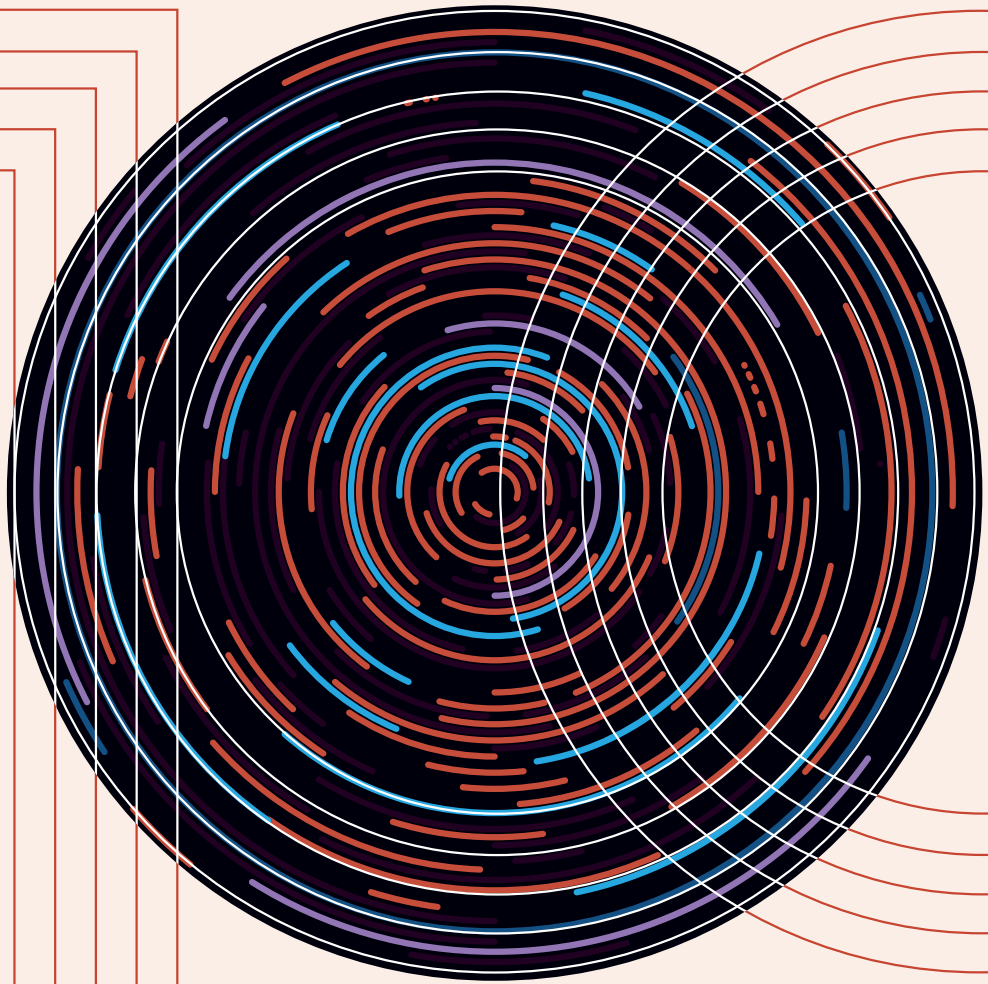
# RiskTech 100 2020



Chartis

Independent. Insightful. Actionable.

# About Chartis

Chartis Research is the leading provider of research and analysis on the global market for risk technology. It is part of Infopro Digital, which owns market-leading brands such as Risk and WatersTechnology. Chartis' goal is to support enterprises as they drive business performance through improved risk management, corporate governance and compliance, and to help clients make informed technology and business decisions by providing in-depth analysis and actionable advice on virtually all aspects of risk technology. Areas of expertise include:

- Credit risk.
- Operational risk and governance, risk and compliance (GRC).
- Market risk.
- Asset and liability management (ALM) and liquidity risk.
- Energy and commodity trading risk.
- Financial crime including trader surveillance, anti-fraud and anti-money laundering.
- Cyber risk management.
- Insurance risk.
- Regulatory requirements including Basel 2 and 3, Dodd-Frank, MiFID II and Solvency II.

Chartis is solely focused on risk and compliance technology, which gives it a significant advantage over generic market analysts.

The firm has brought together a leading team of analysts and advisors from the risk management and financial services industries. This team has hands-on experience of implementing and developing risk management systems and programs for Fortune 500 companies and leading consulting houses.

Visit **www.chartis-research.com** for more information.

Join our global online community at **www.risktech-forum.com**.

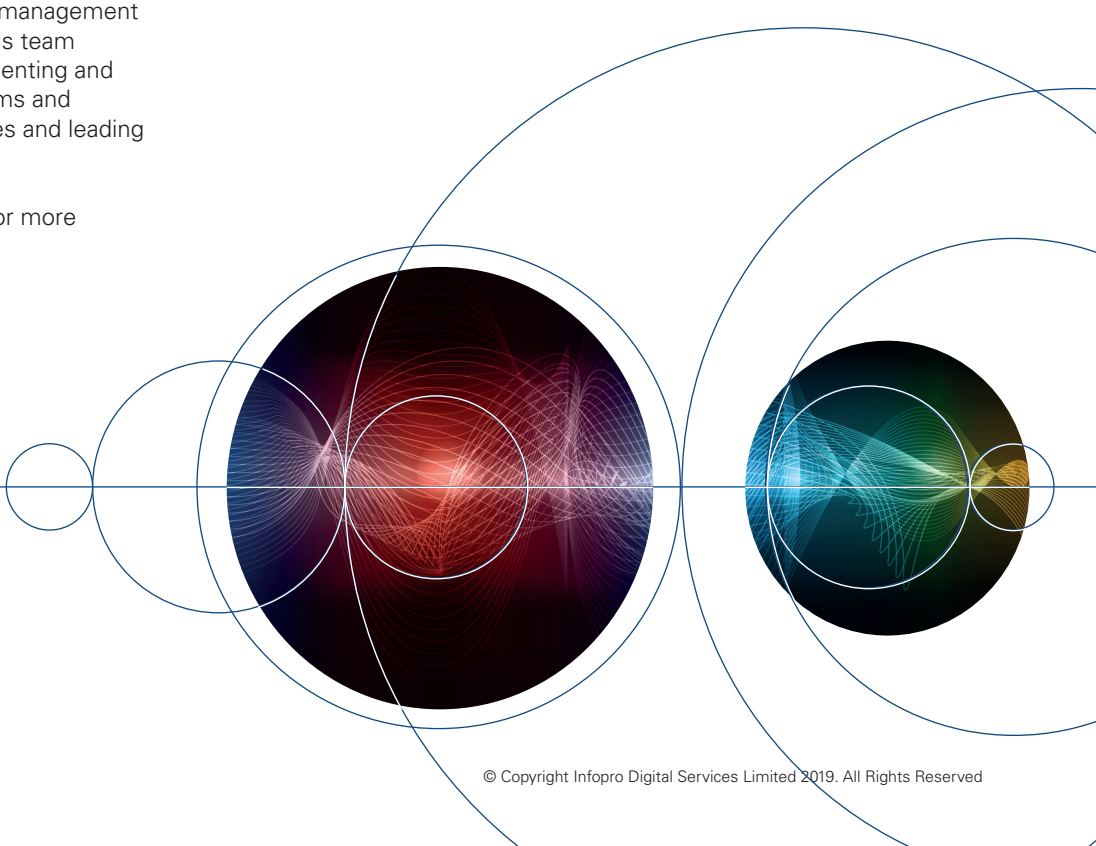
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# 1. Foreword



I'm delighted to welcome you to RiskTech100® 2020. Now in its fourteenth year, RiskTech100® is still the most comprehensive independent study of the world's major players in risk and compliance technology, globally acknowledged as the go-to place for clear, accurate analysis of the risk technology marketplace. Together with its accompanying awards, the RiskTech100® ranking provides a valuable assessment and benchmarking tool for all participants in risk technology markets.

As in previous years, we have refined and updated our award categories to reflect the latest trends shaping the risk technology landscape, some of which we also highlight in this report. As we outlined in our Big Bets report at the start of the year, for risk technology users and providers, this might seem the best of times: offering new technologies, new ways of doing business, and new opportunities. But below the surface threats and risks, old and new, fester and rankle. The wave of cutting-edge statistical techniques sweeping finance, crested by AI and machine learning, threatens to leave a storm of costly confusion and misapplication in its wake. As new business structures appear, companies are regrouping and consolidating. And the perennial caveat with technology is that no matter how sophisticated your tools, mechanisms and defenses, they are available to everyone – good and bad.

At Chartis we believe that a successful risk technology strategy hinges on three vital factors. Firms need to be aware of new technologies, they need to understand where and how they can best be implemented, and they need teams across the business – CRO's office, risk IT, engineers, quants and data scientists – to be familiar enough with the latest technologies to be able to implement them to greatest effect. A recurring theme in our research this year has been how knowledge and experience provide the vital glue holding everything together. And, of course, these can only come from proper engagement and a sober realization that understanding how solutions work is more important than simply acquiring them.

Another important dynamic we have been tracking has been the push by regulators and standards-setting bodies to integrate risk into value, embedding the forward-looking principles of risk management into the finance industry. This is important for buyers and sellers of risk technology, with implications for how each party addresses the data aggregation, analytics, modeling and reporting requirements of standards such as IFRS 9, IFRS 17 and CECL. In the featured article in this year's report, Chartis analyst Maryam Akram explores the potential impact of so-called 'risk-aware' finance, examining its benefits and challenges, winners and losers. I hope you find it an interesting read.

At Chartis we continue to expand our research and analysis – and our team – to reflect ongoing developments in the wider risk technology landscape. Our various quadrant reports and updates have covered areas as diverse as AI, model validation, IFRS 17 and cyber risk quantification. The quantification theme is one we have been exploring in other areas too – most notably operational risk. This has led us to split it this year from its traditional partner GRC, allowing us to recognize achievements in the area of operational risk quantification.

Alongside this research, we have also introduced a new ranking. Energy25, launched last month, recognizes how energy trading and risk management has grown in recent years, nourished by a boom in data and the more sophisticated analytics needed to crunch it. Our inaugural Energy25 awards, held on 16 October, were a huge success, and we plan to make them a regular feature of the Chartis research calendar. For those interested in the accompanying research report, you can access it for free on our website.

Energy25, and other planned initiatives (in areas such as cyber risk and statistical techniques for risk management), represent the latest steps in our strategy of defining, researching and understanding the ever-changing RiskTech market in all its complexity – research for which RiskTech100® remains the cornerstone.

With that in mind, it only remains for me to congratulate the winners in RiskTech100® 2020. On behalf of the whole Chartis team, we look forward to working with our clients in what promises to be another vibrant and dynamic year in RiskTech.

Enjoy the report!

**Rob Stubbs, Head of Research**


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# 2. Overview

The companies featured in RiskTech100® are drawn from a range of risk technology specialisms, and meet the needs of both financial and non-financial organizations. However, they share a number of qualities that rank them among the top 100 risk technology providers in the world.

The RiskTech100® rankings are determined based on the classifications illustrated in Figure 1, and again focus on solutions, industry segments and success factors.

The RiskTech100® report only includes companies that sell their own risk management software products and solutions. While many provide professional services and consulting offerings to support companies that implement and use their software solutions, we have excluded pure consulting or professional services firms from this study.

