

# Vendor Analysis: Moody's Analytics

## CLO Solutions, 2020



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## 1. Report context

This Vendor Analysis is based on the Chartis quadrant report '*Technology Solutions for Credit Risk 2.0: Credit Risk Analytics, 2020; Market Update and CVA/CLO Solutions Vendor Landscape*' (published in April 2020). This section summarizes the key theses in that report; subsequent sections take a detailed look at the quadrant positioning and scoring for Moody's Analytics, and Chartis' underlying opinion and analysis.

### Key thesis

In our report *Technology Solutions for Credit Risk 2.0, 2018*, published in May 2018, we identified an emerging credit risk environment – which we call Credit Risk 2.0 – in which the banking book and default risk analytics are experiencing a structural revolution. Every aspect of the banking book, from data to core analytics, is in the process of being reshaped by the impact of accounting standards and technology.

In 2019<sup>1</sup> we considered the structural changes these 'risk-aware accounting' standards – such as International Financial Reporting Standard (IFRS) 9 and Current Expected Credit Losses (CECL) – have made to the vendor landscape, and assessed the new tools and capabilities that financial institutions (FIs) need to comply effectively.

In our follow-up report, *Technology Solutions for Credit Risk 2.0: Credit Risk Analytics, 2020*, we analyzed four key credit segments of the credit landscape:

- Credit for the banking book.
- Credit for the trading book (xVA/credit valuation adjustment [CVA]/margin analytics).
- Traded credit markets (credit-risk fixed-income products including corporate credit, collateralized debt obligations [CDOs], collateralized loan obligations [CLOs] and high-yield credit).
- Credit for wealth management.

Highlighting the key trends across all segments of the credit landscape, we focused on analytics, considering the rapidly moving credit revolution, its regulatory drivers, and the evolving technology consequences arising from it. We also examined the relative rates of adoption for new and different technological paradigms in the four key segments of the credit risk landscape listed above.

Finally, to complement our previous analysis of credit in the banking book, the report included a more detailed exploration of the extensive and diverse trading book segment of the credit landscape. It included deep dives into the rapidly growing CLO and CVA markets, assessed developments in dedicated specialist analytics, and provided a view of the vendor landscape in each segment, highlighting the methodological differences between both approaches to modeling credit risk.

### Demand-side takeaways

#### Context: a revolution driving change in four key areas of credit

In our 2018 Credit Risk 2.0 report<sup>2</sup>, we highlighted how the credit risk environment is changing, driven by three factors:

- **Changing regulations and reporting standards.** New 'risk-aware accounting' standards, such as IFRS 9 and CECL, are changing the fundamental nature of how default risk is calculated. In addition, Basel IV/FRTB3, due to be implemented in 2021, will affect the way that FIs calculate risk-weighted assets (RWA) and capital floors, constraining the use of internal models.
- **Changes to counterparty risk management.** Regulators have renewed their focus on market-linked contingent credit in the trading book (with measures such as standardized approach for counterparty credit risk [SA-CCR] and FRTB-CVA). These reforms are pushing FIs to adopt clearer, more stringent and sustainable practices for measuring and managing counterparty risk. Despite the heightened focus on bilateral collateralization and the increase in trade volumes through cleared markets, CVA remains a significant dynamic in this area.

<sup>1</sup> See '*Technology Solutions for Credit Risk 2.0; Vendor Landscape, 2019*'.

<sup>2</sup> '*Technology Solutions for Credit Risk 2.0, 2018*'.

<sup>3</sup> *Fundamental Review of the Trading Book*.

- The recent emergence of **new computational techniques** for assessing credit and credit risk. These include changes to the underlying mathematical models, such as new graph-based approaches, for example. Graph analytics (GA) are techniques that analyze network relationships, employing graph theory and combinatorial mathematics, and simplifying their implementation using graph databases.

- Intersecting these three trends are evolving demands for **data and data technology**.

Driven in part by the barrage of regulation and reporting requirements hitting the credit space, FIs are increasingly looking to obtain data from third parties, in larger volumes and with greater granularity than ever before. To address this, technology vendors are vying to provide the analytical tools to process this data, as well as the interfaces to manage its many sources, and the databases to store it.

### Credit analytics take center stage

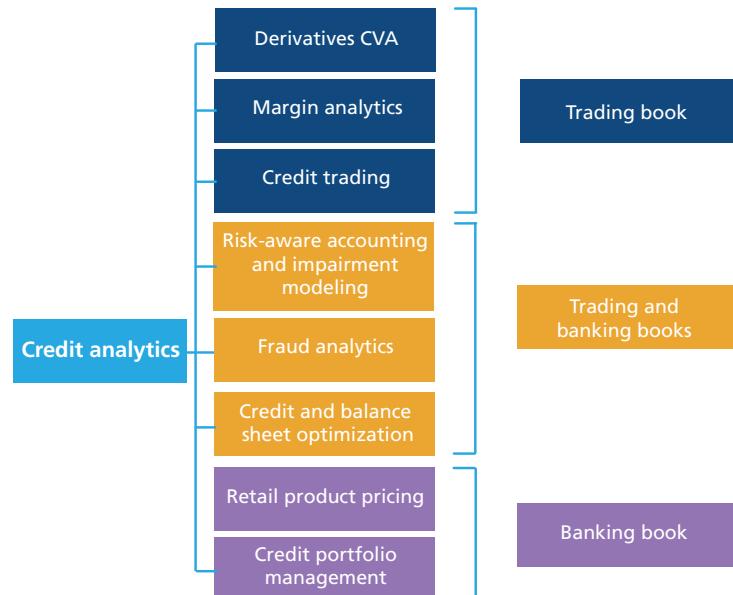
Credit analytics are a core element of the new credit risk environment. Every aspect of credit modeling has been transformed in recent years, and many new mathematical techniques have become widespread (see Figure 1). IFRS 9, for example, has inspired a set of responses from banks, which have modified many of their credit-intensive processes (such as impairment modeling). The standard has catalyzed changes to the specific technological and methodological landscape underpinning these processes. Requirements include building detailed performance models for the new credit frameworks that are emerging.

Many transformations remain in mid-flight – the theoretical and methodological underpinnings of most aspects of traded credit modeling (such as CLOs) continue to evolve. Of all market segments, margin analytics is the area that is most methodologically stable.

Different credit applications require different analytical components. In recent years credit and balance sheet optimization, for example, have become a focus in private banking and wealth management. And alongside existing statistical frameworks, new tools such as machine learning (ML) and GA are making deep inroads.

