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APPLYING BIG DATA TO RISK MANAGEMENT:

Transforming Risk Management Practices
within the Financial Services Industry



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Stéphan De Prins

As an Associate Partner with Avantage Reply in the Benelux and France, Stéphan De Prins draws on over 17 years' experience in developing and implementing cutting-edge solutions in risk management. Stéphan has devised numerous risk solutions for leading institutions across Europe and North America. Key recent projects have included creating a Large Exposures and Concentration Counterparty Credit solution for a Global Custodian, and implementing a risk and regulatory reporting system for a universal bank. Prior to joining Avantage Reply, Stéphan led the development and implementation of the IFRS Module of FRS Global.

About **Avantage Reply**

Established in 2004, Avantage Reply (a member firm of Reply) is a pan-European specialised management consultancy delivering change initiatives in the areas of Compliance, Finance, Risk and Treasury.

Website: www.avantagereply.com

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As you are reading, the world's data is exploding in unprecedented velocity, variety, and volume. It is now available almost instantaneously, creating possibilities for near real-time analysis. While Big Data is already being embraced in many fields, risk managers have yet to harness its power. Big Data technology has revolutionary potential. It can improve the predictive power of risk models, exponentially improve system response times and effectiveness, provide more extensive risk coverage, and generate significant cost savings. In a world of increasing complexity and demand, the ability to capture, access and utilise Big Data will determine risk management success.

Big Data technologies and risk management:

- Improved **predictive power** and stability of risk models
- More extensive coverage of **real-time risk intelligence**, improving monitoring of risk and reducing noise-to-signal ratios
- Strengthened **evidence based decision-making** capacities across a number of key domains
- Significant **cost savings** in risk management

Over 90% of the world's data has been created in the last two years ¹. Forward-thinking industries and organisations have already begun to capitalise on this gold mine. But what does the Big Data revolution mean for risk management?

Put simply, Big Data represents the future in this field. Why? Big Data technologies can help Risk teams gain more accurate risk intelligence, drawn from a variety of data sources, in almost real-time. Within the financial services industry, they can allow asset managers, banks and insurance companies to proactively detect potential risks, react faster and more effectively, and make robust decisions informed by thousands of risk variables. Already used widely across other sectors - particularly in eCommerce - Big Data is a true game changer.

Big Data is routinely defined as high-volume, high-velocity and high-variety information assets demanding new technological approaches to organisation and analysis. When applied to risk management within the financial services industry, we would add 'high-velocity' and 'high-value' to this list - effective analysis of this data has the potential to drive increased accuracy and reliability, and offers potentially significant cost savings by combatting the risks that can cost financial institutions billions.

Big Data technologies are set to transform the world of risk management. Make sure you're part of it.

1. <http://www-01.ibm.com/software/data/bigdata/what-is-big-data.html>

'Noise' or 'signal'



The era of data warehouses - with their static structures and limited interaction paths - is over. The complexity and variety of sources now available (including social media, email, sensor data, business apps, archives and documents), and the speed required for retrieval and analysis, demand fresh new approaches. We are now moving into the era of data lakes.

'Time is critical in the new world of risk management. If you can react to a risk faster, you have a competitive advantage'

Jason Hill
Executive Partner - Reply

The approach to data lakes is simple: instead of organising data in a siloed, prescriptive store, you can retain all types of data together in their original formats. Data lakes store both structured data - as contained in relational databases and spreadsheets - and unstructured data - such as social media, email and text documents. It can then be used far more rapidly and flexibly. This system allows users to run ad hoc queries, perform cross-source navigation, and make analytical decisions, all based on real-time information.

For example: imagine you want to conduct a credit check on a new customer. Data lakes allow a risk profile to be developed based on a range of data - including customer credit reports, spending habits, social media profiles, and credit card repayment rates - in seconds.

Worried about fraud on the trading floor? Rather than manually - and laboriously - track staff trading actions, data lakes allow the retrieval of an instant snapshot of activity, including information from chat room sites, mobile phones, and even door swipe cards. Suspicious activity can be identified and stopped as it is happening, before incurring fines and devastating damage to your bank's reputation.