**Figure 1: RiskTech100® taxonomy**




*Source: Chartis Research*


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## RiskTech100® 2020: Highlights

FIS, MSCI, Oracle, Moody's Analytics and SAS remained in the top five spots. Wolters Kluwer rose six places into the top 10.

There were 16 new entrants to the rankings this year:

- Numerical Technologies (ranked 22)
- GBG (25)
- Raise Partner (36)
- LSEG (45)
- Pelican (49)
- GTreasury (63)
- Appian (66)
- 3i Infotech (67)
- BlackSwan Technologies (68)
- Appway (74)
- ZMFS (75)
- Vichara Technologies (78)
- Thetica Systems (90)
- Featurespace (93)
- Manipal Technologies (99)
- KYC Global Technologies (100)

7 companies rose in the rankings by 5 places or more:

- ION moved up 13 places, from 26 to 13
- SAI Global moved up 8 places, from 77 to 69
- Wolters Kluwer moved up 6 places, from 14 to 8
- Beacon Platform moved up 5 places, from 52 to 47
- BlackRock Solutions moved up 5 places, from 33 to 28
- QRM moved up 5 places, from 58 to 53
- Quantexa moved up 5 places, from 48 to 43

### Highlights of RiskTech100® 2020

**16** new entrants

**12** rising stars

**7** notable rises



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# 3. Key highlights

This section contains highlights of our 2019 research program, grouped according to four broad categories: technology; financial crime; industry landscape; and market structure and regulation.

For details of Chartis' full research scope and agenda, visit **www.chartis-research.com**.

## Artificial intelligence in financial services

### The cog in the machine

Rather than being 'new', artificial intelligence (AI) is one of several statistical tools that have been with us for some time. Nowadays AI tools are everywhere in financial services, used mostly as 'cogs' in bigger, established processes and systems. And like every dedicated process or system, AI must be understood properly to be used effectively. Financial institutions (FIs) implement AI largely because it gives them opportunities to optimize various points in their process chains. Decisions about where, how and why to deploy AI tools are governed by three factors: process, motivations and technology focus.

Most vendors provide AI as an add-on to existing capabilities. True 'AI vendors' are rare: most vendors focus on one of three key technology areas, while some combine these various offerings into packaged solutions. Indeed, by trying to apply AI techniques broadly across many areas, vendors could spread themselves too thinly, with no focused expertise in one area. The unique and complex requirements of areas such as anti-money laundering (AML) or regulatory change management, for example, are difficult to master. Making solutions work in these areas is also dictated by how well vendors have understood and internalized the governance, regulatory and cultural nature of the marketplace they are addressing, and then tailored their technology and approach to fit.

## Model validation

### Taking a holistic view to stay up front

Model validation is a complex area, covering a wide variety of highly specific tools and techniques of varying maturity. Current model validation, using relatively well established technologies and techniques, has its challenges: notably around workflow, the ease with which models can be interpreted, and how to tackle the opportunities and challenges presented by data.

More sophisticated technology (including AI and machine learning [ML]) is driving an evolution in the landscape that is challenging the structures on which established model validation has been built. Much of this evolution is being influenced by the need for 'explainability' and interpretability, now demanded by regulators and CROs. Explainable AI (XAI) could become a critical element in meeting any future regulations and ultimately preventing systemic technological risk.

Chartis believes that, to compete successfully, vendors should start to take a more 'holistic' view, ensuring they are at the forefront of developing and implementing new validation techniques, and continuing to provide services for traditional models. Ultimately, for model validation to be possible and effective in FIs' new, AI-led future, vendors and users will have to dramatically change their attitude and approach to modeling, to make the end-to-end process of model development and validation transparent and effective.

## STORM (Statistical Techniques, Optimization and Risk Management)

### A deluge of digital: making best use of AI in finance

Statistical techniques, models and processes are well established in the finance sector today, cutting across every process and category in the industry. The growth in new statistical techniques in the last few years has increased the complexity in FIs' systems and processes, and made it harder for them to fully appreciate or even understand what tool should go where. Battered by hype and in fear of being left behind, many FIs may have adopted these tools without a clear idea of what they do. They may even have adopted some techniques without even realizing it.

Exacerbating the issue, risk management is increasingly becoming a core part of processes across the finance organization, enabled in part by this new technology revolution. As risk management – and in particular risk analytics –


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becomes more distributed, FIs now have to know exactly where everything should go to get the best results from their risk management systems.

Together, these trends are creating what Chartis has identified as STORM: Statistical Techniques, Optimization and Risk Management – a growing disturbance that affects FIs and the tech vendors that supply them.

## Anti-money laundering/ watchlist monitoring

### Moving into new areas, and new challenges

Within FIs, AML capabilities increasingly function on a continuum: centralized within specific compliance departments, but also present in other operational areas such as Know Your Customer (KYC) and customer lifecycle management (CLM). FIs now want to reconfigure their existing AML processes to make them more efficient and valuable, but there has also been a shift toward understanding and quantifying AML solutions, which has sharpened the focus on model risk management and validation capabilities. And as AML use matures in investment and retail banking, it is spreading into other areas, notably trade finance, gambling and the FinTech sector.

Packaged solution vendors and data providers remain the backbone of the AML marketplace. But new entrants, such as commercial workflow and advanced analytics vendors, pose a threat, especially to packaged solution vendors. And as AML moves beyond its core compliance areas, solution vendors are having to consider ancillary sectors where it is relatively immature, such as trade finance, gambling and the burgeoning FinTech sector. While these areas offer new opportunities, they also bring their own challenges and impacts for the vendor landscape, in terms of addressing the wide range of firms and requirements they contain.

## Cyber risk quantification

### Cooperation needed to exploit a growing market

Cyber crime is one of the biggest challenges facing FIs, which must now also address the growing risk of technology outages. It's a costly issue – overall, breaches and outages can cost the average FI millions of dollars annually. Facing a rise in threats, institutions of all types are spending big on their cybersecurity systems.

Yet the task of systematically quantifying firms' relative cyber risks has until recently gone unaddressed. FIs and vendors have sought to quantify cyber risk before, but increasingly they are spending such large sums on cybersecurity systems that they require defensible risk scores for their cyber domains. And only now is there technology available to automate analysis and leverage the vast datasets required to properly quantify cyber risk.

Increasingly, Chartis believes, vendors of cyber risk quantification (CRQ) solutions will develop specific functionality across four key functional and operational areas: the cyber risk score, loss estimation, portfolio optimization, and attribution. Vendors currently approach CRQ from two angles: externally, assessing a firm's network in relation to that of other firms; and internally, mapping the risk of cyber events occurring on a firm's own network. By partnering and cooperating, vendors can start to offer comprehensive solutions that will enable them to exploit the ever-growing CRQ market.

## Enterprise fraud

### A divergence in fraud and vendor strategies

The landscape for enterprise fraud is increasingly dividing into two distinct areas: account-based fraud (which has remained relatively static) and payments-based fraud (which has been growing). Two major developments are driving anti-fraud capabilities:

- In payments fraud, fewer transactions are cash-based, making payment processors and anti-fraud systems for payments more important than ever.
- In both payments- and account-based fraud, a growing number of vendors provide curated data sets, used primarily for identification and verification.

These changes are causing shifts in the marketplace, and the payments market in particular has become a hotbed of company acquisitions, creating challenges and new considerations across the vendor landscape. What's more, the bifurcation of fraud systems will clearly impact vendors' strategies. In particular, vendors will need to decide if and how they want to specialize. In general, firms tend to be more effective in one


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area or the other, dictated by factors such as their underlying infrastructure capabilities.

Payments-based fraud is currently undergoing seismic market shifts, driven by the rapidly changing payments landscape. Vendors of account-based fraud solutions, meanwhile, should take particular note of the shift toward cloud-based fraud systems, since it has implications for the way they should manage new types of fraud.

## Know Your Customer

### Seeking the single view

FIs have long sought a 'single view' of their customers that enables analysts to access all the relevant information about an individual in one place. For many, a universal single view across all operations remains beyond reach, but a more integrated customer view – one that unifies pertinent information into a single-access system and interface – is now achievable.

KYC is an entity-centric process that requires and produces large volumes of information on each customer. As such, it can form a useful foundation on which to develop an integrated view, serving not only financial crime compliance but other areas of the business too, in areas such as credit risk and customer relationship management.

But achieving the single view will require careful thought and planning. To set its scope and design, FIs must consider the different KYC requirements of each business line, and develop a realistic scope and a straightforward data storage architecture. The roles of components – and services – in this will also be key.

For vendors hoping to sell into this evolving market, integration should be a top priority, as should deepening their services capabilities and – where feasible – augmenting their solutions through partnerships with complementary firms

## Trade surveillance – transaction monitoring

### Ease of use - rather than outcomes - is the key differentiator

In Chartis' definition, 'transaction monitoring' is one of two distinct activities covered by the term 'trade surveillance' (the other is 'communications surveillance'). We define transaction monitoring as 'examining how individuals and institutions conduct trades'.

FIs have been sharpening their focus on transaction monitoring in recent years, but Chartis believes that many surveillance algorithms are only partially effective, and false positives are a persistent problem. To prove market abuse, FIs need more capabilities, and as the surveillance marketplace grows, infrastructure, processing capability and ease of use, rather than outcomes, will increasingly differentiate effective solutions. Infrastructure trade-offs are also a vital consideration in transaction monitoring. FIs will prioritize their requirements according to the type of institution they are and the specific regulations they must abide by, forcing them to make significant choices between system components.

The market for transaction monitoring solutions is complex, with a mixture of leading providers and smaller players supplying a variety of products. In some trading areas (such as retail broker-dealing and equity trading), requirements have changed little over time, so vendors in these areas have remained dominant. In other areas – such as over-the-counter (OTC) derivatives and wholesale broker-dealing – where analysts need to monitor transactions in real time, FIs increasingly require streaming databases and an ability to replay and reconstruct trades and order books at a fine-grained level.

## Fixed-income technology solutions

### Data at the heart of a complex market

The complexity of the fixed-income landscape is creating wide differences across segments of the market in three main areas: the quality of reference data available, the level of modeling, and the level of electronicification and automation. But at the heart of the fixed-income value chain is data, which is having the most profound effect on fixed-income markets. As the supply of data increases, it is helping to drive something of a 'renaissance' in analytical techniques and tools such as ML, robotic process automation (RPA) and natural language processing (NLP).

Against this background, securitization has enjoyed a resurgence since the 2008 financial crisis, and we believe it is one area of the market that is likely to see considerable change in the coming years.


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Most of the demand for securitized products is now coming from the buy-side, creating a large potential market in cutting-edge analytics with integrated data and simplified access.

Some vendors are investing in buy-side solutions to tap into this strong demand, while those without a deep focus on securitization have tended to cover areas of the market well with more generalized offerings. Data, of course, is central. To offer the best solutions, vendors must continue to develop their technology, by devising more sophisticated analytics and improving their solutions' resistance to attacks.

## Front office risk management

### Consolidation driving more strategic choices

Over the past year several developments have been shaping the front office risk management (FORM) landscape, including:

- The increasing popularity and use of risk as a service (RaaS).
- The continued growth of decoupled architectures (including the leveraging of the Python ecosystem).
- Wider use of fixed-income analytics.
- A re-examination of the role of high-performance computing (HPC) and other technology components (including graphics processing units [GPUs] and GPU databases) in building performant computational capabilities (in both internal and RaaS scenarios).

For vendors, cost pressures resulting from changes to the operating environment following the financial crisis continue to play a key role. Banks are more skeptical of the return on investment (ROI) for new FORM systems, despite the opportunities they offer, and are much more open to systems consolidation and new technologies that could reduce cost and enhance flexibility.

