Chartis

Vendor Analysis: SAS
ALM Solutions, 2024

Vendor Analysis

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1. Report context

This Vendor Analysis is based on the Chartis report **ALM Solutions, 2024** (published in October 2024). This section summarizes the key theses in that report; subsequent sections take a detailed look at SAS's quadrant positioning and scoring, and Chartis' underlying opinion and analysis.

Key thesis

The 2024 edition of Chartis' asset and liability (ALM) solutions industry report tracks the market landscape during a period of heightened monetary uncertainty that is significantly impacting banks' ALM strategies. This report builds on insights from the 2021 iteration, which detailed various roles and departments within the ALM value chain, covering such areas as liquidity risk management, balance sheet optimization and funds transfer pricing (FTP).

In 2024, monetary tightening, duration risk and liquidity crises continue to drive the re-evaluation of ALM strategies and risk management practices. Our earlier research, in the aftermath of the international banking crisis, examined the implications of the Silicon Valley Bank incident on broader industry perspectives on ALM, as well as the stability of the banking sector. Chartis focused on the structural run risk highlighted by the incident – specifically, how to handle a large concentration of depositors and counterparties and manage liquidity risk profiles. The incident highlighted how duration mismatches and rising interest rates can dramatically erode asset values and trigger liquidity shortages. In the context of ongoing interest rate volatility, firms must anticipate and address these risks while managing interest rate sensitivity and navigating the impact of shifting net interest income (NII) and economic value of equity (EVE).

Building on this backdrop, Chartis observes several key trends in the market:

- **An increased focus on interest rate risk**. As defined above, the heightened dynamics of monetary policy, accompanied by its divergence in different countries, is increasing the focus on interest rate issues. This renewed focus comes within a more complex interest rate architecture (with LIBOR replacement) and significant restructuring of credit intermediation. For central banks, the restructuring of the credit intermediation ecosystem poses many challenges, including decreasing clarity around the efficacy of monetary policy. The transmission mechanics around monetary policy are increasingly unclear.

- **Increased integration of pricing and analytics libraries (derivatives, securitized products, etc.)**. The growing importance of derivatives in hedging against such risks as interest rate volatility and currency fluctuations has led to increased demand for integrated derivatives pricing and option-theoretic modeling in ALM solutions. However, not all regions use these instruments to the same extent, and banks in emerging markets may generally adopt simpler approaches.

- **Increased relevance of banking-style ALM models to the broader institutional base**. Either due to regulations (in specific jurisdictions) or a desire to manage interest rate risk, many institutions (such as non-bank financial institutions [NBFIs], FinTechs and other similar providers) are adopting banking-oriented ALM systems.

- **Focus on liquidity management**. Regulators are increasingly scrutinizing banks' liquidity risk management frameworks. In the US, this applies in particular to smaller institutions that previously had fewer requirements. Enhanced regulatory frameworks, such as the liquidity coverage ratio (LCR), net stable funding ratio (NSFR) and internal liquidity adequacy assessment process (ILAAP), continue to shape the market.

- **Commercial real estate (CRE) exposure**. CRE exposure, particularly in the office space market, is posing substantial ALM risks for smaller US banks. CRE loans are characterized by long-term maturities and illiquidity, and post-pandemic decline in office space demand is amplifying the potential for loan defaults and deteriorating collateral quality. US regulators have intensified their scrutiny of institutions with heavy CRE portfolios, which are often smaller banks. These banks often lack the sophisticated liquidity management systems and hedging mechanisms employed by larger institutions.

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- **Importance of interest rate simulation**. As global interest rates become more volatile, firms are re-evaluating their ALM and investment strategies. The shift from ultra-low post-2008 rates to a more unpredictable environment makes interest rate simulation essential for managing risks. Firms must simulate how rate changes impact duration mismatches, prepayment behaviors and market yields while maintaining adequate liquidity buffers. This capability is critical for identifying vulnerabilities and ensuring long-term financial stability in a rapidly shifting rate environment.

Chartis strives to reflect the vendor market and end-user requirements accurately in our quadrant and scoring criteria. The 2024 report introduced two new quadrants: Financial Planning and Budgeting and Hedging and Risk Management.

Demand-side takeaways

ALM entails a complex integration of analytics and processes that links various departments and necessitates the reconciliation of multiple metrics, strategies and policies. The roles of these interconnected departments have evolved and can vary significantly between institutions. Each department's specific responsibilities depend on such factors as the organization's size, structure and market focus (i.e., commercial banking versus capital markets).

One notable example is treasury departments, which not only differ in their roles and focus across institutions but have also evolved over time. Although their specific functions can vary greatly among organizations, in many firms, the treasury department plays a strategic role within the ALM framework.

In Chartis' view, given the recent volatility in interest rates, there is a renewed focus across the industry on modeling and understanding ALM risks. This heightened attention has prompted a reassessment of key dimensions, including capital optimization and balance sheet forecasting. Organizations are now prioritizing how to model interest rate risks effectively to ensure that their hedging and market strategies align with overall business objectives. The increased interest rate volatility has significantly driven this push for a more comprehensive approach to ALM risk management.

Supply-side takeaways

The ALM vendor landscape is as complex and varied as the subject itself, characterized by diverse analytics, workflows and processes tailored to organizational specifics. Some vendors concentrate on individual analytical components, such as behavioral modeling for specific contexts, while others provide comprehensive operational frameworks that encompass the entire infrastructure, from cash flow generation and aggregation to cost of funding and product pricing, creating a holistic view.

Additionally, some vendors focus on financial performance and analytics, particularly in financial planning and budgeting. They consider how these processes can be conducted within regulatory contexts and applied to various business lines and products.

Moreover, certain ALM providers emphasize aligning balance sheet strategies with market dynamics to facilitate capital and balance sheet optimization throughout the lifecycle. This includes defining what constitutes relevant measures for assessment.

Given this context, it is not surprising that many vendors target specific geographies and adapt to the market and organizational structures prevalent in those areas. These include the small banking environment in the US or the architectural framework of banks in the Eurozone; firms also often engage with emerging markets in APAC.

However, there are also a few vendors that transcend regional boundaries, offering a broad range of analytics and promoting greater hybridity in ALM processes. While few vendors can claim to fully address the integrated balance sheet for organizations, many leading firms, in growing numbers, are striving toward this aspirational goal.

2. Quadrant context

Introducing the Chartis RiskTech Quadrant®

This section of the report contains:

• The Chartis RiskTech Quadrant® for ALM Solutions, 2024.

