Risk Management in the Small

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Operational Risk in Global Financial Organizations in the small

COMPLEX COMBINATIONS

Risk Management in the Small
Overview

• Context
  – Potential areas and topics for research related to Operational Risk management in the financial sector.
• Background – 2007-Present
• Key Perspectives, Issues, and Missing Pieces
• Models and Tools
  – How we’re trying to solve the problem in practice
• Possible areas or directions for investigation
“Operational Risk refers to financial loss resulting from a host of potential operational breakdowns that we can think of in terms of people risk, process risk, and technology risks (e.g., frauds, inadequate computer systems, a failure in controls, a mistake in operations, a guideline that has been circumvented, or a natural disaster).” – BASEL II

The “kitchen sink” – People, Process, and Systems
“The modern financial complex has morphed into something unrecognizable to many astute market veterans and academics.” Bill Gross, PIMCO, October 2007

“...in order to be sustained in an orderly fashion, the proliferation of structured products requires retooling and upgrades at virtually every level of the financial system, including a revamping of the pipes through which transactions flow. This inevitably takes time and requires managerial focus.”

“When Markets Collide” by Mohamed El-Erian, 2008
Supply Chains – Cumulative Risks and Errors

Source: PWC – Collateral Management • Challenges & Opportunities, April 2008
Supply Chains – Cumulative Risks and Errors

In summary

• Certain clients are experiencing significant error rates and exposures generated from broken operational processes and flawed data – leading to as much as hundreds of millions of dollars in margin deficiencies and untold billions in parameter errors.
• A root cause of the high levels of operational risk and/or actual operational failures can be traced to fragmented processes and siloed systems that can’t keep pace with product and volume growth.
• We recommend that organizations undertake end-to-end operational effectiveness assessments in highly complex product areas.
• Processes need to be re-designed to meet the current and future needs of business and large stores of critical data may need to be remediated.
• Experience shows millions (USD) or more may be at unnecessary risk and can be identified and collected in an early phase of the overall project.

Source: PWC – Collateral Management • Challenges & Opportunities, April 2008
Firm Level Risk Management Challenges

- **Spreadsheets** are often used to consolidate data from smaller branch offices, this means information needs to be entered, often manually, into larger systems resulting in data errors.
- **Inconsistent systems and terms** from different bank locations results in errors in reporting and inconsistent information from different locations.
- **Regulations** continue to change or be updated, it is often difficult to implement changes or report in a timely fashion.
- **Acquisitions** result in many divergent systems that do not communicate with each other, this increases risk and accuracy in reporting.
- **Point-to-Point integration** of disparate systems is complicated and costly to reporting in this setup. Rarely actually occurs ...
- **Agility to grow the business** through new acquisitions is restrained, change management is complicated and cumbersome.
- **Cumulative effects** of above are rapidly degenerative...
Enterprise Risk Management – State of the Art

INDUSTRY PRACTICE – EXAMPLE
Risk Management in the small

Event: any incident that needs to be captured, measured, and contextually analyzed.

For any event, Risk Management personnel need to know...

- what (Transaction \ Event Alert)
- where (Branches)
- which (Transactions)
- when (Frequency)
- why (Associate Links)
- who responds (Managers)
- HOW? (PROCESS/SEQUENCE)

Need to relate—not just copy—information from many sources.
Data Models are required

Using Modeling Tools (MagicDraw) to Visualize:

- Traceable, Modeled representation of granular data requirements for firm-level risk management applications (including market, credit, liquidity),

- Connection between data management and operational risk.
Model all the Risk Management Formulae for banks' major products: e.g. corporate, small-medium enterprise (SME), residential mortgage and qualifying revolving retail exposure.

**Corporate exposure**

\[
\begin{align*}
\text{Correlation} (R) &= 0.12 \times \left(1 - \exp(-50 \times PD)\right) / \left(1 - \exp(-50)\right) + \\
&0.24 \times \left[1 - (1 - \exp(-50 \times PD))/(1 - \exp(-50))\right]
\end{align*}
\]

\[
\text{Maturity adjustment} (b) = (0.11852 - 0.05478 \times \ln(PD))^{2}
\]

\[
\text{Capital requirement} (K) = LGD \times N \left[(1 - R)^{0.5} \times G(PD) + \left(R / (1 - R)\right)^{0.5} \times G(0.999)\right] - PD \times LGD \\
\times \left(1 - 1.5 \times b\right)^{2} - 1 \times (1 + (M - 2.5) \times b)
\]

\[
\text{Risk-weighted assets (RWA)} = K \times 12.5 \times \text{EAD}
\]

**Corporate exposure adjusted for SME**

\[
\begin{align*}
\text{Correlation} (R) &= 0.12 \times \left(1 - \exp(-50 \times PD)\right) / \left(1 - \exp(-50)\right) + \\
&0.24 \times \left[1 - (1 - \exp(-50 \times PD))/(1 - \exp(-50))\right] - 0.04 \times \left(1 - (S-5)/45\right)
\end{align*}
\]