Consolidation, in fact, is manifesting among FIs and vendors in two ways – either as a means to increase in size, or as a way to specialize – and both are shaping firms' strategies. Vendors have several courses of action to consider as they acquire or extend different parts of the FORM value chain, including modularization, partnerships and RaaS strategies.

Chartis believes that those that adopt a more flexible, modular and open approach can offer the best and most efficient solutions and partnering options.

## Sell-side risk management technology

### Crucial choices to make

Several developing trends have been creating new challenges for sell-side FIs. As firms' stress-testing obligations increase, demand for good quality, timely data is rising, pushing many FIs to supplement their existing data with that from other sources. Other challenges facing sell-side firms include more complex capital management, and a blurring of risk-related responsibilities across the business.

One major development is the need for more sophisticated computational technology to handle the growing complexity of sell-side risk management, especially in the areas of initial margin (IM) and margin valuation adjustment (MVA) calculations. To upgrade their systems to address the issues, sell-side firms have a crucial choice to make: handle the increased burden themselves, or look for help elsewhere.

Although no sell-side vendor offers a single solution that can deliver all the required functionality, some vendors now cover a wider range of firms and requirements. This is creating a growing convergence among vendors' functionality, business models and approaches to implementation. Sell-side firms are more interested in buying 'modular' components, and packaged solutions are in decline. Most sell-side risk management vendors now employ a 'generalist' strategy, growing their offerings horizontally, and covering more valuation adjustments (especially MVA capabilities).

## Global risk IT expenditure

### Flattening growth, as spend shifts to the cloud

Overall, risk IT expenditure grew by about 5% between 2017 and 2018, to $77.8 bn – a slight decrease on the 6% growth for 2016-2017. Globally, growth is starting to flatten, and even decline in some areas, as spending shifts from new risk IT projects to the maintenance of existing ones.


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Regulation continues to be a common theme in risk IT expenditure, with notable impacts in several areas, including credit risk, asset and liability management (ALM)/liquidity and insurance risk.

Another key theme is the shift from expenditure on internal systems to spend on external software and services. Many FIs have shifted their expenditure on risk IT systems to the cloud, and providers are supplying more 'productized' solutions that combine software, services and data in packaged offerings. The other key influencer of risk IT spend is the gradual blurring of the boundaries between risk and other areas of FIs' expenditure, such as market data.

Much of the activity that shapes FIs' expenditure is happening out of view, with increasingly subtle and nuanced dynamics shaping purchase and implementation decisions, as well as a morass of competing and overlapping definitions. These developments are complicating the business of assessing, calculating and predicting FIs' risk IT expenditure, and more sophisticated models will be needed to address the growing complexities involved.

## IFRS 17

### The next stage in risk-aware accounting

International Financial Reporting Standard (IFRS) 17 is the first comprehensive global accounting standard for insurance and reinsurance contracts. Following other standards (such as Current Expected Credit Losses [CECL] and IFRS 9), it represents the next stage in a wider regulatory project of integrating risk into accounting practices, in line with other areas of financial services. For insurers, complying with IFRS 17 could be costly and complex, requiring considerable investment in skills and technology. But it also offers a longer-term opportunity to modernize and make their accounting processes more efficient.

While the opportunity for vendors is potentially lucrative, the diversity in existing infrastructure will require a variety of approaches that will differ by region and the size and type of firm involved. Many insurers in the EU will likely work with their existing contracted vendors so they can comply with elements of the IFRS 17 value chain. In emerging markets, vendors are attempting to establish new client relationships and develop solutions from overlaps in new and existing technology. The variability in end-user requirements, and IFRS 17's principle-based nature, mean that IFRS 17 solutions at their core must be flexible.

## RiskTech vendors

Mergers, acquisitions and partnerships continue apace among vendors in the risk and compliance technology market. These deals range from large to small; some focus on filling product and technology gaps, while others are driven by the need to defend market share and acquire new clients. Below is a representative list (selected by Chartis) of deals announced in the past 12 months:

- Abrigo acquired Sageworks, a provider of lending, credit risk and portfolio risk software.
- BlackRock acquired eFront, a provider of alternative investment management software.
- CME Group acquired TriOptima, a provider of operational and credit risk management tools and services.
- Cognizant acquired Meritsoft, a provider of post-trade processing systems.
- Deutsche Börse Group agreed to acquire Axioma, an analytics provider.
- FIS acquired Worldpay, a payments processor.
- Gresham acquired B2 Group, a cash management and payments specialist.
- IBM acquired Red Hat, a provider of open source-powered cloud services and operating systems.
- ION acquired Allegro Development Corporation, a provider of enterprise commodity management solutions.
- SAI Global acquired Nasdaq's BWise, a provider of governance, risk management and compliance (GRC) software.
- SimCorp acquired AiM Software, a data management provider.
- SS&C acquired IBM's Algorithmics assets (risk analytics products and services).
- SS&C acquired Eze Software, a provider of solutions for asset managers.


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- State Street Corporation acquired Charles River Development, a provider of automation tools for the front and middle office.
- StatPro acquired financial services firm ODDO BHF's regulatory risk bureau.
- StatPro acquired the ESG research and index business unit of ECPI, a provider of sustainable investment solutions.
- StatPro itself was acquired by investment data management firm Confluence.
- Symphony acquired risk management software provider Ayasdi, renaming it Symphony AyasdiAI.
- The banks BB&T and SunTrust merged to form Truist Bank.
- LSEG agreed to acquire Refinitiv, a market data provider and owner of the Eikon terminal.
- VMWare acquired Carbon Black, a provider of endpoint security systems.

Chartis Research's *Quarterly Market Intelligence* updates provide more detail on the main RiskTech market and vendor trends throughout the year.


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# 4. Making finance risk-aware: setting the standard?

***The challenges, winners, and losers in finance's revolutionary new paradigm***

## The next big thing

In a bid to boost risk-awareness in the finance industry, the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB) have instituted a series of new accounting standards, among them IFRS 9, CECL and IFRS 17. Together, these standards form part of a concerted initiative to introduce 'risk-aware accounting' (RAA) into financial services, to increase standardization and transparency in the sector post-financial crisis. As such, RAA, we believe, constitutes the next significant paradigm shaping the financial services sector, determining how firms report and recognize value.

For technology vendors the standards offer big opportunities as financial firms scramble to comply. But like any risk-mitigation measures (such as margin and solvency requirements), RAA has its downsides. Highly standardized measurement and classification methodologies could create common blind spots and force market participants to make the same mistakes. Technology vendors might be the winners in RAA, but who are the losers? Could RAA even have systemic effects on the market? And how did we arrive at RAA in the first place – what's the theory underpinning it?

In this article we explore all these themes, mapping the standards that fall under the RAA banner in a wider, interconnected, post-crisis supervisory landscape. We also explore the conceptualization of value and risk under RAA, before considering the impacts and challenges of its key pillars – IFRS 9 and CECL – and what they mean for suppliers and users, as well as who the real winners and losers are likely to be. Finally we consider the future of RAA in the finance industry.

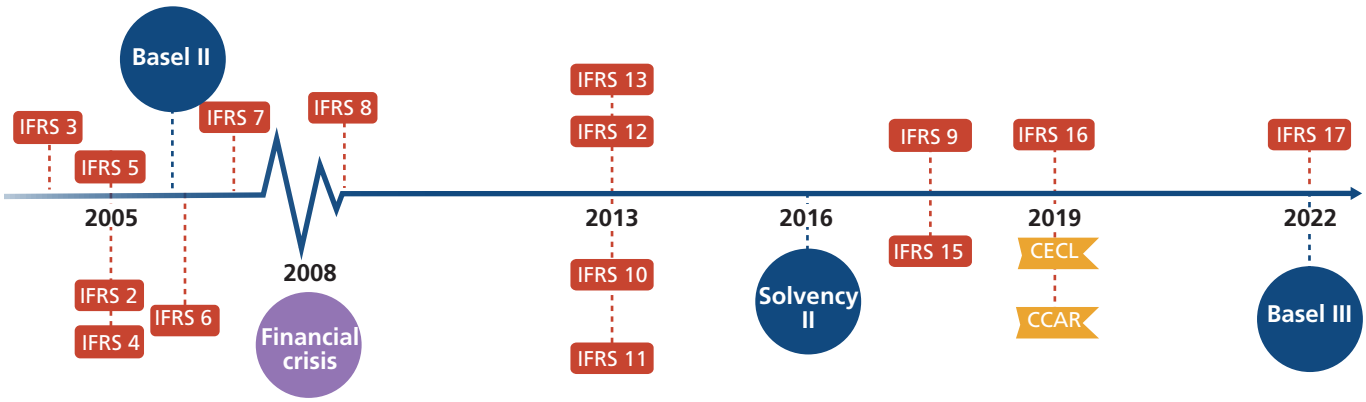
## The path to risk-awareness

The IASB and FASB's RAA agenda is effectively an overhaul and rebuild of global accountancy standards in financial services. Ten years in the making, it has recently reached fruition. IFRS 9 and IFRS 15 came into effect in 2018, IFRS 16 in 2019, and IFRS 17 is due to come into effect in 2022 (see Figure 2).

RAA stems from wider moves by governing bodies, following the 2008 financial crisis, to reassess existing standards and regulations in the finance sector and improve statutory risk-mitigation requirements. Previous accounting regimes and frameworks were widely seen as contributing to the financial crisis. In the run-up to 2008, many banks were overly optimistic about their real profits and losses, overstating profits and neglecting to mention losses. This had a knock-on effect on the accuracy of banks' capital ratios and liquidity (the ratio of their capital to their risk-weighted assets).

After the crisis it wasn't just the misrepresentation of profits and losses that were thrown into the IASB and FASB's reforming spotlight. Also at issue was the way that the market risk inherent in assets

**Figure 2: Supervisory timeline**




*Source: Chartis Research*


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or liabilities was calculated: in short, the inputs, consistency and quality of market modeling were sorely lacking.

Of course, the reform of financial practices after 2008 is not limited to accounting – capital and margin requirements are also continuously evolving (the main methods of risk mitigation outlined by supervisory regimes are shown in Figure 3). Crucially, crossover between the different methods following the financial crisis – particularly solvency and accounting regimes (such as IFRS 9 and 17) – has increased, especially as statistical forward-looking models are no longer confined to firms' risk departments.

Poor accounting can have huge impacts on the health of the financial system, not least because accounting errors can wildly mispresent the liquidity an institution needs to hold. By their very nature solvency and margin requirements must be forward-looking, fed by unbiased economic data. And as RAA hoves into view, the process of financial reporting is following suit.

## An analysis of RAA and its pillars

### Fair value: more large instruments covered

RAA represents a shift in the way that institutions must approach *value*. Under the IFRS standards, firms must measure their assets and liabilities at 'fair value' – in other words, the estimated price of an asset or liability under current market conditions.