A variety of new tools are transforming the environment for credit processes and analytics. While ML-style models have had the most dramatic impact in retail banking, traditional tools

**Figure 1: New-style credit analytics are being applied across the financial landscape**



Source: Chartis Research

and techniques (such as simulation engines and stress testing) are increasingly being leveraged for banking-book frameworks.

Overall, the credit risk market has experienced transformational growth. However, the impact of different credit analytics and credit flow processes on market growth, technology and data varies. Risk-aware accounting has encouraged huge market growth, for example, with a corresponding need for data management and sourcing for compliance.

### Traded credit 2.0

The CLO market is in the middle of a strong period of growth. Unlike its counterpart for CDOs, the CLO market not only survived the fallout of the financial crisis, it has thrived. CLOs are a form of structured product, composed of spliced loans organized into credit risk tranches, and they function as a way to help members of a syndicate loan to businesses, gather returns and manage risk.

A bank will aggregate a group of business loans and sell them to a syndicate of CLO buyers. CLOs are organized into tranches with different loan cash flows based on the risk appetite of the CLO buyer. The lower the risk appetite (those buyers in higher tranches), the lower their potential interest pay-off. In the case of defaults and lower overall cash flows, however, higher tranches are entitled

to returns relative to their position first. In essence, the greater the risk a buyer takes, the higher their potential yield – but the lesser their protection from adverse conditions that limit cash flows.

Recent accounting rule changes, such as IFRS 9, require the fair valuation of securitizations such as CLOs. CLO portfolio valuation is a challenge, especially as the underlying collateral pool creates a multitude of necessary cash-flow calculations based on complex credit and payment projections. Determining the fair value demands the calculation of the probability of default (PD) and the correlation of default between loans. FIs can make these calculations either using a constant default rate (CDR) or by modeling them stochastically using tools such as Monte Carlo simulation. Market data for default curves is often not readily observable in the market, and default curves are often based on bond spreads or CDS spreads. The interest rate used in discounting is based on a floating rate, usually the London Interbank Offered Rate (LIBOR); however, that will now have to switch to alternatives<sup>4</sup> (such as the Secured Overnight Financing Rate [SOFR]).

More corporate credit data is now available, shining new light on what was historically a relative black hole in terms of transparency. Likewise, a blend of private loan data and bond data is now giving traders better insights, allowing them to model entire corporate structures more easily. However, constructing credit curves in illiquid assets remains a challenge, making it difficult to develop and maintain a coherent picture.

## Supply-side takeaways

### Vendors continue to diverge

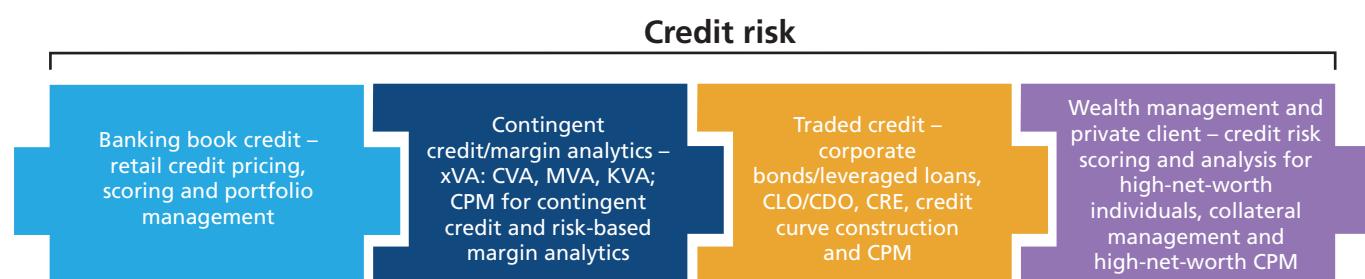
Vendors in each of the four segments of credit risk considered here – the banking book, the trading

book (contingent credit and margin analytics), traded credit markets, and wealth management – remain diverse. They also differ considerably in their product offerings, penetration of various market segments, and their level of specialization. Few vendors have a presence in more than one sector – and even within sectors they generally offer distinct products. Within segments, product offerings remain component-based, and vendors that are analytically focused are increasingly diverging from more process-oriented players.

Theoretically, vendors could easily cross and overlap different market segments and sub-sectors, but in practice such a journey is not straightforward. Technologies and underlying methodologies cannot be easily transferred across segments and subsectors. Vendors' ability to widen their offerings is often constrained by methodological barriers, algorithmic variability, the existing technology context and the required data models. Different segments are also subject to varying regulatory requirements and stringency. The relative focus of different business groups and lines can also differ hugely.

And while the overarching category of credit risk provides a useful market overview, in practice it is complex and varied. Credit markets and their analytics have fragmented into many segments, each requiring its own focused analysis. Each segment has sub-sectors with very different technology structures, data demands and consumers (see Figure 2). This market variation is mirrored in the vendor landscape – hence our focus on CVA and CLO markets.

**Figure 2: Key functionality and products in different credit segments**



Source: Chartis Research

<sup>4</sup> <https://www.morganstanley.com/ideas/libor-its-end-transition-to-sofr>

## 2. Quadrant context

### Introducing the Chartis RiskTech Quadrant®

This section of the report contains:

- The Chartis RiskTech Quadrant® for CLO solutions, 2020.
- An examination of the positioning and scores for Moody's Analytics, as part of Chartis' analysis.
- A consideration of how the quadrant reflects the broader vendor landscape.

#### Summary information

##### **What does the Chartis quadrant show?**

The 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 CLO 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. It 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 and FinTech quadrants 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 Research 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 Research's 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.

### Chartis Research RiskTech Quadrant® for CLO solutions, 2020

Figure 3 illustrates Chartis' view of the CLO solutions vendor landscape, highlighting Moody's Analytics.

#### Quadrant dynamics

##### **General quadrant takeaways**

The CLO vendor market is relatively dispersed, with vendors in the category leaders, best-of-breed and point solutions quadrants, and there is a strong correlation between vendors' breadth of functionality and their market potential. Although there has been huge growth in the CLO market in the past 10 years, the complexity of the analytics involved limits the vendors in the category leaders quadrant.

CLO solutions lack the methodological history and stability of techniques for other credit-pricing processes (such as CVA), but the increasing availability of corporate credit data has opened up the market. This is because CLO portfolio valuation requires a vast amount of complex granular

**Figure 3: RiskTech Quadrant® for CLO solutions, 2020**



Source: Chartis Research

data for the underlying collateral-pool cash-flow calculations.