• An examination of SAS's positioning and its scores as part of Chartis' analysis.

• A consideration of how the quadrant reflects the broader vendor landscape.

Summary information

What does the Chartis quadrant show?

Chartis' RiskTech Quadrant® uses a comprehensive methodology that involves in-depth independent research and a clear scoring system to explain which technology solutions meet an organization's needs. The RiskTech Quadrant® does not simply describe one technology option as the best ALM solution; rather it has a sophisticated ranking methodology to explain which solutions are best for specific buyers, depending on their implementation strategies.

The RiskTech Quadrant® is a proprietary methodology developed specifically for the risk technology marketplace and takes into account vendors' product, technology and organizational capabilities. Section 4 of this report sets out the generic methodology and criteria used for the RiskTech Quadrant®.

How are quadrants used by technology buyers?

Chartis' RiskTech Quadrant® and FinTech Quadrant™ provide a view of the vendor landscape in a specific area of risk, financial and/or regulatory technology. We monitor the market to identify the strengths and weaknesses of different solutions and track the post-sales performance of companies selling and implementing these systems. Users and buyers can consult the quadrants as part of their wider research when considering the most appropriate solution for their needs.

Note, however, that Chartis does not endorse any vendor, product or service depicted in its research publications and does not advise technology users to select only those vendors with the highest ratings or other designation. Chartis' publications consist of the opinions of its research analysts and should not be construed as statements of fact.

How are quadrants used by technology vendors?

Technology vendors can use Chartis' quadrants to achieve several goals:

• Gain an independent analysis and view of the provider landscape in a specific area of risk, financial and/or regulatory technology.

• Assess their capabilities and market positioning against their competitors and other players in the space.

• Enhance their positioning with actual and potential clients and develop their go-to-market strategies.

In addition, Chartis' Vendor Analysis reports, like this one, offer detailed insight into specific vendors and their capabilities, with further analysis of their quadrant positioning and scoring.

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Chartis Research RiskTech Quadrant® for ALM Solutions, 2024

Quadrant dynamics

General quadrant takeaways

The ALM landscape is changing rapidly, driven by evolving market dynamics and regulatory pressures. ALM vendors are responding by developing innovative solutions tailored to the specific needs of different regions and institutions. As a result, ALM solutions today offer a wide range of capabilities, from basic asset-liability matching to advanced risk management and optimization tools.

The ALM landscape is multifaceted, with vendors offering a wide range of specialized solutions. The lines between different types of ALM solutions can be blurred. Some vendors focus on capital and balance sheet/hedge risk management, essential for mitigating interest rate risk and optimizing balance sheet positions.

The US market's emphasis on asset-backed securities has led to a niche of vendors specializing in this area. These vendors prioritize ALM from a risk management, trading and hedging perspective. They offer extensive expertise in managing mortgage-backed securities (MBS) portfolios and provide sophisticated interest rate management systems, enabling financial institutions to manage interest rate risk effectively within their MBS holdings.

The six quadrants in Chartis' 2024 ALM solutions report cover the broad ALM value chain, which requires distinct features and functionality. All six quadrants encompass a diverse array of ALM vendors, catering to the requirements of both asset liability committees (ALCOs) and treasury departments. Some vendors specialize in operational ALM, focusing on day-to-day calculations, while others approach ALM from a trading and hedging perspective. The quadrants also feature specialist providers offering specific analytics support, as well as vendors that closely align their ALM offerings with those for regulatory reporting and compliance.

Figures 1 to 6 illustrates Chartis' view of the vendor landscapes for ALM solutions, highlighting SAS's position.

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The **ALM Quadrant** serves as a comprehensive category for ALM analytics, bringing together a diverse set of modeling frameworks and methodologies. This category's high level of maturity is reflected in the large proportion of vendors in the category leader section. However, the ALM market remains highly fragmented, with market leaders varying by geography and institution type. Key differentiators in this space include the sophistication of analytics, linkages with capital market frameworks, credit risk integration, behavioral modeling, advanced interest rate modeling, accounting portfolio linkages and scalable calculations.

Figure 1: RiskTech Quadrant® for ALM solutions, 2024

Source: Chartis Research

Vendor Analysis

The **FTP quadrant** encompasses a range of functions and processes, including funding, fund price calculation and allocation/attribution. Effective FTP requires capabilities in handling granular detail at the product and transaction levels. Equally important are master data management, product coverage and flexible computational methodologies.

Figure 2: RiskTech Quadrant® for FTP solutions, 2024

Source: Chartis Research

Vendor Analysis

The **LRM quadrant** centers on liquidity risk reporting and management, particularly for Basel reporting, including NSFR, LCR and ILAAP. It also addresses liquidity risk from a computational perspective within the ALM framework. A key dynamic in the LRM quadrant is the integration of data across different business silos and accurate cash flow projections.

Figure 3: RiskTech Quadrant® for LRM solutions, 2024

Source: Chartis Research

Vendor Analysis

The **capital and balance sheet optimization quadrant** reflects a mix of vendors. Some leverage market-consistent and market-linked approaches to optimize the balance sheet through financial hedging (leveraging derivatives and other market instruments), while others focus on a more operational approach to ALM that centers on business planning and operational strategy.

Figure 4: RiskTech Quadrant® for capital and balance sheet optimization solutions, 2024

Source: Chartis Research

Vendor Analysis

The **hedging and risk management quadrant** dives into the dynamics of interest rate management as it pertains to the importance of financial hedging and risk management. This heightened need for effective risk profile management has renewed attention on robust risk frameworks and strategic hedging approaches. For hedging strategies and position forecasting to be effective, they must closely align with prevailing market conditions. Vendors that have a strong foundation in theoretical modeling and deep expertise in markets hold a distinct competitive advantage in providing hedging and risk management solutions.

Figure 5: RiskTech Quadrant® for hedging and risk management solutions, 2024

Source: Chartis Research

Vendor Analysis

The **financial planning and budgeting solutions quadrant** can be approached from various perspectives. One approach combines business intelligence-style analytics with targeted analytics styles, such as cost allocation and performance assessment. Equally, some solutions take a more mathematical and simulation approach. The leading players in this space possess robust data management capabilities and effectively combine profitability optimization with cost allocation and strategic planning.

Figure 6: RiskTech Quadrant® for financial planning and budgeting solutions, 2024

Source: Chartis Research

Vendor Analysis

Vendor positioning in context – completeness of offering

ALM solutions

SAS's acquisition of Kamakura in 2022 enables highly advanced interest rate capabilities that possess foundational assets in interest rate modeling. SAS's integration of Kamakura into the Viya platform has significantly enhanced the vendor's market presence and potential. The integration of its features and functionalities offers substantial benefits to existing customers, providing a competitive edge in the marketplace. SAS's customers can also take advantage of integration with cloud-native solutions within the broader ALM ecosystem, including tools for expected credit loss and regulatory capital.