**Residential mortgage exposure**

\[
\text{Correlation} (R) = 0.15
\]

\[
\text{Capital requirement} (K) = LGD \times N \left[(1 - R)^{0.5} \times G(PD) + \left(R / (1 - R)\right)^{0.5} \times G(0.999)\right] - PD \times LGD
\]

\[
\text{Risk-weighted assets} = K \times 12.5 \times \text{EAD}
\]

**Qualifying revolving retail exposure**

\[
\text{Correlation} (R) = 0.04
\]

\[
\text{Capital requirement} (K) = LGD \times N \left[(1 - R)^{0.5} \times G(PD) + \left(R / (1 - R)\right)^{0.5} \times G(0.999)\right] - PD \times LGD
\]

\[
\text{Risk-weighted assets} = K \times 12.5 \times \text{EAD}
\]
Blueprints – Models based Traceable Enterprise Framework

Requirements Documents are formally traced to 73 other formally modelled artefacts: business processes, strategic goals, business functions, processes, static data models, infrastructure topology models in order to:
- share and scale best practices and
- be able to view requirements from the perspective of all relevant types of stakeholders

Requirements (word) document for OPS RISK traceable to:

- Strategic Goal Model, Measurement Model
- Process & Organization Models
- Static Data Models
- Infrastructure & Topology Models

• Traceability is the backbone for maintaining and managing the alignment between different stakeholders during requirements gathering.

For example: Clicking on process activity allows you to see corresponding requirement, goal or static data model
Accurate Measurement

- **Operations should be designed to meet Key Performance Indicators (KPIs).**
- **KPIs are derived from information in many levels of an operating enterprise**
- **Blueprints aligns these metrics.**

You cannot improve what you cannot measure!
Standards based Firm Wide Risk Management – Tracing Data to Real Time Ops Risk

1. Standards based business and system models
2. Perform simulations to optimize business models
3. Using 3D-VE approach, create detailed models & implementation
4. Instrument the deployed application
5. Monitor application operation & collect metrics
6. View dashboards & perform gap analysis
7. Update business models

Includes emergency and other Notifications

Includes automated execution of ACTION PLANS
Comprehensive TRACEABLE visibility into policy compliance

- Document and manage goals, policies, rules, and action plans
  - Capture from source documents
  - Linkage
- Enforce standards
  - During message capture & transformation
  - At transaction level
- Track and report violations
  - Clear traceability. Exceptions linked to rule that is violated
  - Record remediation
  - Custom reports and charts
Quick Dashboard Demo
– KPIs for Risk Management in the small
Real World Challenges for building comprehensive Automated Risk Compliance solution for Financial Institutions

- Define transformations from proprietary to standard formats
- Identify exceptions and create alerts
- Implement custom weightages
- Remove sensitive data like names and account numbers
Real-time transaction capture and standardization

Monitor network
- Capture messages of interest
- Discard other messages

Transform messages
- ISO 20022 format
- Rules based
- Remove sensitive information

Identify violations
- Bank specific policies
- Basel II rules
- Raise alerts
Tie up of Data Analysis with OPERATIONAL RISK ASSESSMENT

- SYSML content can be easily updated for regulatory changes
- Certified by the Basel Committee of Banking Supervision (BCBS)

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<th>Risk Categories</th>
<th>Approaches to calculate capital requirement</th>
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<td>Credit Risk</td>
<td>Standardized, Foundation IRB, Advanced IRB</td>
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<td>Market Risk</td>
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Bank Specific Models

Industry Models

Regulatory Compliance Service
Model validation using artificial intelligence engine

- Artificial Intelligence engine
  - continuously learns
  - provides better insights into operations
  - facilitates the creation of new policies
  - model based simulation and assessment of the impact of new policies

- Identifies new cause and effect relationships between multiple variables by learning from real data.
  - Automatically determines mathematical formulas (with a specified range of error)

- Bayesian Reasoning application was developed and proven within NASA’s Mars Rover™. Project enabled the rover to make decisions on its own.
ADVANCED RESEARCH – ARTIFICIAL INTELLIGENCE engine to monitor and analyze continuously changing cause–effect scenarios: B.R.A.I.N (Bayesian Reasoning Analytics in Intelligent Networks)

EVENTS In SBVR

Patterns

REAL WORLD

TRANSDUCERS

ACTUATORS

Inference Engine based on Agents

Patterns of events causing state changes in models

Mathematical WHAT–IF inference calculations

Actions from Inference results

Inference

Results \ Inferences

Learn and Remember for future inferences

Analyze during inference

GOALS and Constraints in the form of SBVR Rules

Modeling and Meta–Modeling Patterns Repository (MEMORY)
Areas for Investigation

RESEARCH TOPICS
Models on Models
“What has the credit crisis taught us? First, that typical observed diversification doesn’t always work. You’ve got to worry about all of the effects—on equity, on liquidity, on capital availability, etc. Also, whatever you imagined as an extreme tail event, imagine something even worse. And then make sure you understand all its implications to your business as a whole and also to your various entities.”

— Insurance Chief Risk Officer
Table 1: Long-Term Correlations

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How do we know they are changing?
“Almost no one expected what was coming. It’s not fair to blame us for not predicting the unthinkable.”

Daniel H. Mudd, former CEO, Fannie Mae