Nevertheless, pricing challenges and credit curve construction (despite asset illiquidity) has limited development in this area in the past. To achieve category leader status, vendors with strong data infrastructures need to have combined those capabilities with a wide variety of analytical tools.

For some vendors, embedding credit portfolio management support within their CLO solution is a distinguishing feature. In our analysis we assessed not only pricing but also performance analytics and credit portfolio support, which users increasingly expect in solutions in the structured credit space.

### **Vendor positioning in context – completeness of offering**

Moody's Analytics is the stand-out category leader for CLO solutions, with an offering that performs strongly in all areas of the functionality we assessed. Moody's Analytics is a leading provider in the credit space, and its focused development in the CLO market has enabled it to cultivate a comprehensive solution. It scored particularly well in the categories for collateral data analytics, pricing engine and credit portfolio management (CPM) support functionality. Few vendors in this space have achieved fully fledged standalone solutions, and many continue to offer functionality as components.

The Moody's Analytics CLO solution offers a structured finance data feed that enables users to aggregate and analyze granular tranche, loan and asset-performance data from the vendor's own databases and third-party sources. As well as aggregating vital information on all the underlying assets of a CLO and calculating the industry exposure, the solution also tracks principal and interest payments for each tranche. Overall, the solution enables users to quantify and manage risk when purchasing and selling CLO tranches. In terms of data infrastructure, the offering's CLO database can be used in conjunction with those of other providers, while text files can also be integrated with other database servers. While CLO pricing is a challenging function because of the multitude of cash-flow projections required, the extensive proprietary market databases offered by Moody's Analytics enables its simulations to generate more accurate predictions.

Moody's Analytics also offers a sophisticated user interface for reporting and visualizations, enabling users to easily access and view their comparative analytics and performance over time. Users can also view the performance metrics of different CLO managers, as well as data about their respective styles, on an accessible, user-friendly and modern platform. In addition, users can track the exposure for issuers and orient CLO assets against other transactions, with historical or real-time views. The solution is highly configurable, and users can customize their reporting requirements depending on their selection criteria for portfolios and managers.

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

### **Vendor positioning in context – market potential**

The maturity of the Moody's Analytics CLO solution is reflected in a consistently high market potential score. The solution's advanced functionality tailored to specific market needs and user requirements is reflected in its relatively high customer satisfaction score. Because of the vendor's commitment to a comprehensive solution, and its solid foundation of collateral data analytics, it is likely to continue to increase its market penetration at a reasonable rate.

The current status and features of the Moody's Analytics solution highlight the vendor's commitment to standardizing the theoretical and methodological underpinnings of CLO pricing and

**Table 1: Completeness of offering – Moody's Analytics, CLO solutions, 2020**

Completeness of offering criterion	Coverage
Collateral data analytics	High
Pricing engine	High
Data infrastructure	Medium
CPM support	High
Performance analytics	Medium
Reporting and visualization	Medium

*Source: Chartis Research*

analytics, which are immensely challenging areas. Moreover, the solution demonstrates that Moody's Analytics has tracked significant growth in the CLO market over the past 10 years, by developing an independently tailored CLO solution. Following the general trend in the credit analytics market it has included CPM support, which helps to make the system more competitive.

Table 2 shows Chartis' rankings for the vendor's coverage against each of the market potential criteria.

**Table 2: Market potential – Moody's Analytics, CLO solutions, 2020**

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

*Source: Chartis Research*

### 3. Vendor context

#### Overview of relevant solutions/capabilities

Table 3 gives an overview of Moody's Analytics and its CLO solution.

In a constantly evolving marketplace, CLO solutions from Moody's Analytics provide quick, straightforward access to financial intelligence and analytical tools. Its solutions include a combination of comparative analytics, global coverage and a sophisticated cash-flow engine to help CLO market participants make informed decisions, while providing a comprehensive view of the CLO universe.

Its client profile consists of asset managers, banks, educational institutions, financial services firms, government entities, hedge/pension funds, information providers, insurance companies, issuers, professional services firms and risk managers.

#### Vendor leading practices

Moody's Analytics offers an end-to-end solution for CLO market participants through flexible delivery methods, including a web portal, data feeds, local/hosted APIs, microservices, iFrames and Excel add-ins.

#### Solutions for the CLO value chain

##### *Issuer module for managing warehouses and CLOs*

The CLO Manager Module is a comprehensive solution for monitoring and managing compliance requirements and reporting.

Key features (see Figure 4):

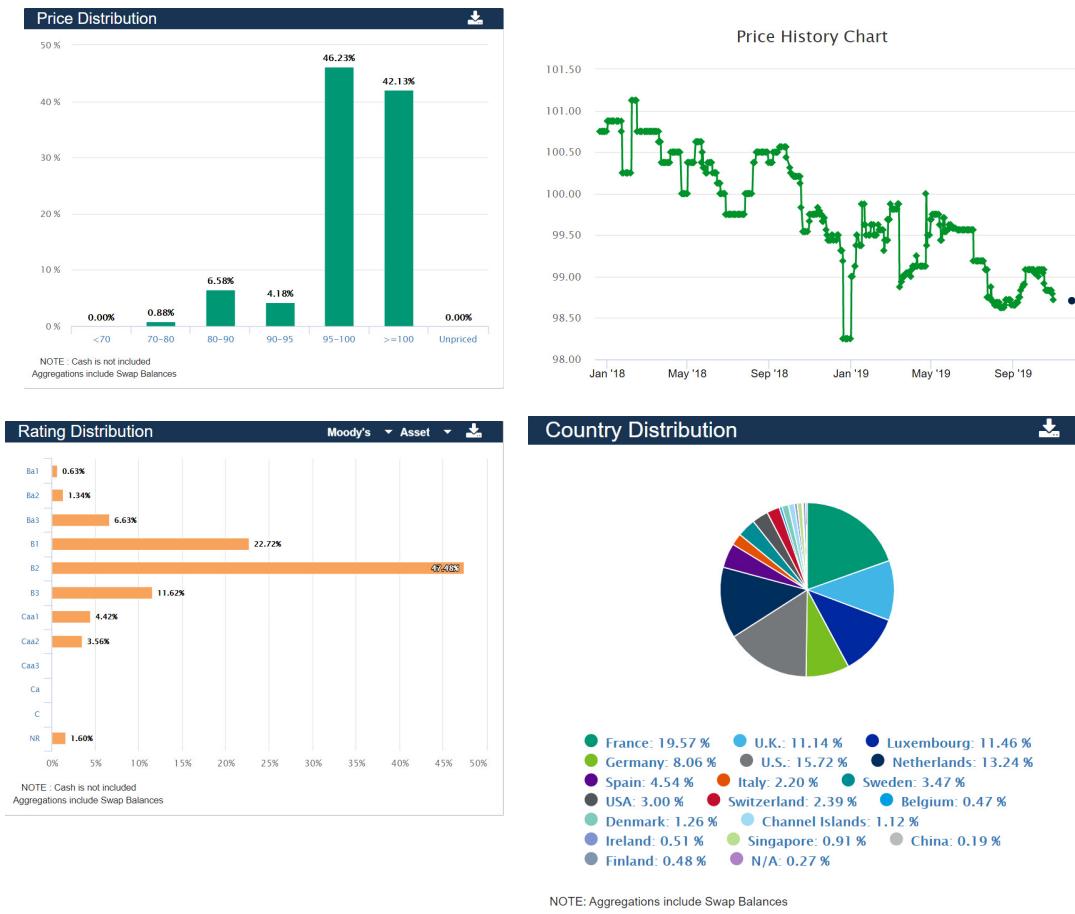
- Rapid hypothetical trade results. Real-time loan and CLO processing offers instant pre-trade and post-trade impact across the portfolio, enabling users to drill down into test details to determine indenture-specific calculations. Traders can track hypothetical balances via trade blotter.
- Unification of front, middle, and back office. Centralized data repositories streamline issuer operations and data analysis. Portfolio managers, loan traders, operations analysts and trustees can unite on a single platform.
- Customized reporting. Creation of user-specific reporting using current data. Users can also make updates to deal- and account-related data directly from the user interface.
- Compliance details. Detailed visibility into how each test is calculated. Analysts can easily access test-specific indenture language.
- Portfolio business analytics. Dynamic user interface provides key insights into portfolio-, deal- and asset-level metrics.