Big Data suggests big promises - but can it live up to them? It is still very early days. Nate Silver points out that, with the amount of data being generated daily, the 'noise (may well be) increasing faster than the signal. There are so many hypotheses to test, so many data sets to mine - but a relatively constant amount of objective truth'². Determining useful signal requires targeted strategies and appropriate technologies, or the sheer volume of data threatens to obscure insight and value. Our experience has provided us with a number of insights as to how Big Data might benefit the risk management sector, and how we can get closer to the 'objective truth' beneath the noise.

2. Silver, Nate. 2013. The Signal and the Noise: The Art and Science of Prediction. Penguin.

Big data applied: it's a game changer

Risk management faces new demands and challenges. In response to the crisis, regulators are requiring more detailed data and increasingly sophisticated reports. Banks are expected to conduct regular and comprehensive bottom-up stress tests for a number of scenarios across all asset classes. Recent, highly publicised 'rogue trader' and money-laundering scandals have prompted further industry calls for improved risk monitoring and modelling. Big Data technologies present fresh opportunities to address these challenges. Vast, comprehensive and

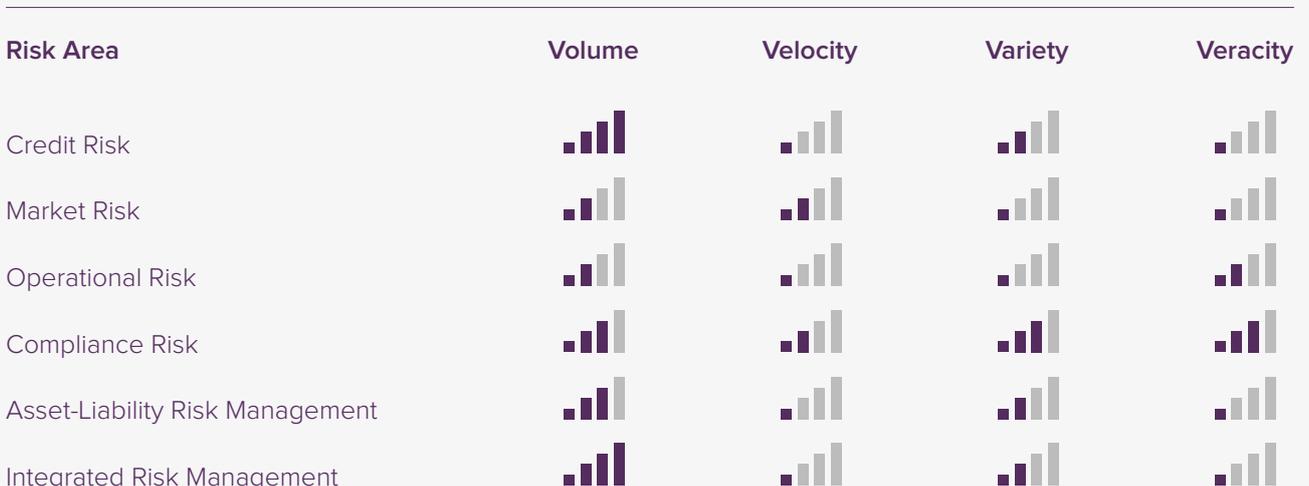
near real-time data has the potential to improve monitoring of risk (while reducing noise-to-signal ratios), risk coverage, and the stability and predictive power of risk models. In a number of key domains - particularly operational and compliance risk - Big Data technologies will allow the development of models that will support everyday Risk Officer decision-making. Able to process enormous amounts of data in fast timeframes, the technologies can also accommodate new requirements for scenario stress tests at the trade, counterparty and portfolio levels.

The majority of benefits - and challenges - offered by Big Data stem from its massive volume and variety (fig.1). However, different risk domains stand to benefit from Big Data technologies in diverse ways. Big Data can be targeted to an organisation's particular needs - whether they are for greater volume, variety, velocity or veracity - and strategically applied to enhance different risk domains.

BIG DATA OFFERS SIGNIFICANT OPPORTUNITIES IN MOST RISK DOMAINS

fig.1

IMPACT OF BIG DATA ON RISK MANAGEMENT AND DECISION-MAKING



Credit Risk: Better Predictive Power

Post-crisis, financial institutions are now expected to have thorough knowledge of their clients. Increasingly, forward-thinking banks - for example - will harness Big Data to develop more robust predictive indicators in the credit risk domain. New data sources - including social media and marketing databases - can be used to gain greater visibility into customer behaviour. These sources can reveal startling information: a costly divorce, an

expensive purchase, a gambling problem.