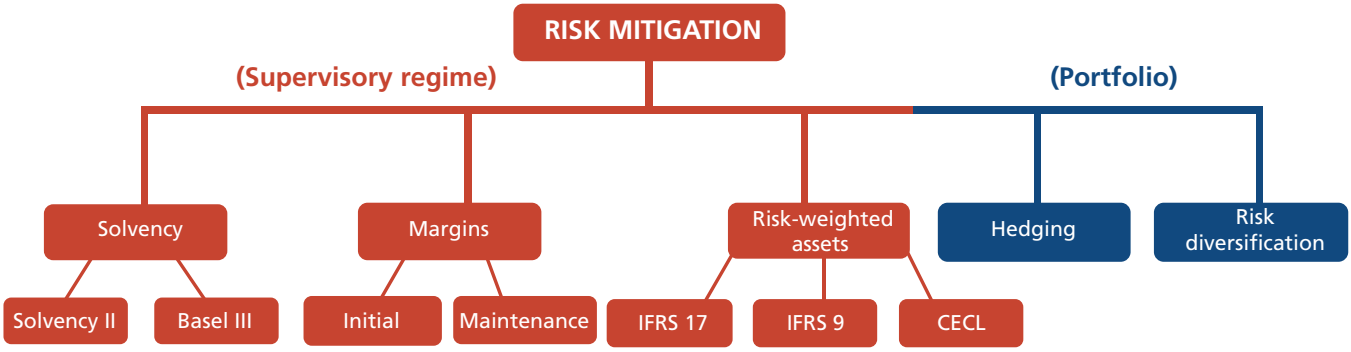
Leading up to the 2008 crisis, the regulations then in force – US Generally Accepted Accounting Principles (GAAP) and International Accounting Standard (IAS) 39 (Financial Instruments and Recognition and Measurement) – failed to spot a decline in value of certain financial instruments (notoriously subprime mortgage loans). As a result, firms' balance sheets continued to look healthy right up until they were forced to sell large quantities of these 'bad' loans. Put simply, firms only needed to assess financial instruments at fair value when they suffered an actual loss in value.

With RAA, all that has changed. Firms are now required to assess a larger scope of instruments (beyond derivatives and marketable securities) at fair value, and must do so more often and for longer periods. Both the IASB and the FASB have emphasized the time value of money and market risk via discount-rate and impairment-modeling measures. The aim of these is to ensure that firms aren't caught off-guard when economic conditions change significantly and their balance sheets are left wanting in terms of accuracy.

### IFRS 9: integrating credit risk into financial reporting

IFRS 9 came into force in 2018, replacing IAS 39. Figure 4 outlines the key stages in IFRS 9 compliance. Notable among the structural changes introduced by IFRS 9 are a requirement for forward-looking impairment projections, and substantial alterations to hedge accounting and the classification of assets. Depending on the estimated level of credit risk associated with an asset, expected losses must now be projected on either a 12-month or a lifetime basis.

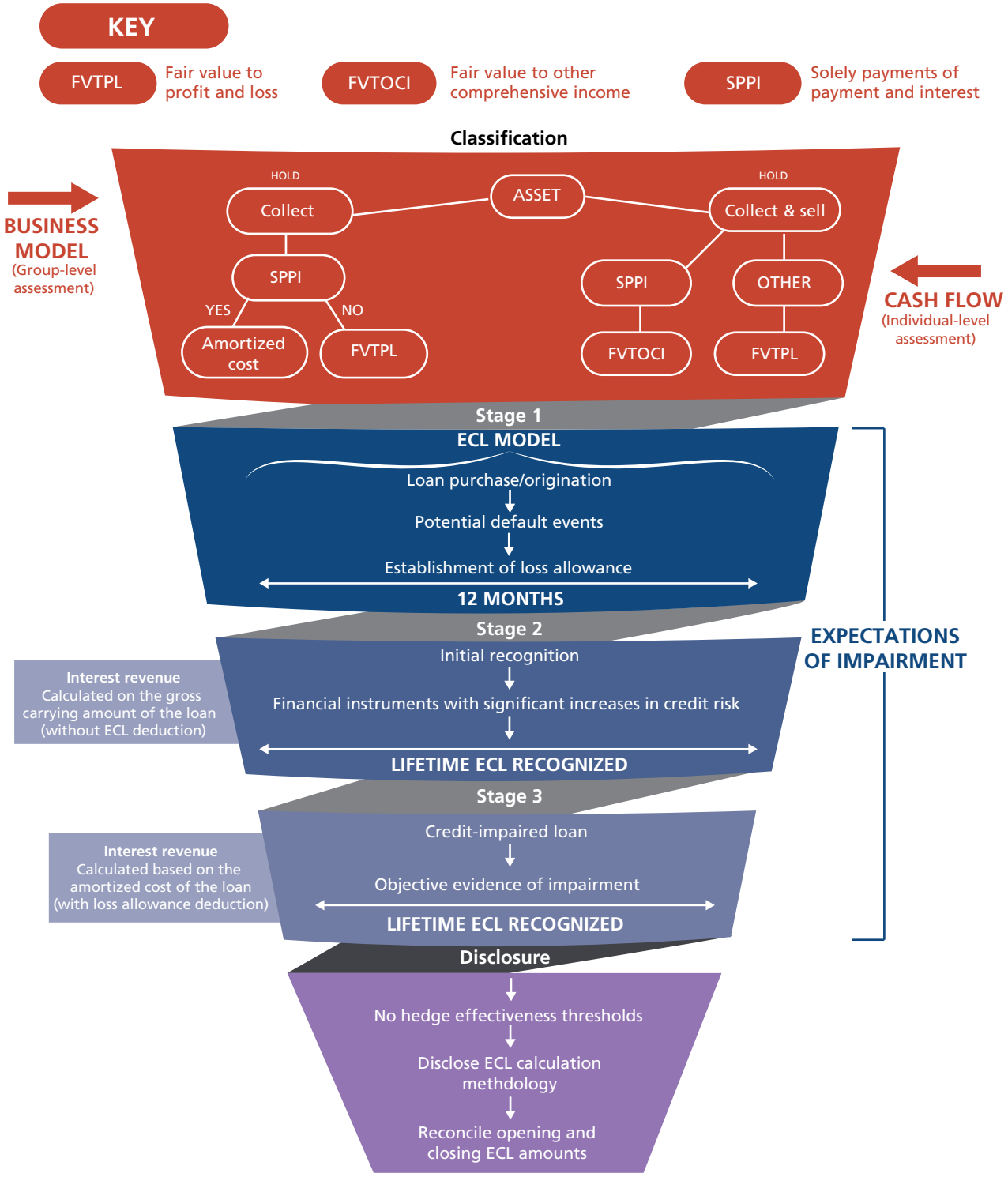
**Figure 3: Risk-mitigation techniques**




*Source: Chartis Research*


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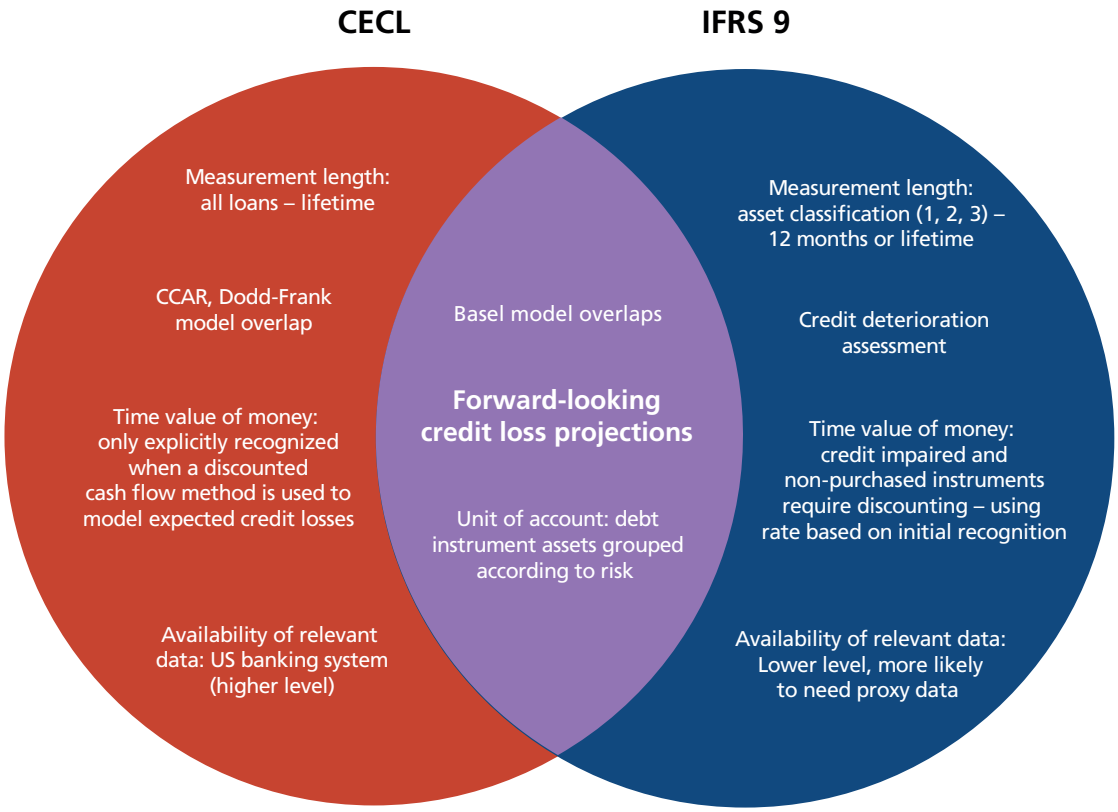
**Figure 4: IFRS 9 compliance value chain**




*Source: Chartis Research*


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**Figure 5: IFRS 9 and CECL – overlaps and differences**




*Source: Chartis Research*

This use of forward-looking credit risk planning is not unprecedented: credit risk modeling has long been involved in financial firms' quantification of their supporting capital relative to their exposure. That said, the appearance of credit risk modeling in financial reporting and accounting *is* unprecedented.

IFRS 9 has fundamentally altered the timing of credit loss recognition: firms can no longer wait until there is objective evidence of credit loss before recognizing it (as they could under IAS 39). Under IFRS 9, if a credit loss event is anticipated but hasn't occurred, it must still be recognized. Impairment modeling under IFRS 9 also requires projections; unlike IAS 39 modeling cannot be limited to past and present conditions.

## IFRS 9 and CECL – accounting for credit risk

CECL is the US version (issued by the FASB) of accounting rules that cover debt instrument assets. Although IFRS 9 and CECL overlap, they diverge on some important points (see Figure 5). Notably, for forward-looking credit loss projections, CECL requires all loans to be measured as lifetime projections. Under IFRS 9, by contrast, if a firm believes that an asset does not have significant credit deterioration, it doesn't have to extend a 12-month credit projection to a lifetime one. For financial firms, bearing this in mind is important when they are considering scaling their CECL modeling regimes to cover both standards. Applying stage 2 (lifetime credit modeling) assets to stage 1 (12-month credit modeling), for example, which is required under CECL, is a challenge.

On the face of it, new accountancy standards aimed at reforming how firms recognize profits and losses and adjust for the market risk of assets and liabilities should help to improve the overall stability of financial markets. Compliance will inevitably create a cost burden for FIs, but with the right technology this investment should eventually pay off. However, challenges will exist – these we consider in the following section, focusing specifically on IFRS 9 and CECL.


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## The challenges of RAA

Under RAA, the three big challenges facing FIs are balance sheet volatility, having to invest in the technology and expertise required to comply, and – for IFRS 9 and CECL – increased loan loss provision.

What's more, new demands on incorporating market risk into financial reporting not only require institutions to expend considerable resources in complying, they also create operational challenges. To comply with RAA standards effectively and efficiently, firms need cross-functional teams that include members from both the risk and finance departments. Relevant data also needs to be organized within a centralized system with proper functionality to ensure data integrity, so that the complex flow and manipulation of compliance data can be controlled.