**Table 3: Moody's Analytics – company information**

<b>Company</b>	Moody's Analytics
<b>Headquarters</b>	New York, NY, US
<b>Other offices</b>	San Francisco, Toronto, Brussels, Paris, London, Singapore, Hong Kong, Tokyo
<b>Description</b>	Moody's Analytics provides financial intelligence and analytical tools to help business leaders make better, faster decisions. With its risk expertise, expansive information resources and application of technology, it aims to help its clients navigate an evolving marketplace. Its solutions are made up of research, data, software and professional services.
<b>Solution</b>	Moody's Analytics provides CLO market participants with end-to-end solutions via multiple delivery methods, including its proprietary web-based Structured Finance Portal, microservices, local/hosted application programming interfaces (APIs), iFrames, and Excel add-ins.

Source: Moody's Analytics

**Figure 4: Key features of the CLO Manager Module**



Source: Moody's Analytics

- Trustee reconciliation workflows. Daily reviewing, locking and updating of data as teams facilitate trustee reconciliation.

Technological efficiencies and security:

- Flexible suite of data-ingestion options, including direct cloud connectivity, APIs and secure file transfer protocols (SFTPs).
- Rapid performance allows users to run portfolio-wide compliance in seconds.
- Scalable, cloud-based technology allows for optimized support for growing portfolios.
- Secure cloud access keeps data safe.
- Centralized technical capabilities allow operations teams to optimize efforts around reporting and compliance.

Table 4 summarizes the vendor's service offering.

### ***Sell-side workflows to support primary and secondary market activity***

Moody's Analytics provides sell-side CLO market participants with a wide depth and breadth of capabilities and customizable modules. Its solutions offer a number of benefits to primary and secondary market participants, via the **CDOEdge** and **CDOnet** platforms and APIs, data feeds and microservices. For primary markets, users can:

- Assist with structuring of deals and many types of transactions within CDOEdge and CDOnet.
- Gain transparency and visibility into a deal's waterfall structure, swaps, supports, capital structure and underlying collateral.
- Share a link to potential investors, who can access deal information and run cash-flow analytics through the web-based Structured Finance Portal.

**Table 4: CLO service offering from Moody's Analytics**

Implementation	Modeling	Support and maintenance
Consulting and advisory	Initial portfolio setup	Technical infrastructure
Data analysis	New issuance models	Product releases
Data ingestion	Deal maintenance	Security and administration
Customized reporting		

Source: Moody's Analytics

For secondary markets, users can:

- Employ microservices to supplement bid lists and offer sheets with essential key-deal- and tranche-level information.
- Leverage the information in its data feeds to write research to disseminate to the market and keep current on recent trends.
- Utilize its APIs to enhance speed and scalability by performing multi-threaded deal analytics.
- Leverage cloud-based technologies to quickly run price/yield analytics for a multitude of scenarios on the entire structured universe.

## Delivery methods

Figure 5 illustrates the vendor's main delivery methods for its CLO offerings and services.

### Structured finance APIs

Users can analyze structured finance products by linking the vendor's CLO data, asset/liability cash flows and analytics to custom in-house applications. The API applies to a wide range of demanding use cases, from multi-threaded deal analytics to stochastic simulations. API integrations scale easily in most multi-server environments and can be implemented under various load-balancing schemes.

### Data feeds

- Include detailed data on tranche, deal and loan performance via hundreds of performance metrics derived from surveillance reports, third-party providers, and the vendor's proprietary databases.
- Include both historical and current data, updated daily.

- Contain the same data used by Moody's Analytics software and in Moody's Analytics research, and undergo multiple layers of checks and verification.

### Microservices

Moody's Analytics offers customized solutions that can be delivered through easily consumable technologies. Its cloud-based analytics can quickly calculate prices, yields and discount margins (DMs) across the structured finance universe, and can be delivered through microservices as a package. Everything is hosted by Moody's Analytics, cutting the users' overhead and maintenance costs.

### Structuring and cashflow modeling products

#### CDOEdge

CDOEdge's flexible user interface and trends and optimization modules make it suitable for CLO and CLO managers. Loan warehouse providers can also use it to calculate optimized attachment/detachment and risk weightings (see Figure 6).

#### CDOnet cash-flow engine

- CDOnet is a comprehensive cash-flow suite that can run analytics across all CLO products.

**Figure 5: Delivery methods for CLO offerings from Moody's Analytics**


Source: Moody's Analytics

- CDOnet cash-flow forecasts allow for deterministic parameters such as conditional prepayment rate (CPR), constant default rate (CDR), recovery constants or vectors; stochastic parameters; and Moody's Analytics Economic Scenarios.
- CDOnet has a wide variety of potential uses due to its expansive list of capabilities and customizable modules (see Figure 7).