Drawn from data lakes, this information can augment traditional data sources including financial, socio-demographic, internal payments and external loss data. Together, the datasets can produce a highly robust, comprehensive risk indicator.

Rather than waiting to review loan

clients' financial reports to discover loan-servicing problems, firms can utilise Big Data technologies to detect early warning signals by observing clients' on-going behaviours, and act in time.

Anti-Money Laundering: Real-Time Actionable Insights

Following several recent scandals, the industry has zero tolerance for money laundering/terrorism financing. Fines have been huge, recently reaching a record \$8.9bn for one French bank found to be working with countries subject to US sanctions.

The high cost of money laundering cases has prompted banks to seek new ways to address the severe limitations in current anti-money laundering risk management.

Traditional approaches to anti-money laundering remain dependent on rule-based, descriptive analytics to process structured data. This system clearly has limitations - without automated algorithms, detecting information within the wealth of data requires laborious keyword searches and

manual sifting through reports. For instance, we recently observed the case of a large financial institution where 'CBI' in payment instructions could signify the Central Bank of Ireland, Italy or Iran. All 'CBI' transactions within this firm were routed to: AML Operations staff to be manually reviewed: a resource-consuming, potentially error-prone task.

Big Data analytics can improve the existing processes in AML operations. Its approaches allow for the advanced statistical analysis of structured data, and advanced visualisation and statistical text mining of unstructured data. These approaches can provide a means to quickly draw out hidden links between transactions and accounts, and uncover suspicious transaction patterns. Advanced

analytics can generate real-time actionable insights, stopping potential money laundering in its tracks, whilst still allowing fund transfers for crucial economic and human aid to troubled regions. Big data technologies can identify incidents, help draw a wider picture, and allow a bank to raise the alarm before it's too late.

Market Risk/Traded Credit Risk: The Need for Speed

Credit counterparty risk quantification has become considerably more complex. Derivatives are no longer simply the net discounted value of each leg - rather, the bank's own credit quality (debt valuation adjustment - DVA), that of its counterparty (credit valuation adjustment - CVA) and unsecured funding (Funding Valuation Adjustments - FVA) need to be taken into account. These calculations often have to be run in sets with differing pricing data (for example producing 'risk-neutral' CVA) and at various frequencies for reporting - monthly, weekly, daily, intraday.

Calculating these components is enormously data intensive. To calculate CVA at the portfolio level, large banks typically run between 1,000 and 5,000

Monte Carlo scenarios. However, to fully simulate potential exposure for all path-dependent derivatives as structured products, banks may need to run around 100,000 Monte Carlo scenarios. Traditional grid-farm technologies simply cannot cope with such large processes at high enough speeds - blades on a grid often simply fail due to processing overload.

In-memory graphics processing units (GPU) can offer enormous benefits in the increasingly data-heavy market risk domain.

Adapted from the gaming industry, in-memory/GPU technologies allow systems to handle large amounts of data at incredibly high speeds. In-

memory implementation brings a of key advantages over traditional approaches: no compromises such as approximations are required any longer, and incremental what-if statistics are possible in seconds. Overall, the solutions can produce greatly improved balance sheet optimisation and collateral management, including real-time exposure simulation for new client trades and market price/volatility changes.

In market risk and counterparty credit risk management, volume and velocity are driving factors. Put simply, banks with increased Monte Carlo abilities will be able to price 'path dependent' derivatives trades at better levels than their competitors.

'New HPC and in-memory technologies are taking us to the next level of market risk management. Technology is both from a computational power as well as a cost point of view not a limiting factor anymore. Both market and credit risk exposures as well as valuations can be simulated in far greater detail by using these new technologies.'

It even allows for models and simulations which until recently were perceived to be impossible or too costly.'

Marc van Balen, Global Head of MRMB Trading, ING Bank



Trading Surveillance and Fraud Management: Covering all Bases

Fraud costs banks billions. High-profile rogue trading scandals - such as those caused by Kweku Adaboli and Jerome Kerviel - have dominated press coverage in recent years, and resulted in staggering fines. These cases can wreak havoc on the financial system as a whole - Nick Leeson's fraudulent speculative trading caused the catastrophic collapse of an entire bank. Six banks were recently fined \$4.3bn following the global forex probe, reflecting a 'failure to improve their controls in the wake of Libor' ³.