The breadth of optimization capabilities from SAS, supported by its core analytics stack, proves to be foundational for these optimization capabilities. The market-oriented optimization techniques and theoretical frameworks from Kamakura, together with the enhancements of the SAS platform, contribute significantly to SAS's breadth of offering.

SAS's best-in-class capabilities in interest rate modeling and its industry-leading capabilities in behavioral modeling underscore its expertise in advanced analytics. The solution offers interest curve analytics and calculations for interest rate sensitivities, along with various behavioral and prepayment models. SAS enables firms to view their balance sheets from multiple perspectives, including runoff, static and dynamic views that incorporate business assumptions. Additionally, the vendor allows users to extend and customize their analytics.

SAS's high ratings in capability and analytical breadth – encompassing stress testing, reverse stress testing, simulation engine capabilities, liquidity risk analytics and balance sheet analytics – further emphasize its strength in ALM analytics.

Table 1 shows Chartis' rankings for SAS's coverage against each of the completeness of offering criteria.

Table 1: Completeness of offering – SAS (ALM solutions, 2024)

Completeness of offering criterion	Coverage
Capabilities and breadth of optimization	High
Scenario management systems (including specific ESG support)	High
Stress testing/reverse stress testing	High
Interest rate modeling	High
Simulation engine(s) capability	High
Liquidity risk	High
Balance sheet optimization	High
Behavioral modeling	High
Data management	High
Integration capabilities	High

Source: Chartis Research

FTP solutions

Chartis' FTP quadrant focuses on fundamentally operational ALM, as it involves integrating ALM with market data to create FTP curves that can be applied to specific business lines, products and strategies.

SAS is a significant player in the operational ALM space, with strong capabilities in data management and pricing. as evidenced by its category leader position in the quadrant. The vendor, which provides a range of broad risk-adjusted pricing analytics and profitability calculations, also received advanced ratings for its simulation and pricing capabilities.

Moreover, SAS's robust data management and comprehensive simulation capabilities enhance its overall system performance. The vendor provides models that can reflect a range of cash flow profiles, term structures and optionality. It supports cash flow projections across different economic and market scenarios, incorporating both contractual and behavioral cash flows.

Table 2 shows Chartis' rankings for SAS's coverage against each of the completeness of offering criteria.

Table 2: Completeness of offering – SAS (FTP solutions, 2024)

Completeness of offering criterion	Coverage
Business line management	High
Simulation	High
Data management	High
Pricing	High

Source: Chartis Research

Vendor Analysis

LRM solutions

Liquidity risk management (LRM) encompasses both reporting and liquidity risk management from a Basel perspective. This includes the ability to calculate such key metrics as net cash requirements (NCR), net stable funding ratio (NSFR), liquidity coverage ratio (LCR), and other Basel-defined liquidity metrics, making reporting more effective and focused on data integration.

SAS is a strong player in this domain, with robust data management and governance capabilities and integration features. Its high rating for integration specifically highlights its strong data integration functionalities, which are essential for effective LRM. Its comprehensive reporting capabilities position the company as a leader in the LRM space.

Table 3: Completeness of offering – SAS (LRM solutions, 2024)

Completeness of offering criterion	Coverage
Scenario generation	High
Cash flow projections	High
Integration capabilities	High
Reporting	High
LCR + NSFR	High

Source: Chartis Research

Another competitive advantage of SAS's LRM offering is its ability to generate cash flows across various business units, allowing for scenario-based actions and optimizations within specific business and regulatory constraints. SAS also facilitates regulatory compliance for liquidity risk, including adherence to Basel liquidity ratios and European Banking Authority (EBA) liquidity classifications.

Table 3 shows Chartis' rankings for SAS's coverage against each of the completeness of offering criteria.

Capital and balance sheet optimization solutions

This overview quadrant focuses on the comprehensive process of executing optimization strategies for overall capital utilization, which enables the optimization of the balance sheet while adhering to various constraints. Users can establish individual strategies and integrate a range of regulatory and management constraints into the balance sheet. Key considerations include the flexibility of the system, the variety of asset classes encompassed and the range of business lines and structures supported. All these capabilities are underpinned by a robust data management environment and core framework.

Table 4: Completeness of offering – SAS (capital and balance sheet optimization solutions, 2024)

Completeness of offering criterion	Coverage
Breadth of asset class/business line coverage	High
Optimization engine	High
Scenario and simulation frameworks	High
Data management	High

Source: Chartis Research

SAS provides a variety of simulation and mathematical optimization techniques, and its position as a category leader reflects the scalability of its platform and the integration of optimization offerings from both SAS and Kamakura. The vendor's flexibility and scalability in managing diverse data types allow firms to perform dynamic and frequent optimizations using various methods. SAS also offers a financial planning and forecasting engine that enables users to allocate resources across different business hierarchies and market conditions.

Additionally, SAS supports scenario-based analysis of the balance sheet across multiple market and risk factors, enabling firms to evaluate impacts on liquidity, capital, interest rates and funding. Users can define features of risk factors, scenarios and shocks, which can also be imported from external sources. Balance sheet optimization objectives and constraints can also be specified by users over multiple periods.

Table 4 shows Chartis' rankings for SAS's coverage against each of the completeness of offering criteria.

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Hedging and risk management solutions

As market interest rates become more volatile and conditions grow increasingly complex, it is essential for institutions to align their ALM strategies more closely with market dynamics. They must effectively integrate their forecasting models and hedging strategies in this market context, using them as a foundational framework for their risk management efforts.

We believe that SAS, including Kamakura, facilitates this integrated balance sheet framework, allowing for efficient connections between market signals and the balance sheet. This integration ensures that various components of the balance sheet – whether in retail banking, corporate banking or other sectors – are mapped and managed in alignment with market strategies. This enhances the accuracy of pricing for interest rate risk, credit risk and optionality components. SAS demonstrates sophisticated capabilities in this area, particularly with its focus on deep contingent claims.

Table 5 shows Chartis' rankings for SAS's coverage against each of the completeness of offering criteria.