### **Universal deal sharing**

- Users can create links to their deals through the Structured Finance Portal and share with prospective investors free of charge.
- Users can access deals through any web browser without having to download any software.
- Links can be shared easily to post-closing deal documents, comparative analytics, cash flows and price/yield tables.
- Users can keep track of who accessed their deals and other essential activities for better transparency.
- Users can also model deals themselves using CDOnet, or request an express modeling service from in-house experts free of charge.

### **Enhanced BWIC Analyzer**

The Enhanced BWIC5 Analyzer is a buy-side trading workflow available through the Structured Finance Portal (see Figure 8).

Key features include:

#### **Streamlined single-page analysis**

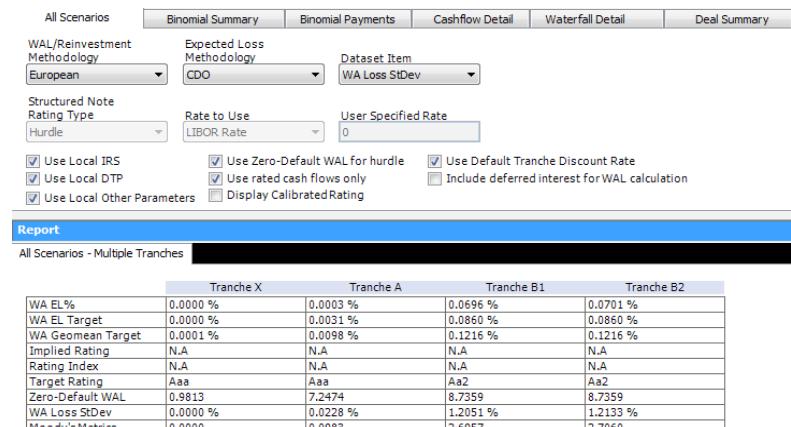
- Users can quickly access and alternate between portfolios, BWICs and dealer inventories.
- They can perform analysis within a single view, accessing top industry and issuer breakdowns, market value (MV) metrics, asset-level details, manager-style assessments, and price-yield analytics on a single page.

#### **Advanced tranche-filtering capabilities**

- Users can start from the entire universe of tranches and filter on any number of metrics

<sup>5</sup> Bid wanted in competition

**Figure 6: CDOEdge sample screen**

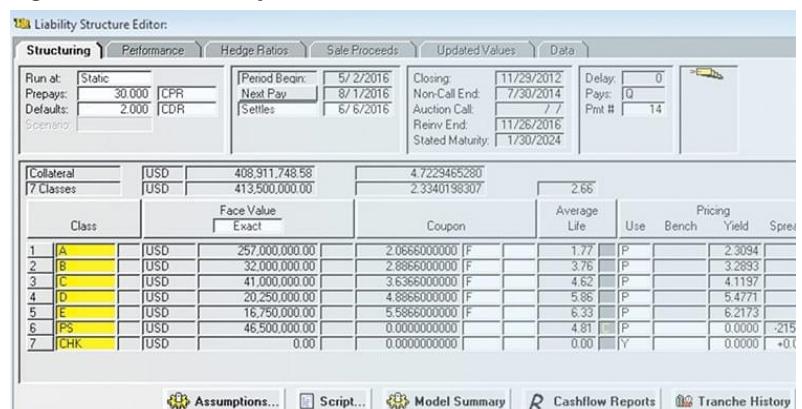


The screenshot shows the CDOEdge interface with various configuration tabs at the top: All Scenarios, Binomial Summary, Binomial Payments, Cashflow Detail, Waterfall Detail, and Deal Summary. Under 'All Scenarios', settings for WAL/Reinvestment Methodology (European), Expected Loss Methodology (CDO), Dataset Item (WA Loss StDev), Structured Note Rating Type (Hurdle), Rate to Use (LIBOR RATE), and User Specified Rate (0) are visible. Below these are several checkboxes: Use Local IRS, Use Zero-Default WAL for hurdle, Use Default Tranche Discount Rate, Use Local DTP, Use rated cash flows only, Use Local Other Parameters, and Display Calibrated Rating. A 'Report' section shows 'All Scenarios - Multiple Tranches'. A summary table follows, showing data for Tranche X, Tranche A, Tranche B1, and Tranche B2 across various metrics like WA EL%, WA EL Target, and WA Loss StDev.

	Tranche X	Tranche A	Tranche B1	Tranche B2
WA EL%	0.0000 %	0.0003 %	0.0596 %	0.0701 %
WA EL Target	0.0000 %	0.0031 %	0.0860 %	0.0860 %
WA Geomean Target	0.0001 %	0.0098 %	0.1216 %	0.1216 %
Implied Rating	N.A	N.A	N.A	N.A
Rating Index	N.A	N.A	N.A	N.A
Target Rating	Aaa	Aaa	Aa2	Aa2
Zero-Default WAL	0.9813	7.2474	8.7359	8.7359
WA Loss StDev	0.0000 %	0.0228 %	1.2051 %	1.2133 %
Moody's Metrics	0.0000	0.0983	2.6957	2.7060

Source: Moody's Analytics

**Figure 7: CDOnet sample screen**

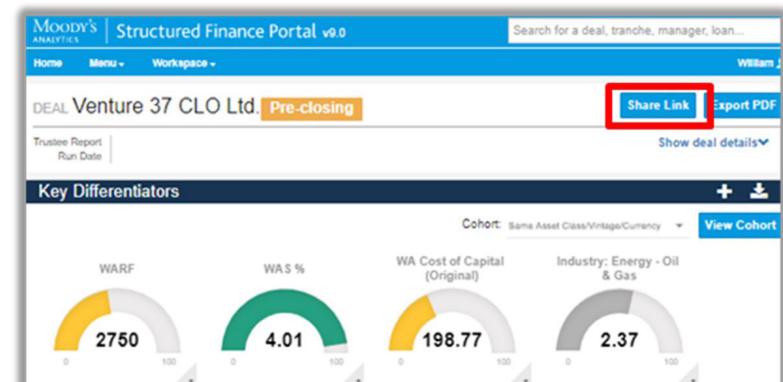


The screenshot shows the CDOnet interface with tabs for Liability Structure Editor, Structuring, Performance, Hedge Ratios, Sale Proceeds, Updated Values, and Data. Under 'Structuring', fields for Run at (Static), Prepays (30.000), and Defaults (2.000) are set. The 'Performance' tab shows a table of collateral classes (A through ICHK) with their face values and coupon rates. At the bottom are links for Assumptions, Script, Model Summary, Cashflow Reports, and Tranche History.