Traditional approaches are proving cumbersome and slow in identifying fraud. The traditional

Operational Risk team approach to catching rogue traders is to manually track Dealer and Operations staff actions that could manipulate positions, and profit and loss. However, fraudsters now utilise a range of technologies and strategies, like the private chat rooms used in the recent FX scandal. New data lake technologies have the benefit of collecting data from any imaginable source, including not only trading systems, email, social media and mobile data, but also HR systems, door swipe card activity, and computer access log files. The result is a fully comprehensive, integrated approach to data analysis that can

detect fraud before the damage has hit disastrous levels.



'In Operational Risk, the power of Big Data lies in the ability to integrate vast information from legacy platforms into a single highly flexible solution. For example, we can leverage Big Data solutions to gain superior insights for access control management across the various platforms in which our clients interact with us, helping us to ensure the safety, security and confidentiality of client transactions at all times.'

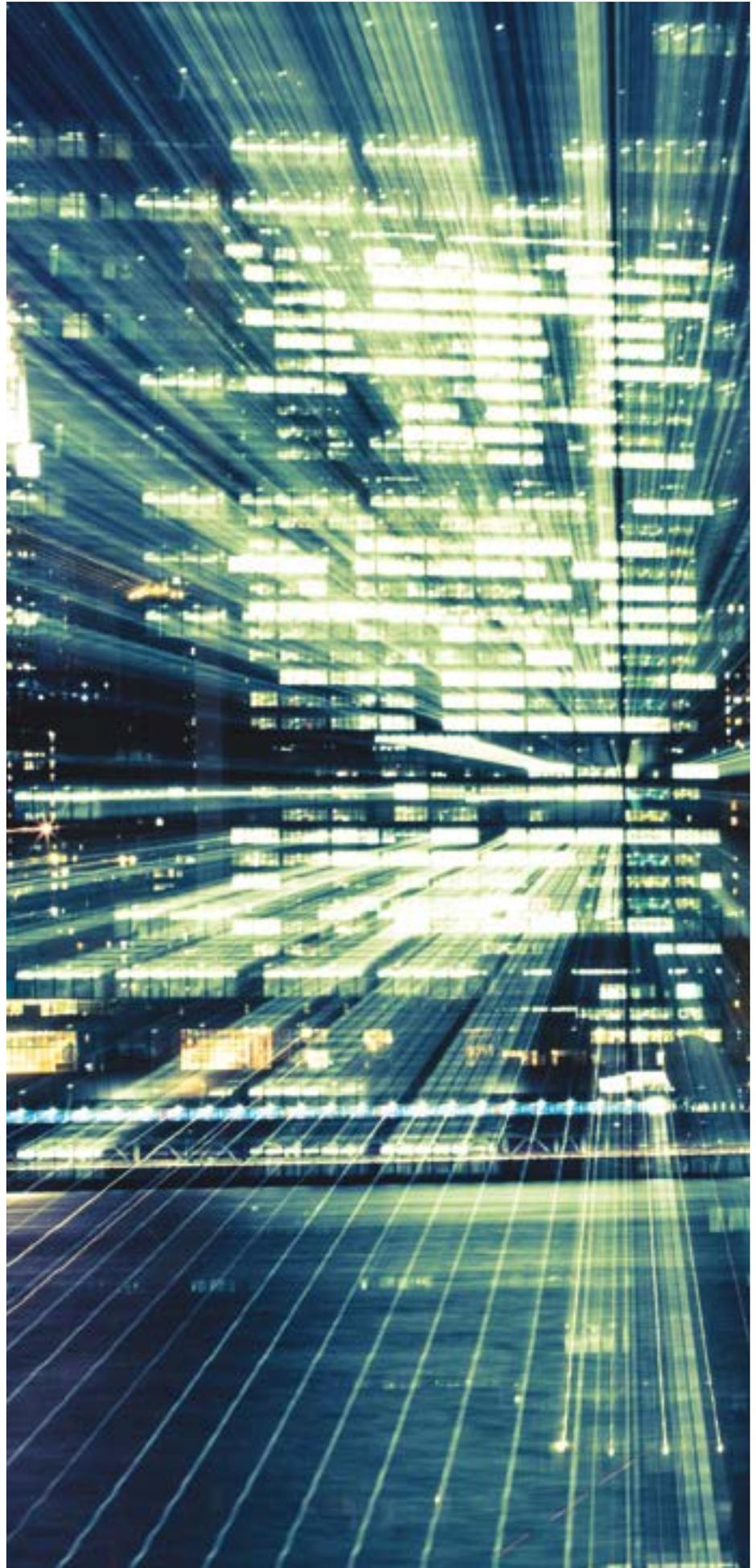
Andy Smith, Managing Director - Operational Risk Management, BNY Mellon