Table 5: Completeness of offering – SAS (hedging and risk management solutions, 2024)

Completeness of offering criterion	Coverage
Balance sheet and position forecasting	High
Hedge strategy management	High
Product pricing and product risk strategy	High
Market alignment	High

Source: Chartis Research

Financial planning and budgeting solutions

As banks strive to optimize product pricing, lending programs and overall balance sheet performance, there is a growing emphasis on the core elements of financial planning and analysis. This emphasis includes a deep dive into cost allocation, long-term planning, simulation of the planning cycle and careful profitability analytics across different business segments, customer types and geographic regions.

SAS is recognized as a leader in this field, largely due to its robust data management infrastructure, which provides a strong foundation for developing these solutions. Historically, a range of statistical solutions in the finance sector has also contributed to the effectiveness of these applications, further enhancing SAS's capabilities in this area.

Table 6: Completeness of offering – SAS (financial planning and budgeting solutions, 2024)

Completeness of offering criterion	Coverage
Cost allocation	High
Planning	High
Profitability analytics	High
Performance analytics	High
Data management	High

Source: Chartis Research

Table 6 shows Chartis' rankings for SAS's coverage against each of the completeness of offering criteria.

Vendor positioning in context – market potential

SAS has become established as a leader in providing analytics support for a variety of specifications within a complex and ever-changing regulatory environment. This capability has contributed significantly to the vendor's position as a category leader in all six RiskTech Quadrants® and its market potential in the financial services industry. In particular, SAS's robust market position is further solidified by its diverse range of modeling approaches, which enable financial institutions to gain granular insights into multifaceted impacts on their income statements and balance sheets.

Amid persistent market volatility, financial institutions grapple with the effective management of their business models. SAS's comprehensive approach empowers these institutions to develop a holistic risk perspective, facilitate informed decision-making and optimize capital allocation to mitigate market uncertainties.

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Furthermore, SAS's sustained commitment to investment and research highlights the strategic significance of its recent endeavors. Its robust optimization engine, for instance, constitutes a pivotal component of its ALM solutions. Moreover, its provision of sophisticated tools for enhanced pricing, risk management and decision-making, along with a comprehensive suite of analytics tools tailored to regulatory requirements, has cemented its position as a category leader.

The integration of Kamakura Risk Manager's (KRM's) robust ALM capabilities into SAS Viya creates a powerful synergy, enabling firms to leverage a unified platform that seamlessly integrates ALM functions, risk management and advanced analytics. The ongoing integration of Kamakura's expertise in areas such as funds transfer pricing (FTP) will further expand and enhance SAS's already established market presence.

Table 7: Market potential – SAS (ALM Solutions, 2024)

Market potential criterion	Coverage
Customer satisfaction	High
Market penetration	High
Growth strategy	High
Business model	High
Financials	High

Source: Chartis Research

Table 7 shows Chartis' rankings for SAS's coverage against each of the market potential criteria.

Vendor Analysis

3. Vendor context

Overview of relevant solutions/capabilities

Table 8 gives an overview of SAS and its ALM solutions.

Table 8: SAS – company information

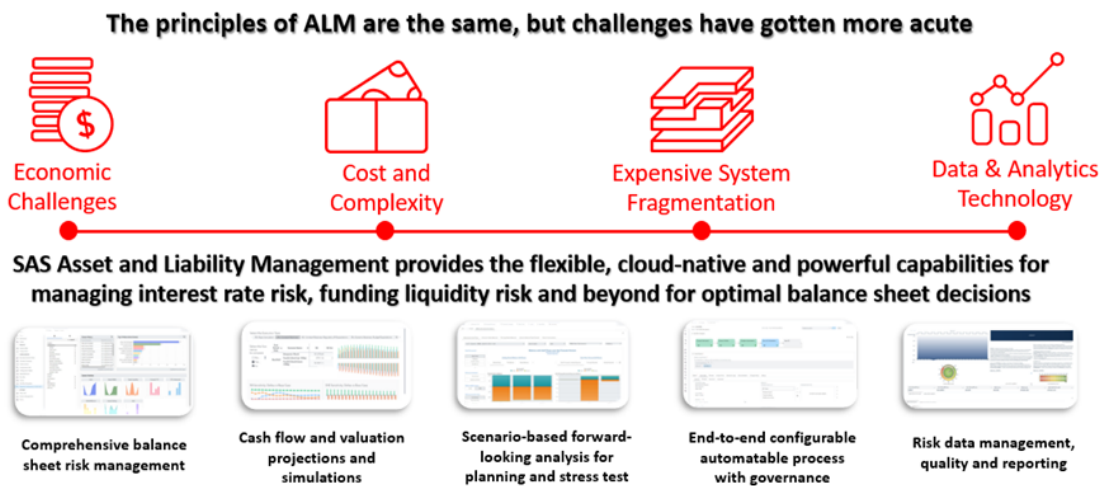| Company	SAS
Headquarters	Cary, NC, US
Other offices	• Total number of countries where SAS has R&D offices: 7 (US, UK, China, Denmark, India, Japan, Republic of Korea). • Total number of countries where SAS has offices: 56. • Total number of SAS regional offices in the US: 12 in 10 states. • Total number of SAS offices in the US (including executive suites and training centers): 44 in 20 states.
Description	SAS's continued development of next-generation risk solutions will emphasize a cloud- and API-first architecture based on SAS Viya 4, an AI, analytics and data management platform. With more than 40 years of experience in analytics and business intelligence software, and 30 years of enterprise risk management solution and practice, SAS aims to use its risk expertise, cutting-edge analytics and reporting technology to help clients analyze and manage integrated balance sheet risk.
Solution	SAS has a long history of research, solutions and practices in balance sheet risk management, covering: • Open, scalable technology for granular and timely analyses. • Industry-leading risk analytics backed by SAS's analytical power and quantitative risk research. • Cutting-edge SAS enterprise analytics and business intelligence (BI) platform. • Research-backed thought-leadership in ALM and liquidity risk management. • Interest rate and credit spread curve analytics. • Out-of-the-box financial product cash flow and valuation modeling. • Comprehensive functionalities across ALM, liquidity risk, funds transfer pricing, market and credit risk. • Market, credit and behavioral modeling. • Multi-period balance sheet dynamics for stress testing and simulations. • Flexible risk aggregation and reporting for insightful integrated risk assessments. • Data integration and quality checks. • Process automation and governance. • Embracing third-party models and collaboration.

Source: SAS

Vendor Analysis

SAS Asset and Liability Management

The changing interest rate environment and geopolitical uncertainty have been challenging for financial institutions in their balance sheet risk management (see Figure 7). The rapid development of data and analytics technology has introduced considerable challenges and opportunities to the industry, especially in the adoption of machine learning (ML), AI, digitalization and the cloud.