Class	Face Value Exact	Coupon	Average Life	Use	Bench	Pricing Yield	Spread
1 A	257,000,000.00	2.0666000000 F	1.77	P		2.3094	
2 B	32,000,000.00	2.8866000000 F	3.76	P		3.2893	
3 C	41,000,000.00	3.6366000000 F	4.62	P		4.1197	
4 D	20,250,000.00	4.8886000000 F	5.85	P		5.4771	
5 E	16,750,000.00	5.5866000000 F	6.33	P		6.2173	
6 FPS	46,500,000.00	0.0000000000	4.81	P		0.0000	-215
7 ICHK	0.00	0.0000000000	0.00	Y		0.0000	+0.00

Source: Moody's Analytics

**Figure 8: The Enhanced BWIC Analyzer in the Structured Finance Portal**



The screenshot shows the Enhanced BWIC Analyzer interface. At the top, it displays 'DEAL Venture 37 CLO Ltd. Pre-closing' and 'Share Link' (which is highlighted with a red box). Below this, there are sections for 'Key Differentiators' and 'Cohort'. The 'Key Differentiators' section includes four gauge charts: WARF (2750), WAS % (4.01), WA Cost of Capital (Original) (198.77), and Industry: Energy - Oil & Gas (2.37). The 'Cohort' section shows 'Same Asset Class/Vintage/Currency' and a 'View Cohort' button.

Source: Moody's Analytics

to find the tranches that match the criteria. Alternatively, they can start with a single reference tranche to find comparable tranches ranked by a relevance score based on user input.

- Users can plot recent market color (such as trades, covers, bids and offers) for all relevant tranches in a single chart, to provide context for important trading decisions.

#### **Advanced filters**

- Enable users to quickly filter through the entire tranche universe for specific criteria. Users can filter for a variety of metrics including: managers, vintage, ratings, MV metrics, equity returns and quality tests such as weighted average rating factor (WARF) and weighted average spread (WAS).
- Users can also choose a tranche as a reference point and identify tranches within inputted tolerance levels. For a tranche that has a WARF of 2700, users can filter for all tranches that are +/- 100 of this metric, locating all tranches that have a lower range of 2600 and an upper range of 2800.

#### **Custom BWICs**

- Users can create their own BWICs by providing a list of CUSIPs.
- BWICs are stored for a limited time and can be shared with users in the same company.
- They can be viewed by key metrics to benchmark tranches.

#### **Matcher function**

- Tranches showing up on BWIC and dealer inventory lists which also correspond to the user's portfolios will be highlighted.
- In addition, tranches that fall into the same deals and managers will also be highlighted, allowing greater synergy when comparing the secondary market with what is currently held in a user's portfolios.
- Tranches will be displayed according to their similarity to the compared tranche based on user-provided criteria.

#### **BWIC parser**

- Enables users to parse emails to have BWIC and dealer inventory lists seamlessly integrated into the Structured Finance Portal.

- All historical dealer color is also captured, and can be accessed through the platform.

#### **Investor module for portfolio surveillance and analytics**

The Structured Finance Portal is a web-based tool that offers data and analytics across all structured finance asset classes, with advanced reporting and time-saving data normalization and aggregation. It also provides cash flows, regulatory metrics, comparative analytics and data aggregation in one integrated platform (see Figure 9).

#### **Manager performance analytics**

- Track performance and style of CLO managers (see Figure 10).
- Access aggregated information (such as annualized default rate, par build and industry exposures) to determine a manager's style and trading behavior.
- Easily compare managers side-by-side to identify their strengths, weaknesses, performance and unique characteristics.

#### **Critical issuer analytics**

- Analyze issuer exposures across the CLO universe (see Figure 11).
- Quickly see deals and managers with the largest exposures to any issuer.
- Track and view all historical transactions of CLO assets alongside the daily pricing of assets.
- Gain a complete view of live loan pricing, purchases and sales by managers using advanced graphing capabilities layered with transactional data.

**Figure 9: Key features of the Structured Finance Portal**

Cash Flow Module	Monitoring Module	Regulatory Module
<ul style="list-style-type: none"> <li>» Cash Flow Engine</li> <li>» Loan-Level Data</li> <li>» Deal Libraries</li> <li>» Pricing</li> <li>» Credit Models</li> <li>» Macroeconomic Scenarios</li> </ul>	<ul style="list-style-type: none"> <li>» Manager Style &amp; Performance</li> <li>» Portfolio-Level Reporting</li> <li>» Benchmarking</li> <li>» Complete Asset Coverage</li> </ul>	<ul style="list-style-type: none"> <li>» Regulatory Metrics</li> <li>» OTTI, SSFA, ERBA, SEC-SA</li> <li>» IFRS9, SPPI</li> <li>» Advisory</li> <li>» Model Validation</li> </ul>

Source: Moody's Analytics

### Market color, benchmarking and valuations

- Users can benchmark their tranche with a scatter plot against its cohorts across any given performance metric, or see where a deal falls in the distribution.
- Project cash flows can be dynamically based on users' own assumptions or credit models from Moody's Analytics.
- Users can also obtain a comprehensive picture of a tranche's estimated value with a suite of analytics and comparative metrics.

### Loan-level data, including default probabilities and financial ratios

- Users can dive deeper into credit analysis using a suite of data on underlying loans.
- They can see which deals and managers are most exposed to a loan, and who has been trading it recently.
- Users can also get the history of Moody's Analytics EDFTM (Expected Default Frequency) measures for each issuer.

### Portfolio-level reporting and analytics

- Users can understand overall exposures with portfolio-level charts, graphs and reporting.
- They can project the estimated value of their portfolio all at once with dynamic, batch cash-flow analysis.
- They can determine factors including their most significant industry categories, most risky underlying loans, etc.

### Access up-to-date, estimated regulatory-based metrics

- SSFA, ERBA and SEC-SA6 capital charge calculations (point-in-time and forecasted).
- Stress testing calculations for CCAR/DFAST7 banks (point-in-time and forecasted).
- Other than temporary impairment (OTTI) calculations (point-in-time and forecasted).
- Solely payments of principal and interest (SPPI) test and IFRS 9 impairment and staging.