Under the RAA standards, firms' risk and finance departments are increasingly required to overlap. This is largely because the standards require risk-stochastic modeling to be applied during the process of financial reporting. The demands of IFRS 9 impairment modeling, for example, are more akin to the stochastic modeling methodologies firms use when allocating economic capital, rather than the modeling used for conventional financial reporting. Traditionally, to model financial reporting firms have had to collate pertinent cash flow data and synthesize it into appropriate reporting templates.

Similarly, under IFRS 17, insurers will consistently need market data to determine the value of their liabilities. Under IFRS 17, all cash-flow projections must be subject to discounting; the standard dictates which methodologies to use for this. Along with the production of cash flow data, cohort contractual service margin (CSM) measurements, financial and non-financial risk measures, and initial yield curves, discounting requirements also demand that the finance and actuarial departments be more closely aligned.

### How technology can help

Collectively, IFRS 9, IFRS 17 and CECL require firms to have massive amounts of data, and the right means to manage and model it. They also require firms to conduct repeated and complicated calculations in a relatively short time. Generally, in terms of the functionality required to comply with RAA, institutions will need: a data warehouse, cash flow modeling, market risk modeling, data models, data tagging, workflow management, and data integrity functions, across different levels of aggregation (see Figure 6).

Although IFRS 17 requires extensive actuarial modeling compared to IFRS 9 and CECL, it still more closely resembles traditional accounting methods, providing a context for modeling, accounting frameworks and reporting upgrades. Therefore the main consequence for firms is coping with the granularity of accounting recognitions and contract qualifications. Market-oriented modeling of insurance contracts appears to be more of a second-order consequence under IFRS 17. By contrast, the biggest cog by far in the CECL and IFRS 9 compliance value chain is impairment modeling, which requires many different kinds of data – some of which can be hard to acquire.

#### *Reuse, reuse: exploiting overlaps with capital frameworks*

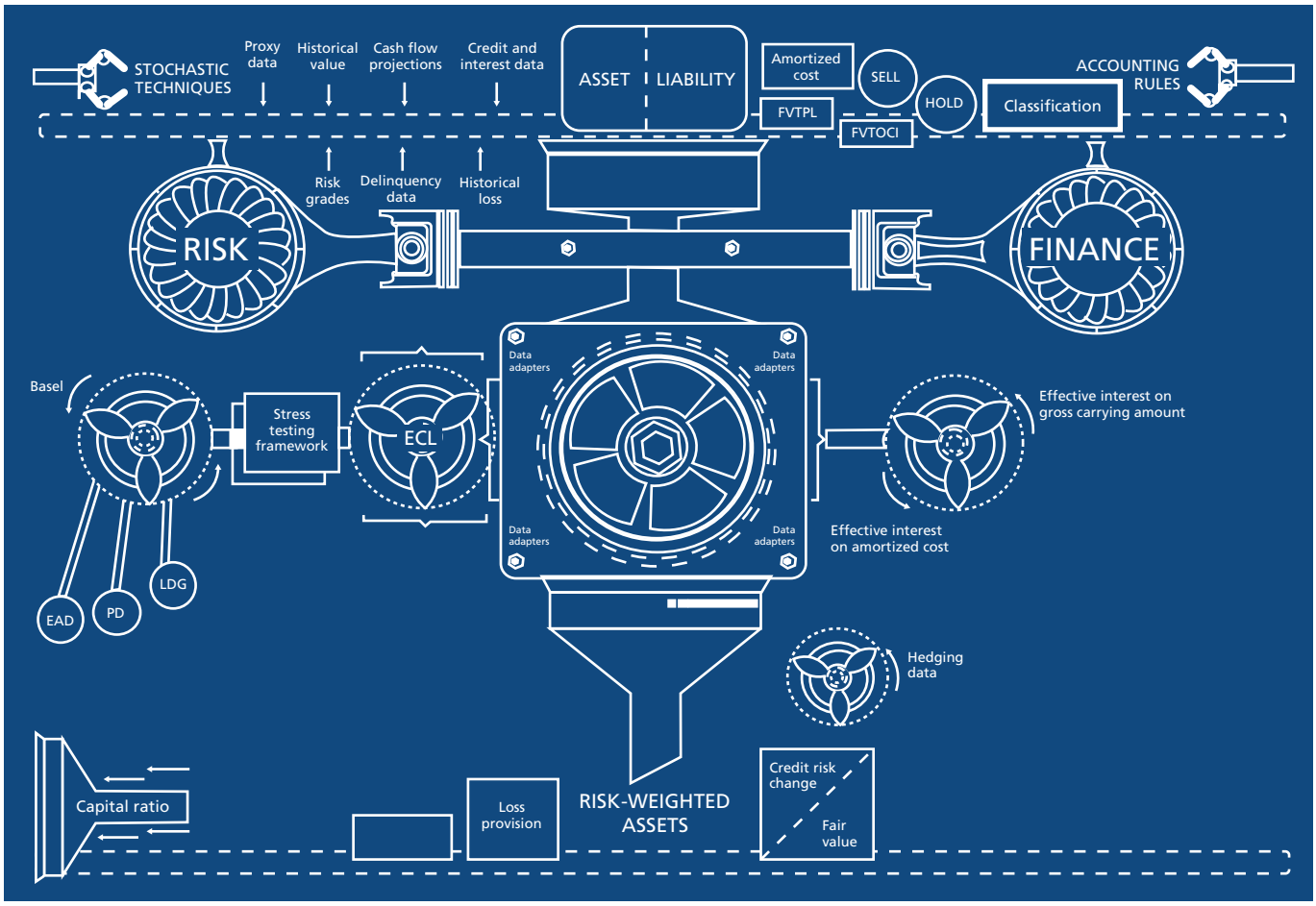
For FIs, although complying with RAA generally could mean a major overhaul of their existing compliance infrastructure, complying with IFRS 9 and IFRS 17 need not have such a profound impact. Firms can often leverage compliance functionality that is already in place to handle capital requirements. Most institutions subject to Basel III are also subject to IFRS 9, and there are functional overlaps between the two standards.

Moreover, the loss provision calculated during IFRS 9 compliance will affect an institution's ratio of capital adequacy to risk-weighted assets under Basel II/III. To calculate capital requirements and leverage ratio and liquidity requirements under Basel II/III, firms will already have credit, loss, default and exposure modeling in place. But while these mechanisms can be repurposed for IFRS 9 calculations, it's worth remembering that in the case of Basel III the timing and purpose of calculations can be fundamentally different. Therefore Basel models cannot simply be transferred, but would have to be need adapted

In the insurance sector, IFRS 17 also overlaps with a capital framework – namely EU directive Solvency II – although the overlaps are not as significant as those for IFRS 9 and Basel II/III. Insurers that have complied with Solvency II could have the option to transfer some risk functions to IFRS 17 compliance. Realistically, however, the functionality most amenable to reuse can be found in data management and discounting engines.


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**Figure 6: Getting it right: an example technology architecture for IFRS 9**




*Source: Chartis Research*

## RAA: winners and losers

### Winners: vendors

The move to integrate risk into finance means more demand for data inputs, data lineage and control, complex aggregations, extensive modeling and automated disclosure and reporting. Enter the technology vendors. For those that make much of their revenue from actuarial modeling, RAA is a huge opportunity to expand and take on new clients. And the opportunities are not limited to bringing extensive actuarial modeling to firms' finance functions. IFRS 9, CECL and IFRS 17 all require strong, flexible accounting engines, cash-flow generators and extensive data management and storage.

### Losers: smaller firms, reinsurers, regions lacking infrastructure

One major complaint among firms about the new rules on recognition inherent in RAA – whereby firms must now recognize losses up front and amortize profit over time – concerns RAA's tendency to increase balance-sheet volatility[1]. In a recent Chartis survey on IFRS 9 compliance, nearly 60% of respondents cited quarter-to-quarter volatility as a central issue, highlighting the impact IFRS 9 is having on firms' business strategy.

#### *IFRS 9/CECL*

The impact of these standards on particular firms varies considerably, depending on a specific firm's portfolio strategy and its approach to Basel modeling. The standards tend have to have a significant impact on mortgage books and credit

[1] *Volatility can be controlled to some extent by the particular strategy a firm chooses to take and the portfolios it chooses to hold.*


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card portfolios. Smaller institutions are likely to struggle more, simply because they lack relevant internal historical loss data for impairment modeling. The profitability of some products may change substantially because of variables such as duration and rating, so firms will have to reconsider their portfolio structure and enhance their performance monitoring.

***IFRS 17***

Life insurers and reinsurers are most likely to feel the full force of IFRS 17. The longer the insurance contract, the more extensive and complex the modeling required. Reinsurers in particular are constrained by the measurement methodology reinsurance contracts are eligible for: the general measurement model (GMM). Unable to use the alternative variable fee approach (VFA), reinsurers cannot employ the measurement model that is tailored to contracts with direct participation features. This can lead to accounting mismatches and increased balance sheet volatility.

Furthermore, regions where accounting infrastructures are underdeveloped and less robust than those in the US and Europe will face particular struggles, and not simply because of the need to invest in more resources. In South Korea, for example, the insurance industry boomed under accounting rules that allowed deposit features to be recognized as revenue. But that is all set to change under IFRS 17, with a likely profound effect on the established and dominant business models in the country's insurance industry.

## What next for RAA and the finance industry?

Predicting the next big global credit crisis, or how such an event could trigger another overhaul of accounting standards, is never easy. The logic underpinning RAA is increased standardization, but the standards are principle-based, and have a degree of flexibility. While the structure of measurements, their timings and the information they must relay are rigid, methodological approaches can be adapted. The benefits of international standardization are clear, ensuring that the quality of financial reporting is consistent no matter what the institution is, or where it is located. With flexible modeling approaches institutions can also use resources that are already available to them to match their specific business needs.

But not everything about RAA is positive. For some market players, the rigidity inherent in standardization can be debilitating because it doesn't accommodate certain product characteristics. Having more standardization can also increase the likelihood that market participants experience common blind spots. On the other hand, flexible modeling approaches can create too much room for maneuver and even in some instances create scope for manipulation.

While some kind of change is inevitable, the logic of adjusting value to long-term market predictions across a variety of assets and liabilities is likely to stay prevalent. Although measurement methodologies and their timings may develop, there will still be an underlying requirement to reflect anticipated long-term market movements in the balance sheet. So any future accounting standards are likely to continue to require compliance that is heavily data-driven. Not only should financial firms continue to invest in data, they should also develop ways to organize and control it.

Finally, one key relationship will be the interaction between a firm's finance and risk departments. RAA compliance will require a joint effort, so institutions should determine how to ensure the best interaction and governance, and learn how to exchange complex data between departments. Quantitative modeling should be flexible, with the capacity to change as new ideas, standards and regulations surface.

But achieving such a thing is no straightforward task. If an institution used the standardized approach to calculate risk-weighted assets under Basel II, for example, it could be precluded from switching to an internal modeling approach for IFRS 9. So institutions have some freedom to establish their own IFRS modeling approaches. But those approaches should be carefully assessed, and should be to some extent transferable to other potential requirements. Firms' quantitative modeling and data infrastructures should be flexible, and able to adapt as new ideas, regulations – and indeed financial paradigms – emerge.