Figure 7: Why SAS Asset and Liability Management?

The principles of ALM are the same, but challenges have gotten more acute

Economic Challenges • Cost and Complexity • Expensive System Fragmentation • Data & Analytics Technology

SAS Asset and Liability Management provides the flexible, cloud-native and powerful capabilities for managing interest rate risk, funding liquidity risk and beyond for optimal balance sheet decisions

Comprehensive balance sheet risk management • Cash flow and valuation projections and simulations • Scenario-based forward-looking analysis for planning and stress test • End-to-end configurable automatable process with governance • Risk data management, quality and reporting

Source: SAS

Over the past decade, forward-thinking institutions have been developing their balance sheet integration, driven by risk data aggregation and reporting, stress testing and other scenario-based risk and finance initiatives, including International Financial Reporting Standard (IFRS) 9 and Current Expected Credit Losses (CECL). The question now, however, is whether that is enough. Institutions in the industry are facing the following key questions:

- Does balance sheet risk management align with their business strategies?

- Are ALM and liquidity risk analysis capabilities rich and flexible enough to provide timely and comprehensive information to executives and board members?

- How can advances in analytics enable better modeling and application of yield curve analytics and behavioral models to provide granular, consistent and insightful outcomes?

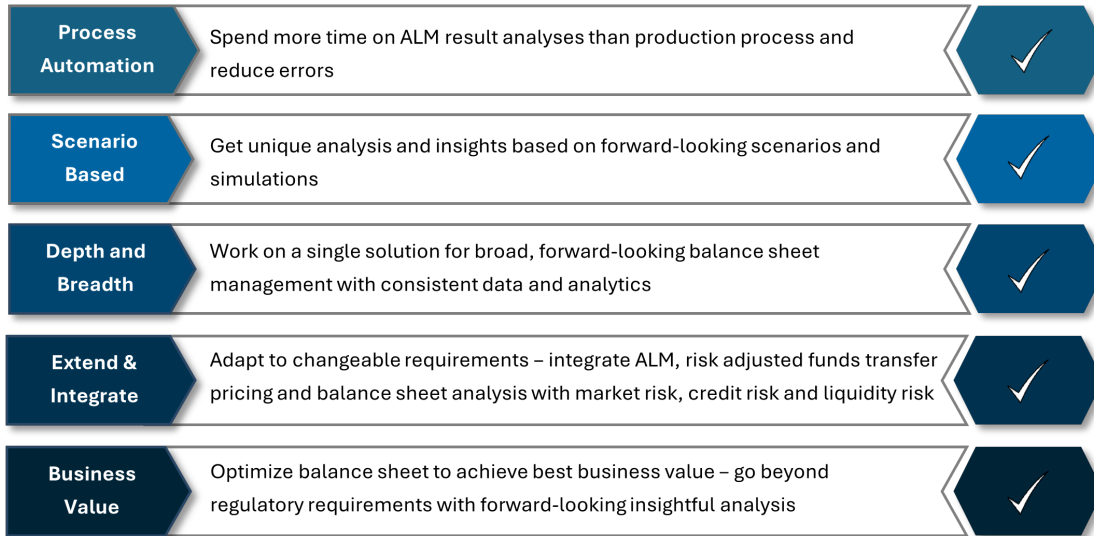- How can management encourage effective collaboration and accountability?

SAS's risk solutions provide comprehensive balance sheet risk management on a modern, cloud-native, scalable technology platform that offers timeliness, agility, flexibility and granularity. As an industry-leading analytics solution provider, SAS has worked with financial institutions of all sizes to address their most pressing analytical challenges across risk and finance functions.

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Modern technology and a best-in-class analytics platform

SAS is a long-standing partner of leading financial institutions, including global systemically important banks (G-SIBs). SAS's ALM solutions provide a broad range of integrated capabilities in data management, modeling, simulation and reporting, supported by the highly scalable power of cloud-native computing technology (see Figure 8 and Table 9).

Figure 8: How SAS Asset and Liability Management helps

Process Automation	Spend more time on ALM result analyses than production process and reduce errors	✓
Scenario Based	Get unique analysis and insights based on forward-looking scenarios and simulations	✓
Depth and Breadth	Work on a single solution for broad, forward-looking balance sheet management with consistent data and analytics	✓
Extend & Integrate	Adapt to changeable requirements – integrate ALM, risk adjusted funds transfer pricing and balance sheet analysis with market risk, credit risk and liquidity risk	✓
Business Value	Optimize balance sheet to achieve best business value – go beyond regulatory requirements with forward-looking insightful analysis	✓

Source: SAS

Table 9: SAS ALM solutions – an integrated balance sheet risk management solution suite

Cash flow modeling and valuation	• Flexible risk factor, curve and group configuration for any market-, macroeconomic- and institution-specific risk assumptions and models.
	• Coverage of a wide range of banking book and trading book products with advanced out-of-the-box methodology.
	• Yield curve smoothing and modeling for both interest rate and credit spreads.
	• Flexible forward-looking credit and behavioral modeling.
Asset and liability management and liquidity risk management	• This core offering provides extensive standard and advanced analytics for interest rate risk, earnings risk and economic value of equity, incorporating basis, spreads, repricing and embedded option risks.
	• Modified, effective and partial duration analysis.
	• Bottom-up cash flow and repricing risk projection and gap analysis at a granular level.
	• Stress testing and simulation with multi-period dynamic balance sheet assumptions, liquidity funding scenarios and hedging strategies.

Source: SAS

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Table 9: SAS ALM solutions – an integrated balance sheet risk management solution suite (continued)

Market risk management	• Advanced market risk methodologies that allow users to apply scenario, sensitivity and simulation analyses of the portfolio valuation, P&L and accounting. • Out-of-the-box and configurable risk metrics. • Risk grouping and attribution.
Funds transfer pricing	• Funds transfer pricing rate calculation and forecasting capability to help measure risk-adjusted performances. • A wide spectrum of standard FTP methods coverage. • Multiple risk adjustments, including embedded options. • Forward-looking FTP projections with impact on NII.
Regulatory and compliance	• Interest rate risk in the banking book (IRRBB) coverage of standardized and internal model approaches, as well as supervisory outlier test. • Basel liquidity risk ratios – liquidity coverage ratio (LCR) and net stable funding ratio (NSFR). • Minimum capital requirement for market risk (FRTB). • Fair valuation and expected credit loss.
Balance sheet dynamics and optimization	• Balance sheet segmentation, modeling and rule-based rebalancing. • Scenario-based balance sheet evolution modeling support, for both business-as-usual and stress scenario planning and hedging strategies. • Run-off, static and changing volume with new business, roll-over and reinvestment, and their impact across valuation and profitability. • Leveraging SAS's optimization analytics on balance sheet planning and hedging strategies.
Hedging and risk management	• Cash flow projection and valuation of embedded and explicit optionality. • Effective and key rate durations, considering the optionalities. • Supporting 'what if' hypothetical portfolio for hedging analysis and testing. • Effective hedging and accounting.
Financial planning and budgeting	• Easy to integrate with SAS and third-party financial planning, profitability and budgeting solutions. • Risk-adjusted profitability analysis. • Stress testing capabilities to enhance planning and budgeting processes.

