk but increase the operating risk of making the collateral calls on a timely basis.

Another place where this is significant is in the area of operating risk due to model errors. Increased model risk is a byproduct of the involvement in highly structured and exotic transactions. The markets in these products often lack transparency and leave traders and risk managers dependent on valuations based on “mark to model” methods of valuation. If the model is wrong, errors can show up as a second order market risk that is not transparent. According to estimates by Capital Market Risk Advisors, this type of risk is on the rise and was a factor accounting for USD 1 billion in derivative losses in 1997.

Most of the progress that has been made in the management of business risk has been on the qualitative side. Banks in general have moved significantly ahead in the implementation of industry best practices in the areas such as segregation of duties, independent risk management functions, timely market valuations, written policies and similar practices. Once again, regulatory pressures have been a key driving factor.

The industry has made less progress in quantifying business risk which lags significantly behind the progress that has been made on market risk and credit risk. Financial institutions measure credit and market risk because these risks are most easily quantified and not because they are the most significant in terms of potential impact on the enterprise. Business risks are less easily quantified and such efforts are still at a very early stage of development. The

efforts range from relatively subjective risk scoring techniques to financial modeling. The financial modeling typically relies on simplistic approaches such as calculating business risk as a percentage of to the expense base.

## **CRITICAL SUCCESS FACTORS**

Trading operations that turn ERM into a strategic management tool will have a competitive advantage in the future. This argument is based on the view that more efficient measures of risk will result in more efficient capital allocation. The enterprise will be in a better position in terms of pricing its products and on deciding the businesses to enter or exit. In the long run, this will provide a competitive advantage that will be a distinguishing factor in performance. An effective ERM process depends upon a number of factors.

First, there must be a strong commitment to building a risk management culture. Development of an effective risk management function must be seen as more than a necessary cost of doing business. It builds shareholder value through a partnership between the risk management function and the businesses. This partnership must focus on identifying the most efficient risk/return tradeoffs and strategic opportunities.

Secondly, the risk framework must be comprehensive. This involves a commitment to developing leading edge measures that quantify all forms of risk and aggregating of these risks on an enterprise wide basis. The qualitative elements must also be covered for each major form of risk including sound documented policies.

Third, technology must be managed as a core competency. Banks that develop and implement the best technology are likely to be the winners at the end of the merger wave. This requires an ongoing commitment to investment in the financial and systems technology that enable the measurement and aggregation of risk on a firm-wide basis.

Finally, a leading edge approach to capital management must be developed. All types of risk – including all types operational risk – must be translated into capital. Portfolio effects must be factored into the capital equation. The end game is knowing the incremental capital required for new deals so transactions can be priced on a risk weighted basis.



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