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# 5. RiskTech100® 2020 rankings

| 2020 Rank | 2019 Rank | Company | HQ | Overall score | Functionality | Core technology | Strategy | Customer satisfaction | Market presence | Innovation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | FIS | US | 76.1% | 93.2% | 79.9% | 70.0% | 62.5% | 84.0% | 67.0% |
| 2 | 3 | MSCI | US | 72.3% | 79.0% | 71.0% | 74.0% | 65.0% | 75.5% | 69.0% |
| 3 | 2 | Oracle | US | 71.7% | 82.8% | 85.0% | 66.0% | 58.5% | 70.0% | 68.0% |
| 4 | 4 | Moody's Analytics | US | 71.6% | 82.0% | 69.0% | 75.0% | 64.5% | 72.0% | 67.0% |
| 5 | 5 | SAS | US | 71.2% | 85.0% | 81.0% | 62.0% | 59.0% | 73.0% | 67.0% |
| 6 | 7 | FICO | US | 68.3% | 78.0% | 65.0% | 65.0% | 65.0% | 64.0% | 73.0% |
| 7 | 6 | Murex | France | 67.5% | 75.5% | 71.0% | 65.5% | 61.5% | 66.5% | 65.0% |
| 8 | 14 | Wolters Kluwer | Netherlands | 67.0% | 82.0% | 68.0% | 55.0% | 65.8% | 71.0% | 60.0% |
| 9 | 10 | NICE Actimize | US | 66.8% | 70.0% | 65.0% | 71.0% | 56.0% | 72.0% | 67.0% |
| 10 | 11 | IHS Markit | UK | 66.3% | 74.0% | 68.0% | 67.0% | 61.5% | 62.5% | 64.5% |
| 11 | 8 | Finastra | UK | 66.0% | 79.0% | 68.0% | 61.0% | 51.0% | 78.0% | 59.0% |
| 12 | 12 | Numerix | US | 65.8% | 65.0% | 60.0% | 72.0% | 67.0% | 66.0% | 64.5% |
| 13 | 26 | ION[1] | Ireland | 64.8% | 80.0% | 70.0% | 64.0% | 41.0% | 72.0% | 62.0% |
| 14 | 15 | Bloomberg | US | 63.8% | 68.0% | 56.0% | 66.0% | 61.0% | 68.0% | 63.5% |
| 15 | 9 | IBM[2] | US | 63.7% | 67.0% | 78.0% | 63.0% | 51.0% | 60.0% | 63.0% |
| 16 | 16 | LexisNexis Risk Solutions | US | 63.0% | 69.0% | 67.0% | 58.0% | 60.0% | 62.0% | 62.0% |
| 17 | 17 | Refinitiv | UK | 62.9% | 76.5% | 65.0% | 55.0% | 55.0% | 70.0% | 56.0% |
| 18 | 21 | Qontigo[3] | Germany | 62.8% | 68.0% | 63.0% | 65.0% | 62.0% | 55.0% | 64.0% |
| 19 | 23 | AxiomSL | US | 62.7% | 64.0% | 64.0% | 64.0% | 66.0% | 59.0% | 59.0% |
| 20 | 20 | MetricStream | US | 62.6% | 62.0% | 60.0% | 63.5% | 65.0% | 69.0% | 56.0% |
| 21 | 19 | FactSet | US | 62.5% | 71.0% | 58.0% | 64.0% | 51.5% | 63.0% | 67.5% |
| 22 | - | Numerical Technologies | Japan | 62.4% | 76.0% | 68.0% | 52.0% | 65.8% | 51.0% | 61.5% |
| 23 | 25 | CME Group[4] | US | 62.3% | 69.0% | 60.0% | 63.0% | 60.0% | 58.0% | 64.0% |
| 24 | 18 | BAE Systems Applied Intelligence | UK | 61.8% | 69.0% | 65.0% | 56.0% | 54.5% | 60.0% | 66.0% |
| 25 | - | GBG | UK | 61.3% | 64.0% | 61.0% | 68.0% | 56.0% | 55.0% | 64.0% |


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| 2020 Rank | 2019 Rank | Company | HQ | Overall score | Functionality | Core technology | Strategy | Customer satisfaction | Market presence | Innovation |
|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 24 | StatPro | UK | 60.8% | 64.0% | 56.0% | 63.0% | 61.0% | 56.0% | 65.0% |
| 27 | 28 | SS&C | US | 60.7% | 66.0% | 56.0% | 67.0% | 57.0% | 61.0% | 57.0% |
| 28 | 33 | BlackRock Solutions | US | 60.5% | 71.0% | 51.0% | 65.0% | 52.0% | 64.0% | 60.0% |
| 29 | 13 | Nasdaq | US | 60.4% | 55.0% | 63.0% | 64.0% | 58.5% | 58.0% | 64.0% |
| 30 | 29 | Fiserv | US | 60.3% | 69.5% | 63.0% | 51.0% | 62.0% | 65.0% | 51.0% |
| 31 | 27 | Accuity | US | 60.2% | 61.0% | 57.0% | 56.0% | 64.0% | 65.0% | 58.0% |
| 32 | 31 | Vermeg | Netherlands | 60.1% | 63.0% | 58.0% | 60.0% | 60.0% | 64.5% | 55.0% |
| 33 | 37 | Duco | UK | 60.0% | 53.5% | 67.0% | 64.0% | 63.0% | 48.5% | 64.0% |
| 34 | 32 | Prometeia | Italy | 59.9% | 63.0% | 58.0% | 58.0% | 69.5% | 50.0% | 61.0% |
| 35 | 30 | BearingPoint | Netherlands | 59.8% | 63.0% | 58.0% | 60.0% | 69.5% | 51.0% | 57.0% |
| 36 | - | Raise Partner | France | 59.7% | 66.0% | 63.0% | 62.0% | 60.0% | 45.0% | 62.0% |
| 37 | 38 | Calypso | US | 59.6% | 68.0% | 63.0% | 58.0% | 53.0% | 57.0% | 58.5% |
| 38 | 39 | ICE | US | 59.5% | 66.5% | 57.0% | 63.0% | 55.5% | 54.0% | 61.0% |
| 39 | 34 | Intellect Design | India | 59.4% | 67.0% | 64.0% | 57.0% | 60.5% | 50.0% | 58.0% |
| 40 | 43 | Workiva | US | 59.0% | 52.0% | 50.0% | 59.0% | 75.0% | 57.0% | 61.0% |
| 41 | 44 | Hanweck | US | 58.9% | 56.0% | 62.0% | 61.0% | 61.0% | 54.5% | 59.0% |
| 42 | 42 | Fenergo | Ireland | 58.8% | 63.0% | 59.0% | 59.0% | 52.0% | 59.5% | 60.0% |
| 43 | 48 | Quantexa | UK | 58.7% | 57.0% | 67.0% | 60.0% | 58.0% | 43.0% | 67.0% |
| 44 | 41 | Imagine Software | US | 58.4% | 63.0% | 59.0% | 51.0% | 63.5% | 56.0% | 58.0% |
| 45 | - | LSEG | UK | 58.3% | 67.5% | 57.0% | 62.0% | 55.5% | 49.0% | 59.0% |
| 46 | 36 | Symphony AyasdiAI[5] | US | 58.2% | 56.0% | 65.0% | 62.0% | 51.0% | 50.0% | 65.0% |
| 47 | 52 | Beacon Platform | US | 58.0% | 59.5% | 62.5% | 53.0% | 62.0% | 50.0% | 61.0% |
| 48 | 35 | Gresham | UK | 57.9% | 55.0% | 61.0% | 59.0% | 59.5% | 54.0% | 59.0% |
| 49 | - | Pelican | India | 57.3% | 58.0% | 62.0% | 57.0% | 55.5% | 45.0% | 66.0% |
| 50 | 45 | FINCAD | Canada | 57.0% | 65.0% | 59.0% | 38.0% | 63.0% | 51.0% | 66.0% |
| 51 | 53 | Quantifi | US | 56.8% | 64.0% | 63.0% | 46.0% | 58.5% | 49.0% | 60.0% |
| 52 | 55 | Abrigo[6] | US | 56.6% | 60.0% | 55.0% | 54.0% | 58.5% | 59.0% | 53.0% |


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| 2020 Rank | 2019 Rank | Company | HQ | Overall score | Functionality | Core technology | Strategy | Customer satisfaction | Market presence | Innovation |
|---|---|---|---|---|---|---|---|---|---|---|
| 53 | 58 | QRM | US | 56.5% | 62.0% | 50.0% | 53.0% | 53.0% | 64.0% | 57.0% |
| 54 | 40 | RSA | US | 56.4% | 60.0% | 53.0% | 52.0% | 54.0% | 62.5% | 57.0% |
| 55 | 46 | SmartStream | UK | 56.3% | 48.0% | 59.0% | 53.0% | 56.0% | 68.0% | 54.0% |
| 56 | 49 | Conning | US | 56.2% | 63.0% | 56.0% | 56.0% | 51.0% | 53.0% | 58.0% |
| 57 | 50 | State Street GX | US | 56.1% | 61.0% | 60.0% | 46.5% | 58.0% | 58.0% | 53.0% |
| 58 | 56 | ACI Worldwide | US | 56.0% | 58.0% | 56.0% | 56.0% | 49.0% | 63.0% | 54.0% |
| 59 | 47 | Broadridge | US | 55.9% | 63.0% | 55.0% | 59.5% | 58.0% | 56.0% | 44.0% |
| 60 | 62 | Kamakura | US | 55.8% | 65.0% | 57.0% | 59.0% | 60.0% | 41.0% | 53.0% |
| 61 | 63 | InfrasoftTech | India | 55.7% | 58.0% | 53.0% | 50.0% | 60.0% | 63.0% | 50.0% |
| 62 | 51 | RiskVal | US | 55.6% | 58.0% | 59.0% | 52.0% | 60.0% | 48.0% | 56.5% |
| 63 | - | GTreasury | US | 55.5% | 57.0% | 58.0% | 44.0% | 60.0% | 53.0% | 61.0% |
| 64 | 68 | Aon | UK | 55.3% | 60.0% | 57.0% | 51.0% | 54.0% | 59.0% | 51.0% |
| 65 | 54 | Pegasystems Inc. | US | 55.2% | 51.0% | 65.0% | 58.0% | 48.0% | 51.0% | 58.0% |
| 66 | - | Appian | US | 55.0% | 49.0% | 63.0% | 62.0% | 48.0% | 46.0% | 62.0% |
| 67 | - | 3i Infotech | India | 54.9% | 60.0% | 52.0% | 50.0% | 59.0% | 64.5% | 44.0% |
| 68 | - | BlackSwan Technologies | US | 54.7% | 54.0% | 60.0% | 56.0% | 55.0% | 40.0% | 63.0% |
| 69 | 77 | SAI Global | US | 54.4% | 65.0% | 50.0% | 52.5% | 49.6% | 66.0% | 43.0% |
| 70 | 61 | Loxon | Hungary | 54.3% | 61.0% | 64.0% | 44.0% | 70.5% | 44.0% | 42.0% |
| 71 | 60 | EastNets | UAE | 54.2% | 60.0% | 51.0% | 54.0% | 56.0% | 55.0% | 49.0% |
| 72 | 59 | SAP | Germany | 54.0% | 65.0% | 67.0% | 51.0% | 48.0% | 43.0% | 50.0% |
| 73 | 57 | iDetect | Luxembourg | 53.9% | 55.0% | 65.0% | 56.0% | 48.3% | 39.0% | 60.0% |
| 74 | - | Appway | Switzerland | 53.8% | 50.0% | 54.0% | 58.0% | 56.0% | 49.0% | 56.0% |
| 75 | - | ZMFS | US | 53.7% | 55.0% | 52.0% | 49.0% | 55.0% | 54.0% | 57.0% |
| 76 | 65 | Arachnys | UK | 53.5% | 56.0% | 60.0% | 48.0% | 58.0% | 39.0% | 60.0% |
| 77 | 66 | FERNBACH | Luxembourg | 53.4% | 65.5% | 58.0% | 44.0% | 54.0% | 44.0% | 55.0% |
| 78 | - | Vichara Technologies | India | 53.3% | 57.0% | 59.0% | 52.0% | 60.0% | 43.0% | 49.0% |