Source: SAS

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A scalable, adaptive architecture

SAS's ALM solutions are delivered on a modern, cloud-native Kubernetes architecture that is highly scalable, embracing fast integration and deployment to accommodate different levels of sophistication and infrastructure usage. The architecture's scalability allows timely delivery of the detailed results of analyses with manageable infrastructure cost. The solution can work on cloud-based and on-premise traditional infrastructures.

End-to-end process management and governance

The solution comes with an institution-configurable workflow framework in which end-to-end analysis processes can be defined for the standardization, governance and containerization of analysis artifacts. This helps to add transparency and support internal and external scrutiny. A particular version of configuration and code base can be incorporated with each of these processes via, for example, a Git repository. Each process can allow multiple iterations and analysis runs. User actions, iterations, task status, approvals and sign-offs are logged and accessible in the graphical user interface (GUI). In the increasingly scrutinized risk management environment, this functionality adds value to transparency and governance for every analysis cycle. Multiple jurisdiction support, business-line and entity-specific configurations and sandbox environments can be set up easily with specific analysis cycles in the same deployment, with clear governance.

Robust data management capabilities

SAS's ALM solutions come with a predefined, yet extendable, data model to make data onboarding easier. SAS's data management tool provides a flow of data loading, extraction and transformation capabilities for transparency, on-screen data mapping and lineage. SAS also provides connection tools to a wide selection of data platforms for data integration. Client institutions can also choose their own preferred data onboarding. ALM analysis-specific data validation and adjustment/correction rules can be specified in the solutions. SAS also advocates Basel risk data aggregation and reporting principles. Sitting on top of the leading SAS analytics technology, users can optionally apply AI/ML and visual explorations to their data management process.

Insightful risk reporting and visual analytics

Risk monitoring and reporting on SAS's fully integrated, open and cloud-native AI and analytics platform give users insight and understanding, based on the results of analysis from the ALM solutions and other systems. The end-to-end process enables the timely availability of granular data for on-demand slice-dice, filtering and drill-down of the information. Regardless of role, every user of the system can be empowered with specifically configured and securely deployed reports.

Integration with risk modeling and model risk

Demand for analytical models for both market rates and customer or counterparty behavior is increasing significantly. An important aspect of integrated balance sheet risk management is facilitating the consistent application and efficient management of risk model lifecycles. In addition to standard analytics capabilities (from generalized linear time series to ML models) that are already included in SAS's ALM solutions, users can also choose to leverage SAS's risk modeling and model risk management solutions to better manage the model lifecycle throughout the ALM applications (see Figure 9 on page 22).

Comprehensive functionality

SAS's ALM solutions are developed for integrated balance sheet risk management to support the increasingly important role of the ALM function in financial institutions. The solution provides comprehensive and advanced functionality based on SAS's sophisticated analytics and risk thought leadership.

Lessons learned from the last financial crisis have been the main catalysts so far for the modernization of balance sheet risk management. This evolution has been driven by supervisory requirements, including regulatory stress testing, LRM requirements (e.g., LCR, NFSR and asset encumbrance),

Figure 9: Model lifecycle management for integrated balance sheet risk management with SAS
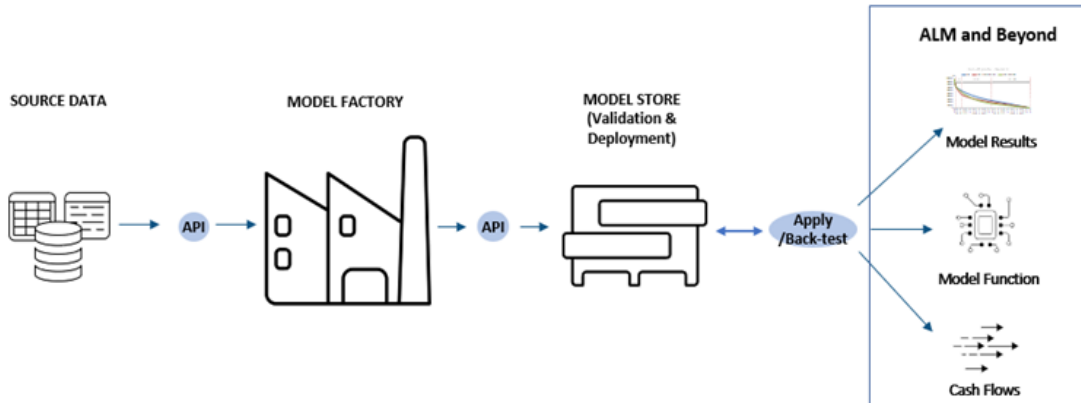
Source: SAS

IRRBB and recovery and resolution planning. Data integration and technological advances have also been instrumental. SAS's mission is to help client institutions build a proper balance sheet risk management infrastructure beyond regulatory compliance, to ensure they can withstand various economic conditions.

Holistic scenario-based balance sheet risk management

While traditional ALM and LRM typically assume static run-off or a constant balance sheet, this practice creates a disconnect between financial planning and enterprise stress testing. SAS's ALM solutions support forward-looking balance sheet risk management using dynamic business evolution assumptions that are conditioned on a range of plausible scenarios. The solution also provides tools to support reverse stress testing and long-duration analysis required for such areas as climate risk modeling.

SAS's solutions are architected to support granular cashflow and valuation modeling and analysis and, as a result, users can apply various segmentation and modeling techniques with risk correlations. For example, given that interest rates do not act alone, an integrated risk management approach should analyze the joint impact of interest rate risk and foreign exchange, as well as market and credit risk. Firms must consider both the macro and micro perspectives of these risks and, more importantly, apply them consistently to business volume projections, as well as cash flows and value projections in a future with multiple horizons.