<sup>6</sup> Simplified supervisory formula approach; external ratings-based approach; securitization standardized approach

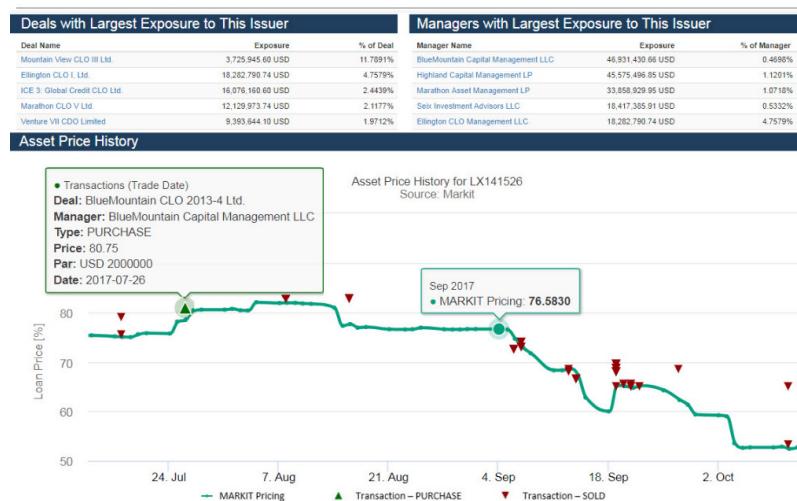
<sup>7</sup> Comprehensive Capital Analysis and Review; Dodd-Frank Act Stress Test

**Figure 10: Manager performance analytics – sample screen**



Source: Moody's Analytics

**Figure 11: Critical issuer analytics**



Source: Moody's Analytics

- Forecasted cash flows and metrics under selected scenarios.

### **Excel add-in**

- Enables users to call the most popular features of the cash-flow analytics engines straight from the cells of an Excel workbook.
- Uses Excel's in-cell formulas without the need for Visual Basic for Applications (VBA) code or advanced programming.
- Users can employ the report wizard to populate spreadsheets in a few steps with structured finance content and analytics.

### **Simplified analysis with the Deal Module**

- Users can import more than 100 metrics to gain information via visualization tools (see Figure 12).
- They can compare a specific deal against a vintage or a self-defined cohort to provide context for decision-making.
- They can also access standardized loan names/identifiers generated by advanced algorithms.
- Live loan pricing can be leveraged from multiple sources to calculate MV OCs and net asset values (NAVs).

- Users can analyze underlying exposures across deals and managers by generating an overlap matrix.
- They can also gain a granular level of understanding for common assets held by a multitude of deals and managers.

### **Risk, regulatory and evaluated pricing solutions**

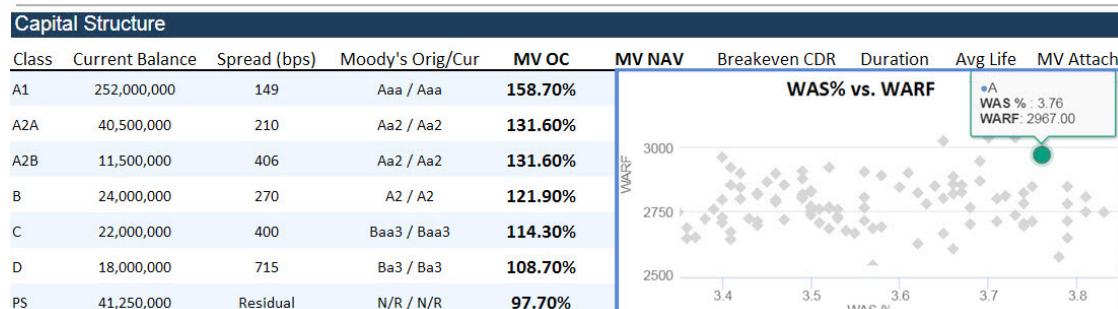
Users can leverage an end-to-end integration of the vendor's economic, credit and cash-flow models. They can:

- Analyze structured holdings as part of larger fixed-income platforms, by linking Moody's Analytics structured finance data, asset/liability cash flow, and analytics into third-party and in-house applications.
- Forecast and stress-test whole-loan and structured credit portfolios by running predefined or custom macroeconomic variables (such as interest rates, human poverty index (HPI), gross domestic product (GDP), and unemployment).
- Analyze portfolios of structured securities by creating static scenario forecasts of interest rates, prepayments, defaults, delinquencies and loan modifications.

**Figure 12: The Deal Module**

Overlap Matrix					
	Deal 1 / Manager A	Deal 2 / Manager B	Deal 3 / Manager C	Deal 4 / Manager D	Deal 5 / Manager D
Deal 1 / Manager A		18.83%	27.49%	20.53%	19.43%
Deal 2 / Manager B	18.83%		23.10%	18.16%	19.87%
Deal 3 / Manager C	27.49%	23.10%		23.17%	25.48%
Deal 4 / Manager D	20.53%	18.16%	23.17%		75.33%
Deal 5 / Manager D	19.43%	19.87%	25.48%	75.33%	

DEAL XV



Source: Moody's Analytics

- Analyze periodic default credit measures, forward-looking default probabilities and other risk metrics using credit/prepayment models from Moody's Analytics or a third-party.

Users can also perform advanced analytics on structured finance portfolios. They can:

- Instantly retrieve necessary regulatory and accounting metrics (such as estimated SFA, SSFA, RWA, OTTI/other comprehensive income (OCI), AP/DP, SPPI, and PD/loss given default (LGD)).
- Measure the impact on market and portfolio risk metrics such as option-adjusted spreads (OAS), duration, convexity, yield to maturity, and DV01 (see Figure 13).

### Regulator solution

The Moody's Analytics CLO Regulatory Module is designed to help banks and FIs meet their structured finance regulatory needs. Leveraging the vendor's proprietary credit model and cash-flow engine, it provides users with access to estimated regulatory metrics (such as risk weights and dynamic analytical capabilities) to run stress-testing scenarios. It can be customized by users so they can:

- Load several macro scenarios, run cash-flow analytics, conduct fair value analysis, and calculate estimated losses.
- View the regulatory impact of their CLO securities across multiple stress scenarios on a customized dashboard.
- Conduct exposure analysis and assess the impact of macro shocks.

**Figure 13: Portfolio analytics**

Accrued Interest	Asset Swap Spread	Average Life	Convexity (Par)	Convexity (Spot)	Current Yield
Discount Margin	Duration to Worst	Annualized Duration to Worst	DV01	Effective Duration (Par)	Effective Duration (Spot)
Local Duration	Macaulay Duration	Maturity Years	Modified Duration	Annualized Modified Duration	Nominal Spread
OAS	Spread Duration	Stated Maturity Years	Yield to Maturity	Annualized Yield to Maturity	Yield to Put
Yield to Option	Annualized Yield to Worst	Yield Value of 32nd	ZVO		

Users have the ability to retrieve market/portfolio risk metrics such as: OAS, duration, convexity, and others.