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| 2020 Rank | 2019 Rank | Company | HQ | Overall score | Functionality | Core technology | Strategy | Customer satisfaction | Market presence | Innovation |
|---|---|---|---|---|---|---|---|---|---|---|
| 79 | 72 | Jack Henry & Associates | US | 53.2% | 61.0% | 51.0% | 49.0% | 50.0% | 60.0% | 48.0% |
| 80 | 74 | Clari5[7] | India | 53.1% | 60.0% | 59.0% | 47.0% | 55.5% | 44.0% | 53.0% |
| 81 | 73 | MathWorks | US | 53.0% | 46.0% | 58.0% | 50.0% | 58.0% | 52.0% | 54.0% |
| 82 | 82 | RiskSpan | US | 52.9% | 52.0% | 57.0% | 52.5% | 61.0% | 44.0% | 51.0% |
| 83 | 69 | Linedata | France | 52.8% | 55.0% | 52.0% | 55.0% | 53.5% | 53.0% | 48.0% |
| 84 | 71 | PolyPaths | US | 52.2% | 63.0% | 52.0% | 38.0% | 63.0% | 49.0% | 48.0% |
| 85 | 75 | Verafin | Canada | 52.0% | 53.0% | 50.0% | 43.0% | 64.0% | 51.0% | 51.0% |
| 86 | 78 | Willis Towers Watson | UK | 51.8% | 57.0% | 52.0% | 46.0% | 51.5% | 58.0% | 46.0% |
| 87 | 85 | MORS Software | Finland | 51.7% | 65.0% | 62.0% | 42.0% | 62.0% | 29.0% | 50.0% |
| 88 | 76 | ClusterSeven | UK | 51.5% | 51.0% | 54.0% | 55.0% | 62.0% | 44.0% | 43.0% |
| 89 | 86 | iMeta | UK | 51.3% | 55.0% | 51.0% | 51.0% | 73.5% | 32.0% | 45.0% |
| 90 | - | Thetica Systems | US | 51.1% | 54.0% | 57.0% | 48.0% | 60.0% | 40.0% | 47.5% |
| 91 | 94 | RDC | US | 51.0% | 45.0% | 49.0% | 54.0% | 51.0% | 54.0% | 53.0% |
| 92 | 79 | SimCorp | Denmark | 50.7% | 50.0% | 47.0% | 47.0% | 51.0% | 55.0% | 54.0% |
| 93 | - | Featurespace | UK | 50.2% | 42.0% | 48.0% | 53.0% | 60.0% | 35.0% | 63.0% |
| 94 | 87 | zeb | Austria | 49.3% | 68.0% | 58.0% | 41.0% | 50.5% | 31.0% | 47.0% |
| 95 | 90 | Lacima | US | 48.3% | 47.0% | 45.0% | 47.0% | 69.8% | 36.0% | 45.0% |
| 96 | 67 | Digital Reasoning | US | 47.7% | 47.0% | 50.0% | 48.0% | 53.0% | 31.0% | 57.0% |
| 97 | 97 | Pitney Bowes | US | 47.3% | 54.0% | 49.0% | 51.0% | 51.5% | 28.0% | 50.0% |
| 98 | 96 | Asset Control | Netherlands | 47.0% | 37.0% | 58.0% | 44.0% | 47.0% | 49.0% | 47.0% |
| 99 | - | Manipal Technologies | India | 46.7% | 46.0% | 48.0% | 44.0% | 52.0% | 39.0% | 51.0% |
| 100 | - | KYC Global Technologies | US | 46.3% | 39.0% | 43.0% | 50.0% | 49.0% | 51.0% | 46.0% |

*[1] ION includes Allegro, following its purchase.*
*[2] Scoring takes account of the divestiture of IBM's Algorithmics capabilities.*
*[3] Qontigo includes Axioma, its capabilities and prior ranking.*
*[4] CME includes TriOptima, its capabilities and prior ranking.*
*[5] Symphony purchased Ayasdi and renamed it SymphonyAyasdi.*
*[6] Abrigo includes Sageworks, its capabilities and prior ranking.*
*[7] Clari5 is the new name for CustomerXPs.*


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# 6. Category winners

| Category award | 2020 winner | 2020 – honorable mention |
|---|---|---|
| Overall winner | FIS | MSCI |
| **Chartis categories** | | |
| Functionality | FIS | SAS |
| Core technology | Oracle | SAS |
| Strategy | MSCI | Moody's Analytics |
| Customer satisfaction | Workiva | iMeta |
| Market presence | FIS | Finastra |
| Innovation | FICO | MSCI |
| **Industry categories** | | |
| Banking | Moody's Analytics | SAS |
| Buy-side | MSCI | Axioma |
| Corporations | MetricStream | ION |
| Insurance | FIS | Aon |
| Sell-side | FIS | Numerix |
| **Solution categories** | | |
| Artificial intelligence | FICO | Clari5 |
| Asset and liability management (ALM) | QRM | Oracle |
| Balance sheet risk management | Moody's Analytics | QRM |
| Capital optimization | Finastra | Prometeia |
| Client lifecycle management (CLM) and KnowYour Customer (KYC) | Fenergo | Pegasystems Inc. |
| Commodity trading risk management (CTRM) | ION | FIS |
| Credit risk for the banking book | Moody's Analytics | Kamakura |
| Current Expected Credit Losses (CECL) | Moody's Analytics | Abrigo |
| Cyber risk management | IBM | RiskSense |
| Cyber risk quantification | FICO | BitSight |
| Data integrity & control | Oracle | Workiva |


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| Category award | 2020 winner | 2020 – honorable mention |
|---|---|---|
| Data privacy | OneTrust | SAI Global |
| Energy trading - applications | FIS | ION |
| Energy trading - data | Enverus | ICE |
| Enterprise stress testing | Moody's Analytics | MSCI |
| Evaluated pricing and data - credit | IHS Markit | Trepp |
| Evaluated pricing and data - fixed income | Bloomberg | ICE |
| Evaluated pricing and data - multi-asset | ICE | Refinitiv |
| Evaluated pricing and data - OTC derivatives | Refinitiv | ICE |
| Financial crime - anti-money laundering (AML) | NICE Actimize | Oracle |
| Financial crime - data | LexisNexis Risk Solutions | RDC |
| Financial crime - enterprise fraud | BAE Systems Applied Intelligence | NICE Actimize |
| Front office risk management | FIS | Numerix |
| Governance, risk management & compliance (GRC) | MetricStream | IBM |
| Hedge fund risk management | Bloomberg | MSCI |
| International Financial Reporting Standard (IFRS) 9 | SAS | Moody's Analytics |
| IFRS 17 | FIS | Aon |
| Integrated trading and risk management | Murex | Calypso |
| Liquidity risk | Wolters Kluwer | Prometeia |
| Market risk - buy-side | MSCI | Bloomberg |
| Market risk - sell-side | Murex | FIS |
| Model risk management | SAS | FICO |
| Model validation | Moody's Analytics | Yields.io |
| Operational risk | Chase Cooper | The Analytics Boutique |
| Portfolio and factor modeling | Qontigo | MSCI |
| Pricing & analytics - credit | Moody's Analytics | Bloomberg |
| Pricing & analytics - fixed income | Bloomberg | Vichara Technologies |
| Pricing & analytics - multi-asset | Bloomberg | Numerix |
| Pricing & analytics - OTC derivatives | Numerix | Quantifi |


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| Category award | 2020 winner | 2020 – honorable mention |
|---|---|---|
| Real-time risk | Hanweck | FactSet |
| Regulatory intelligence | Thomson Reuters | Wolters Kluwer |
| Regulatory reporting | Wolters Kluwer | BearingPoint |
| Risk & finance integration | SAS | Oracle |
| Risk as a service (RaaS) | MSCI | LSEG |
| Risk data aggregation & reporting | AxiomSL | Oracle |
| Risk technology infrastructure | NVIDIA | Kinetica |
| Treasury and FX risk | Finastra | ION |
| xVA | Numerix | Murex |


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## RiskTech100® 2020 Rising Stars

This category recognizes a selection of emerging vendors that didn't make it into the top 100 but, in the opinion of our analysts, are companies to watch.

### Apptus

With a focus on optimizing and modernizing an enterprise's traditional middle-office areas, Apptus brings a digital-first view to the core processes of revenue recognition, relationship management and client lifecycle management. Operating across numerous sectors, it seeks to optimize processes using ML techniques in all areas, from initial onboarding to customer analysis and compliance tracking.

### C3.ai

As its name suggests, C3.ai specializes in AI-enabled solutions, using AI and workflow to accelerate and deploy digital transformation in data-rich processes across numerous sectors. One key example is the deployment of these concepts to reduce the number of false positives in AML processes.

### Cassini Systems

The importance of controlling costs and operating as efficiently as possible, while complying with more complex and demanding regulatory restrictions, is on the minds of all institutions and their leaders. Cassini Systems brings advanced analytics and monitoring out of the finance department, allowing front-, middle- and back-office functions to view their trading and operating costs from margin to trade and on into post-trade processes and compliance. By providing cross-venue and cross-process capabilities, it offers a degree of transparency that businesses have been requesting for some time.

### Cognive

Fraud occurs across processes and lines of business in an enterprise, and across enterprises too. Traditionally, the ability to share and learn internally and across the market as frauds are attempted has been restricted by data, process and entity fragmentation. Cognive brings data and incident information together to enable systems, using AI processes, to learn as they predict and identify issues and adjust models and processes. Combining internal, predictive, external and Internet of Things data, the platform seeks to bridge the physical and digital worlds.

### Credit Benchmark

Combining anonymized credit risk estimates from numerous market players, Credit Benchmark provides a concensus view of the credit risk of a wide range of entities globally. A rare example of an industry-collective approach, it provides an entirely new source and approach for credit data and analytics.

### CUBE

Understanding, monitoring and reacting to change, and mapping regulatory events and requirements, are complex tasks that all institutions must address. CUBE harnesses AI techniques to identify changes and enable users to understand the impact of those changes on their institution and its processes. This includes the ability for firms to map against their own processes and controls, and be alerted to potential gaps and new requirements.

### Finxact

Much has been written and said about the drivers of change and possibilities offered by open banking, and the potential for new entities to emerge in the banking space. The problem remains, however, that many of the processes required do not change, and core banking technology is needed. Finxact provides software as a service (SaaS) core banking, but with well defined open application programming interfaces (APIs) to enable the creation of an ecosystem that new players can build their services on.

### GTreasury

Formed from the merger of GTreasury and Visual Risk, this company provides integrated treasury and risk management on the cloud. Enabling small and mid-market institutions to access and deploy advanced integrated treasury, risk and capital tools of the strength and capability seen at larger institutions, it brings cutting-edge solutions to the broader market.

### Insightful Technology

While this firm can trace its roots to the late 1990s, it has recently invested heavily in its Soteria product, using the real-time capture of electronic and telecommunications-based data to power real-time surveillance, compliance and risk mitigation. Not just a compliance tool, it also enables the


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on-demand collation and containerization of information for external parties such as regulators.