Advanced rate analytics

In the past decade, there has been wide variation in interest rate dynamics. After a long run of ultra-low or even negative rates, we have entered an inflationary period with rapidly rising rates and greater future uncertainty. This uncertainty is not only reflected in the level and volatility of short-term rates but also in the shape of the yield curve. For a balance sheet covering multiple economic regions, the rate uncertainty also creates considerable imparity. This unsettled environment, along with the Interbank Offered Rate (IBOR) transition, demands a more sophisticated approach to rate analytics. A stochastic, simulation-driven multifactor model, such as the Heath-Jarrow- Morton model for the efficacy of rate analytics, allows banks' balance sheet risk management to remain adaptive. To address this sophistication, SAS's ALM solutions provide out-of-the-box rate and curve analytics.

Credit and behavioral modeling and beyond

Credit risk models (whether operating through credit spreads implied by the market prices of traded credits or the probability of default and loss given default) can be flexibly specified or modeled in SAS's ALM solutions. This enables firms to develop cash flow and valuation projections based on both static and dynamic scenarios. Depending on the modeling approach and business applications employed, the modeled credit risk should duly reflect the point-in-time or through-the-cycle nature of the risk. For many use cases, a more dynamic transition-model framework can prove more robust and forward-looking. SAS's ALM solutions are closely connected with SAS's Kamakura Risk Information Services (KRIS), which are used by a large group of central banks, banks and other financial services companies all over the world.

Vendor Analysis

Similarly, cash flow and valuation projections should accommodate the behavioral models used to capture deposit decay, limit utilization, prepayment or curtailment and other optionalities embedded in the products or market instruments on the balance sheet.

While SAS's modeling analytics must be robust enough to support the existing modeling framework, they should also support emerging AI and ML approaches. The SAS solution provides purpose-built capabilities for 'champion and challenger' and 'what if' analyses, in additional to scenario-based analyses to further enable effective risk management in a volatile economic environment. The consistency of credit and behavioral model application across balance sheet risk management and regulatory and risk-based accounting standards is a vital requirement for effective risk management and reporting efficacy.

Risk analytics and technology expertise

SAS's 40-year experience in analytics and technology is backed by its heavy investment in research and development and its close collaboration with customers. SAS's risk solution team comprises a group of researchers and professionals with long academic and industry experience.

Research and thought leadership

SAS has served the analytics, data management and reporting needs of the financial services industry for more than 40 years. Leveraging its comprehensive platform and advanced risk solutions, SAS consistently delivers cutting-edge, research-backed results that enable organizations to make informed decisions and manage risks effectively.

In a strategic move to enhance its financial risk management capabilities, SAS acquired Kamakura Corporation, a FinTech leader renowned for its sophisticated methodologies and pioneering research in risk analytics. This acquisition led to the establishment of the SAS Center for Applied Quantitative Finance, a hub of innovation where such esteemed academics as Professor Robert Jarrow and other leading industry practitioners collaborate. The Center is dedicated to pushing the boundaries of financial risk management by developing original, industry-relevant research and transforming it into actionable models and algorithms within SAS's software and data solutions.

The Center's current research initiatives have a direct impact on ALM capabilities, focusing on:

- Extension of the HJM interest rate modeling and simulation framework to multi-curve and currency systems.

- Hedging optimization.

- Valuation of non-maturing deposits and illiquid assets.

- Credit risk modeling of corporate and sovereign entities.

Customer advocacy

SAS builds long-term partnerships with its customers via its products and services. Solution documentation, education and technical support are the integral components of its success with customers. The company's offices and training centers in many regions and countries are staffed with risk, solution and technical consultants who understand local regulations and business environments, and who have deep solution knowledge for fast, localized support.

A constructive network of partners

SAS's carefully selected business consulting and IT partner networks bring the added benefits of expanded knowledge and support capabilities to customers. They also allow customers to support their preferred business consultants and technical infrastructure vendors with SAS solution implementations.

4. Methodology

Overview

Chartis is a research and advisory firm that provides technology and business advice to the global financial services industry. Chartis provides independent market intelligence regarding market dynamics, regulatory trends, technology trends, best practices, competitive landscapes, market sizes, expenditure priorities, and mergers and acquisitions. Chartis' RiskTech Quadrant® and FinTech Quadrant™ reports are written by experienced analysts with hands-on experience of selecting, developing and implementing financial technology solutions for a variety of international companies in a range of industries, including banking, insurance and capital markets. The findings and analyses in our quadrant reports reflect our analysts' considered opinions, along with research into market trends, participants, expenditure patterns and best practices.

Chartis seeks to include RiskTech and FinTech vendors that have a significant presence in a target market. The significance may be due to market penetration (e.g., a large client base) or innovative solutions. Chartis uses detailed vendor evaluation forms and briefing sessions to collect information about each vendor. If a vendor chooses not to respond to a request for information, Chartis may still include the vendor in the report. Should this happen, Chartis will base its opinion on direct data collated from technology buyers and users, and from publicly available sources.

Chartis' research clients include leading financial services firms and Fortune 500 companies, leading consulting firms and financial technology vendors. The vendors evaluated in our quadrant reports can be Chartis clients or firms with whom Chartis has no relationship.

Chartis evaluates all vendors using consistent and objective criteria, regardless of whether they are Chartis clients. Chartis does not give preference to its own clients and does not request compensation for inclusion in a quadrant report, nor can vendors influence Chartis' opinion.

Briefing process

We conduct face-to-face and/or web-based briefings with each vendor.[1] During these sessions, Chartis experts ask in-depth, challenging questions to establish the real strengths and weaknesses of each vendor. Vendors provide Chartis with:

• A business update – an overview of solution sales and client satisfaction.

• A product update – an overview of relevant solutions and R&D roadmaps.

• A product demonstration – key differentiators of their solutions relative to those of their competitors.

In addition to briefings, Chartis uses other third-party sources of data, such as conferences, academic and regulatory studies, and publicly available information.

Evaluation criteria

We develop specific evaluation criteria for each piece of quadrant research from a broad range of overarching criteria, outlined below. By using domain-specific criteria relevant to each individual risk, we can ensure transparency in our methodology and allow readers to fully appreciate the rationale for our analysis. The specific criteria used for the ALM Solutions, 2024 report are shown in Table 10.

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[1] Note that vendors do not always respond to requests for briefings; they may also choose not to participate in the briefings for a particular report.