3. Financial Times. 12 November 2014. Regulators slap \$4.3bn fines on six banks in global forex probe. Available at <http://www.ft.com/cms/s/0/aa812316-69be-11e4-9f65-00144feabdc0.html#slide0>.

Past, Future and Present

While Big Data can help us improve our reactive and predictive capabilities, it also presents exciting new possibilities for addressing risk in the present. Recent developments in cognitive technology will enable Big Data technologies to make reasoned, informed decisions in real time, defending markets against vulnerability to shocks.

For example, the intertwining of Twitter and Wall Street has led to some disastrous incidents: last year, a false tweet from Associated Press - that the White House had been hit by explosions - sent markets into free fall. Cognitive programs, like IBM's Watson, can be used to address this type of risk. Watson has the cognitive capacity to analyse unstructured data - like social media feeds - and make an immediate, rational assessment of risk. In this case, the fact that the report came from Twitter would have prompted triggers that it should be viewed with caution - not immediately set off a chain of catastrophic market reactions.



Big data: our vision

New technological developments can be daunting. However, Big Data technologies are already proving safe, effective, and value-adding. Developing at an exponential rate, Big Data technologies are fast becoming standard practice in many industries - from online shopping to medical research. Big Data is already making an impact in financial services, particularly in the Marketing and online Retail banking areas.

The transition need not, therefore, be overwhelming. Adopting Big Data technology doesn't require a complete IT system overhaul. Avantage Reply's approach - drawing on the deep Big Data capabilities of Reply - is to bring the best of Big Data technologies to your organisation, while preserving existing, valued technologies.

In the near future, we expect banks will continue to utilise their existing relational databases and data warehouses - these remain essential for complying with the increased regulatory reporting requirements. However, we see these capabilities greatly enhanced by Big Data functionality. For example, the open source software project, Hadoop Ecosystem, can add significant value to existing traditional systems, databases and data marts by mapping sourced data and aggregating results.

Hadoop can act as a One-Stop-Shop for enterprise data (shared

data across an organisation), to create a data lake, leaving the data in its original form by integrating with the data warehouse through 'middle ware' connectors. The approach allows teams to 'connect the dots' across the enterprise data, enabling analytics not possible through traditional means. This flexibility can lead to surprising discoveries: instead of asking pre-defined questions, the data lake allows the user to be guided by the data, and observe patterns and relationships across a variety of data forms. When used to its full potential, Big Data can provide answers to questions that did not exist at the start.

The latest technologies will require team members with new skills.



Why Avantage Reply?



Avantage Reply brings the risk and technology worlds together. We combine Avantage's long-term experience in integrated financial risk management with Reply's leading technology design and implementation solutions to create a unique offering. We know first-hand the challenges of the fast-moving, increasingly demanding risk management field. And we have a proven track-record of working with clients across a range of industries to adapt the latest, safest, most appropriate technology to their needs. Our experts are best placed to make Big Data work for your Risk Management team. Big Data is not just about technology - it's about developing new ways of working and collaborating. Your

Risk Management team may find itself working more closely with your organisation's IT, Finance, and Operations teams. Avantage Reply can facilitate synergy across formally disparate departments, and help foster high-performing team cultures to work effectively with Big Data. We can bring your Risk team closer to the shore of the data lake to develop collaborative solutions, gain faster access to information, and learn how to maximise Big Data's potential.

Implemented now, Big Data technologies will put you at the front of the game. It's a field of rapid expansion, and we are here to help.



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