### Protecht

With a range of solutions in the risk, ALM, credit risk and GRC spaces, Protecht is already an established company with several product lines. In the GRC space in particular there has been an increasing need for integrated solutions that deliver strong assessment methodologies, tools, key risk indicators, audit capabilities and the ability to track actions taken. Protecht provides a visually appealing and integrated solution designed to address internal control and provide the level of detail required by the board and external parties.

### Signzy

Taking a digital approach to FIs' onboarding needs, Signzy seeks to use AI and blockchain tools and techniques to bring the regulatory compliance process into the broader digitalization push underway across the industry. Aiming to deliver real-time KYC and core due diligence, the company's solutions also look to deploy biometrics to provide secure digital identification and affirmed and secure digital contracts.

### ThetaRay

As data volumes continue to increase exponentially, and the information available for online processing becomes ever deeper and broader, knowing what to look for and how to identify suspicious behavior becomes ever more challenging. Using AI in real-time, ThetaRay seeks to identify potential patterns and concerns, reduce false positives and reveal hidden issues in the data. These findings are used to provide immediate analysis for AML, fraud and physical issues like ATM security.


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# 7. Appendix A: Research methodology

Chartis's RiskTech100® report is the most comprehensive study of its kind, and is a core element of our annual research cycle. The rankings in the report reflect our analysts' expert opinions, along with research into market trends, participants, expenditure patterns and best practices. We validated the analysis through several phases of independent verification (see Table 1).

Note that so we can continue to accurately assess the market and its key players, we are developing and refining our methodology as the risk technology market evolves. Any changes will be reflected in subsequent reports.

**Table 1: RiskTech100® research methodology**

| |
|---|
| • Performed a comprehensive market sweep of leading market participants in 40 risk categories. |
| • Completed 1,500 surveys and interviews with risk technology buyers and end users. |
| • Collected data on organizations' expenditure priorities and vendor preferences. |
| • Collated 400 completed questionnaires, briefing documents and product specifications from risk technology vendors. |
| • Conducted and attended 200 interviews, product demonstrations and strategy briefings with risk technology vendors. |
| • Conducted 150 interviews with risk technology buyers to validate our survey findings. |
| • Conducted more than 50 interviews with independent consultants and system integrators specializing in risk technology. |
| • Applied RiskTech100® assessment criteria to filter the top 150 vendors. |
| • Reviewed data with 30 independent consultants and 110 risk technology buyers. |
| • Interviewed 60 ex-employees of the top 50 risk technology vendors to validate our findings. |
| • Undertook final data validation with 102 vendors, receiving 79 completed questionnaires and carrying out more than 100 vendor briefings. |
| • Completed 100+ independent reference checks to validate vendor claims and client satisfaction levels. |
| • Developed the final top 100 rankings, identified the category winners and finalized the report. |

*Source: Chartis Research*


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# 8. Appendix B: How to read the RiskTech100® rankings

The RiskTech100® assessment criteria comprise six categories:

- Functionality.
- Core technology.
- Strategy.
- Customer satisfaction.
- Market presence.
- Innovation.

Within each category we have included a number of sub-categories to encompass the range and scope of current risk technology solutions (see Table 2).

**Table 2: RiskTech100® assessment criteria**

| | |
|---|---|
| **Functionality** | • **Depth of functionality.** The level of sophistication and detailed features in the software product. Aspects assessed include: innovative functionality, practical relevance of features, user-friendliness, flexibility and embedded intellectual property. High scores are given to those firms that achieved an appropriate balance between sophistication and user-friendliness. In addition, functionality that links risk to performance is given a positive score.<br>• **Breadth of functionality.** The spectrum of risks covered as part of an Enterprise Risk Management solution. The risk spectrum under consideration includes treasury risk management, trading risk, market risk, credit risk, operational risk, energy risk, business/strategic risk, actuarial risk, asset-liability risk, financial crime and compliance. Functionality within and integration between front-office (customer-facing) and middle/back-office (compliance, supervisory and governance) risk management systems are also considered. High scores are given to those firms achieving (or approaching) integrated risk management – breaking the silos between different risk management functions. |
| **Core technology** | Chartis evaluates a vendor's overall technology stack by benchmarking it against latest best practice. Key considerations this year have been the use of cloud and Big Data technologies, as well as the agility and openness of the overall technology architecture.<br>• **Data management.** The ability of enterprise risk management systems to interact with other systems and handle large volumes of data. Data quality is often cited as a critical success factor, and ease of data access, data integration, data storage and data movement capabilities are all important factors.<br>• **Risk analytics.** The computational power of the core system, the ability to analyze large amounts of data in a timely manner (e.g., real-time analytics), and the ability to improve analytical performance are all important factors.<br>• **Reporting and visualization.** The ability to surface risk information in a timely manner. The quality and flexibility of visualization tools, and their ease of use, are important for all risk and compliance management systems. |


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| | |
|---|---|
| **Strategy** | • **Vision and leadership**. Market understanding, a scalable business model, product strategy, technology strategy and go-to-market strategy are critical success factors. Both organic and inorganic growth strategies are considered, as well as strategic alliances and partnerships.<br>• **Ability to execute**. The size and quality of the sales force, the sales distribution channels, the global footprint, partnerships, differentiated messaging and positioning are all important factors. Specific consideration is given to the quality of implementation and support functions, post-sales support and training.<br>• **Financial performance**. Revenue growth, profitability, sustainability, financial backing and the percentage of recurring revenues. The ratio of license to consulting revenues is key to business scalability. |
| **Customer satisfaction** | • **Value for money**. The price to functionality ratio, and the total cost of ownership versus license price.<br>• **After-sales service and support**. Important factors include the ease of software implementation, the level of support and the quality of training.<br>• **Product updates**. Important considerations for end users include how often vendors issue updates, and how well they keep pace with best practice and regulatory changes. |
| **Market presence** | • **Market penetration**. The number of customers in chosen markets, and the rate of growth relative to sector growth rate.<br>• **Market potential**. Brand awareness, reputation, thought leadership, and the vendor's ability to use its current market position to expand horizontally (with new offerings) or vertically (into new sectors).<br>• **Momentum**. Performance in the past 12 months, including financial performance, new product releases, quantity and quality of contract wins and market expansion moves. |
| **Innovation** | • **New product development**. New ideas, functionality and technologies to improve risk management for target customers. Chartis assesses new product development not in absolute terms, but in relation to a vendor's closest competitors.<br>• **Exploitation**. Developing new products is only the first step in generating success. Speed to market, positioning of new products and translation to incremental revenues are critical success factors.<br>• **New business models**. Innovation is not limited to the product dimension. Some risk technology vendors are also actively working toward new business models for generating profitable growth. |

*Source: Chartis Research*


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# 9. How to use research and services from Chartis

In addition to our industry reports, Chartis offers customized information and consulting services. Our in-depth knowledge of the risk technology market and best practice allows us to provide highqualityand cost-effective advice to our clients. If you found this report informative and useful, you may be interested in the following services from Chartis.

## Advisory services

Advisory services and tailored research provide a powerful way for Chartis clients to leverage our independent thinking to create and enhance their market positioning in critical areas.

Our offering is grounded in our market-leading research, which focuses on the industry and regulatory issues and drivers, critical risk technologies and leading market practices impacting our sector. We use our deep insight and expertise to provide our clients with targeted market and industry analysis, tailoring content to assess the impact and potential of relevant regulatory and business issues, and highlighting potential solutions and approaches.

Chartis' advisory services include:

### Market dynamics

The markets that our clients – vendors, institutions and consultants – address are changing at an ever-increasing pace. Understanding the market dynamics is a critical component of success, and Chartis uses its deep industry and technical knowledge to provide customised analysis of the specific issues and concerns our clients are facing.

### Market positioning

In today's highly competitive market, it is no longer enough to simply have a leading product or solution. Buyers must be able to appreciate the differentiating capabilities of your brand and solutions, and understand your ability to help them solve their issues.

Working with our clients, we generate compelling, independent co-branded research, targeting critical business issues. This helps our clients to position their solutions effectively, 'own' key issues, and stand out from the crowd.

Collaborating closely with our clients, we develop pragmatic, resonant thoughtleadership papers with immediate industry relevance and impact.

Our offering includes:

- **Co-branded research** on key market topics to provide a unique and compelling point of view that addresses a key industry driver and highlights the relevant issues. Reports can be tailored to varying levels of depth and can be powered by quantitative survey fieldwork, qualitative industry interviews, our deep domain expertise, or a blend of all three.
- **Chairing roundtables and/or facilitating events and workshops**, to support clients in hosting compelling events that put them at the heart of the discussion.
- **Targeted marketing through our sister brands**, leveraging the power of our parent group – Infopro Digital – to reach across leading brands such as Risk.net, WatersTechnology, FX Week and Central Banking.

### Competitor analysis

Our unique focus on risk technology gives us unrivalled knowledge of the institutions and vendors in the sector, as well as those looking to enter it. Through our industry experts, Chartis clients can tap our insights to gain a much deeper understanding of their competitors and the strategies they should pursue to better position themselves for success.

### Regulatory impact analysis

The analysis and assessment of regulatory change and implementation is one of Chartis' core strengths. We can apply our insights to assess the impact of change on the market – both as it applies to vendors and the institutions they serve – or on a client's specific product and customer base. We can also provide insights to guide product strategy and associated go-to-market activities, which we can execute for internal use to drive our client's strategy, or as a co-branded positioning paper to raise market awareness and 'noise' around a particular issue.


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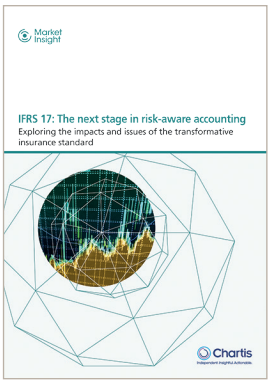
# 10. Further reading



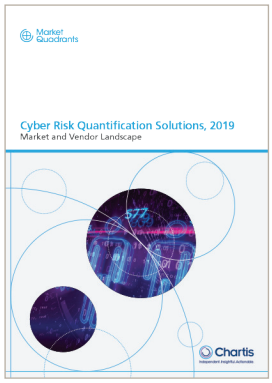

**Artificial Intelligence in Financial Services, 2019: Demand-Side Analysis**



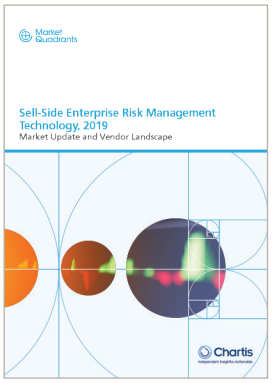

**Model Validation Solutions, 2019: Overview and Market Landscape**



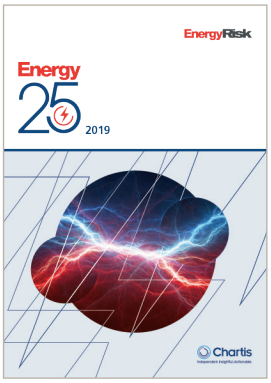

**IFRS 17: The next stage in risk-aware accounting**




**Cyber Risk Quantification Solutions, 2019: Market and Vendor Landscape**




**Sell-Side Enterprise Risk Management Technology, 2019: Market Update and Vendor Landscape**




**Energy25 2019**

For all these reports, see **www.chartis-research.com**


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