Source: Moody's Analytics

- Access back-testing analyses, view underlying analytic assumptions, and read white papers that provide model transparency.
- Benchmark variables against the structured finance universe.
- Enhance their platform with an engagement team and analytics support, to help provide a complete understanding of the models and outputs required for regulatory submission.

Users can employ one platform for all structured finance regulatory analyses. They can:

- Retrieve regulatory metrics without the need for numerous resources.
- Access point-in-time and forecast metrics, enabling them to view the estimated values for CCAR and DFAST scenarios, OTTI and SSFA.
- Access a full IFRS 9 accounting solution with SPPI test results for classification, and staging and ECL calculation for impairment.
- Access point-in-time metrics, enabling them to view the estimated values for Basel III risk weights under the ERBA and the SEC-SA.

### Evaluated pricing

The CLO Evaluated Pricing Solution provides customizable valuation tools for global structured finance securities and bank loans. The solution is designed to support various use cases ranging from day-to-day portfolio management to accounting and risk oversight, ensuring operational efficiencies by supporting access and integration or pricing data across various systems.

A customized solution is available to address many complex requirements that involve dynamic changes in CLO pricing assumptions, pricing scenario adjustments to account for challenges, and intra-day rate movement and granular cash-flow analysis. Users can:

- Securely upload portfolio pricing scenarios and recipes via a user-friendly interface.
- Apply historical and projected prepayment speeds and loss scenarios.
- Look up detailed terms and conditions, projected cash flows and performance for specific securities.
- Run on-demand analysis on individual securities and entire portfolios.
- Access governing documents and trustee reports.

Pricing evaluations are available at various frequencies during the day, via flexible delivery options such as data feeds, APIs and Excel add-ins. Users can:

- Schedule pricing runs on the vendor's hosted environments at different predetermined times.
- Automatically trigger pricing analysis based on certain specified conditions (such as changes in assumptions, bond factors and interest rates).
- Ensure the quality of evaluations through validation processes that monitor tolerance levels, price changes and data integrity.
- Receive pricing files through FTP feeds and email alerts once the files are ready.

#### ***Integration with third-party pricing providers***

- The Moody's Analytics API has been integrated with many specialized pricing, asset and liability management (ALM), trading and risk analytics providers in the fixed-income space. These partnerships have enabled market participants to access the vendor's CLO data, credit, cash-flow and pricing models for their pricing and risk analytics strategies, helping to ensure cost and operational efficiencies.
- The vendor's models provide users with a tool for generating prepayment, default and loss forecasts for loans, pools and securities across a wide range of asset classes. These can be vital

inputs into pricing, risk management, accounting and regulatory reporting.

## 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 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 given 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 Chartis 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 or not 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.

### Selection criteria

The CLO vendor market is highly specialized, containing several distinct vendors with mature

offerings. Some vendors offer components of CLO solution functionality, an aspect of the market reflected in the cluster of vendors in the point solutions category. In selecting vendors we assessed their core pricing engines, collateral data analytics and data infrastructures, and the surrounding analytics – including CPM support and performance analytics – that enable users to track the performance of their CLOs and manage their portfolios.

By assessing the CLO vendor landscape as a defined separate area of credit risk calculations, we were able to adequately highlight the distinct methodological processes entailed in CLO solutions. The analytics used in traded credit markets are progressively becoming differentiating factors, making it essential to assess the various markets independently.

### Briefing process

We conducted face-to-face and/or web-based briefings with each vendor<sup>8</sup>. During these sessions, Chartis experts asked in-depth, challenging questions to establish the real strengths and weaknesses of each vendor. Vendors provided 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 used 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 CLO solutions are shown in Table 5.

<sup>8</sup> 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.

**Table 5: Evaluation criteria for Chartis' CLO solutions quadrant**

Completeness of offering	Market potential
<ul style="list-style-type: none"> <li>• Collateral data analytics</li> <li>• Pricing engine</li> <li>• Data infrastructure</li> <li>• CPM support</li> <li>• Performance analytics</li> <li>• Reporting and visualization</li> </ul>	<ul style="list-style-type: none"> <li>• Customer satisfaction</li> <li>• Market penetration</li> <li>• Growth strategy</li> <li>• Financials</li> <li>• Business model</li> </ul>

Source: Chartis Research

### Completeness of offering

- **Depth of functionality.** The level of sophistication and amount 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 those firms that achieve an appropriate balance between sophistication and user-friendliness. In addition, functionality linking risk to performance is given a positive score.

- **Breadth of functionality.** The spectrum of requirements covered as part of an enterprise risk management system. This will vary for each subject area, but special attention will be 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 to be 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.

### 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 particular 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 BI.
- A key differentiator in this category is the openness and flexibility of the technology architecture and a 'toolkit' approach to risk

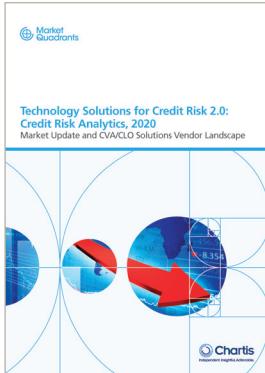
analytics and reporting, which attracts larger clients.

- 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.

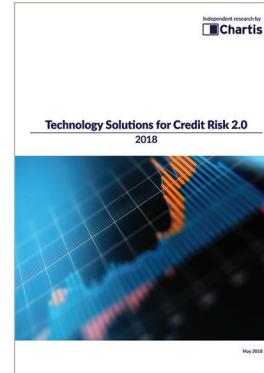
## 5. Further reading



**Technology Solutions for Credit Risk 2.0: Credit Risk Analytics, 2020**



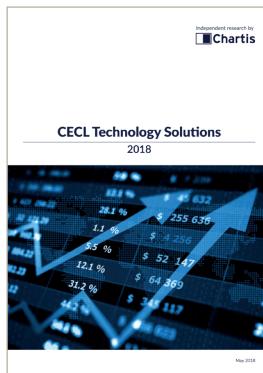
**Technology Solutions for Credit Risk 2.0: Vendor Landscape, 2019**



**Technology Solutions for Credit Risk 2.0, 2018**



**IFRS 9 Technology Solutions: Market Update 2017**



**CECL Technology Solutions, 2018**



**Fixed-Income Technology Solutions, 2019: Market and Vendor Landscape**

For all these reports, see [www.chartis-research.com](http://www.chartis-research.com)