Vendor Analysis

Completeness of offering		Market potential
ALM • Capabilities and breadth of optimization • Scenario management systems (including specific ESG support) • Stress testing/reverse stress testing • Interest rate modeling • Simulation engine(s) capability • Liquidity risk • Balance sheet optimization • Behavioral modeling • Data management • Integration capabilities **FTP** • Business line management • Simulation • Data management • Pricing **LRM** • Scenario generation • Cash flow projections • Integration capabilities • Reporting • LCR + NSFR	**Capital and balance sheet optimization** • Breadth of asset class/business line coverage • Optimization engine • Scenario and simulation frameworks • Data management **Hedging and risk management** • Balance sheet and position forecasting • Hedge strategy management • Product pricing and product risk strategy • Market alignment **Financial planning and budgeting** • Cost allocation • Planning • Profitability analytics • Performance analytics • Data management	• Customer satisfaction • Market penetration • Growth strategy • Business model • Financials

Source: Chartis Research

Completeness of offering

• **Depth of functionality**. The level of sophistication and number of detailed features in the software product (e.g., advanced risk models, detailed and flexible workflow, domain-specific content). Aspects assessed include innovative functionality, practical relevance of features, user-friendliness, flexibility and embedded intellectual property. High scores are given to firms that achieve an appropriate balance between sophistication and user-friendliness. In addition, functionality linking risk to performance is given a positive score.

Vendor Analysis

- **Breadth of functionality**. The spectrum of requirements covered as part of an enterprise risk management system. This can vary for each subject area, but special attention is given to functionality covering regulatory requirements, multiple risk classes, multiple asset classes, multiple business lines and multiple user types (e.g., risk analyst, business manager, CRO, CFO, compliance officer). Functionality within risk management systems and integration between front-office (customer-facing) and middle/back office (compliance, supervisory and governance) risk management systems are also considered.

- **Data management and technology infrastructure**. The ability of risk management systems to interact with other systems and handle large volumes of data is considered very important. 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. Particular attention is given to the use of modern data management technologies, architectures and delivery methods relevant to risk management (e.g., in-memory databases, complex event processing, component-based architectures, cloud technology and software as a service). Performance, scalability, security and data governance are also important factors.

- **Risk analytics**. The computational power of the core system, the ability to analyze large amounts of complex data in a timely manner (where relevant in real time), and the ability to improve analytical performance are all important factors. Particular attention is given to the difference between 'risk' analytics and standard 'business' analytics. Risk analysis requires such capabilities as non-linear calculations, predictive modeling, simulations, scenario analysis, etc.

- **Reporting and presentation layer**. The ability to present information in a timely manner, the quality and flexibility of reporting tools, and ease of use, are important for all risk management systems. Particular attention is given to the ability to do ad hoc 'on the fly' queries (e.g., 'what if' analysis), as well as the range of 'out of the box' risk reports and dashboards.

Market potential

- **Business model**. Includes implementation and support and innovation (product, business model and organizational). Important factors include size and quality of implementation team, approach to software implementation, and post-sales support and training. Particular attention is given to 'rapid' implementation methodologies and 'packaged' services offerings. Also evaluated are new ideas, functionality and technologies to solve specific risk management problems. Speed to market, positioning and translation into incremental revenues are also important success factors in launching new products.

- **Market penetration**. Volume (i.e., number of customers) and value (i.e., average deal size) are considered important. Rates of growth relative to sector growth rates are also evaluated. Also covers brand awareness, reputation and the ability to leverage current market position to expand horizontally (with new offerings) or vertically (into new sectors).

- **Financials**. Revenue growth, profitability, sustainability and financial backing (e.g., the ratio of license to consulting revenues) are considered key to scalability of the business model for risk technology vendors.

- **Customer satisfaction**. Feedback from customers is evaluated, regarding after-sales support and service (e.g., training and ease of implementation), value for money (e.g., price to functionality ratio) and product updates (e.g., speed and process for keeping up-to-date with regulatory changes).

- **Growth strategy**. Recent performance is evaluated, including financial performance, new product releases, quantity and quality of contract wins, and market expansion moves. Also considered are the size and quality of the sales force, sales distribution channels, global presence, focus on risk management, messaging and positioning. Finally, business insight and understanding, new thinking, formulation and execution of best practices, and intellectual rigor are considered important.

Quadrant construction process

Chartis constructs its quadrants after assigning scores to vendors for each component of the completeness of offering and market potential criteria. By aggregating these values, we produce total scores for each vendor on both axes, which are used to place the vendor on the quadrant.

Vendor Analysis

Definition of quadrant boxes

Chartis' quadrant reports do not simply describe one technology option as the best solution in a particular area. Our ranking methodology is designed to highlight which solutions are best for specific buyers, depending on the technology they need and the implementation strategy they plan to adopt. Vendors that appear in each quadrant have characteristics and strengths that make them especially suited to that category and, by extension, to particular users' needs.

Point solutions

- Point solutions providers focus on a small number of component technology capabilities, meeting a critical need in the risk technology market by solving specific risk management problems with domain-specific software applications and technologies.

- They are often strong engines for innovation, as their deep focus on a relatively narrow area generates thought leadership and intellectual capital.

- By growing their enterprise functionality and utilizing integrated data management, analytics and business intelligence (BI) capabilities, vendors in the point solutions category can expand their completeness of offering, market potential and market share.

Best-of-breed

- Best-of-breed providers have best-in-class point solutions and the ability to capture significant market share in their chosen markets.

- They are often distinguished by a growing client base, superior sales and marketing execution, and a clear strategy for sustainable, profitable growth. High performers also have a demonstrable track record of R&D investment, together with specific product or 'go-to-market' capabilities needed to deliver a competitive advantage.

- Because of their focused functionality, best-of-breed solutions will often be packaged together as part of a comprehensive enterprise risk technology architecture, co-existing with other solutions.

Enterprise solutions

- Enterprise solution providers typically offer risk management technology platforms, combining functionally rich risk applications with comprehensive data management, analytics and business intelligence (BI).

- A key differentiator in this category is the openness and flexibility of the technology architecture and a 'toolkit' approach to risk analytics and reporting, which attracts larger clients.

- Enterprise solutions are typically supported with comprehensive infrastructure and service capabilities, and best-in-class technology delivery. They also combine risk management content, data and software to provide an integrated 'one stop shop' for buyers.

Category leaders

- Category leaders combine depth and breadth of functionality, technology and content with the required organizational characteristics to capture significant share in their market.

- They demonstrate a clear strategy for sustainable, profitable growth, matched with best-in-class solutions and the range and diversity of offerings, sector coverage and financial strength to absorb demand volatility in specific industry sectors or geographic regions.

- They will typically benefit from strong brand awareness, a global reach and strong alliance strategies with leading consulting firms and systems integrators.