



CBX[™]MARKET

THE 2019 FIXED INCOME TECHNOLOGY LANDSCAPE

CBX Perspectives

In today's operating environment, asset managers have begun to rethink how they utilize technology due to a confluence of factors. The complexity of fixed income market structures, compressed margins, and increased regulation have all been catalysts for technology adoption and operational change. Any one of these factors can be detrimental for the investment operations of an asset manager... combined, they strain capacity and cut into the profit margins of the business.

The fixed income markets have not kept up with the rapid rate of technological advancement that can be observed across other asset classes. However, that does not mean bond investors aren't looking to innovate.

Fixed income managers face a unique set of technology challenges. Pain points range from data management and portfolio reporting to compliance, middle and back office operations, trade reconciliations, and many more. A good number of these challenges can be overcome with the appropriate technology applications and systems.

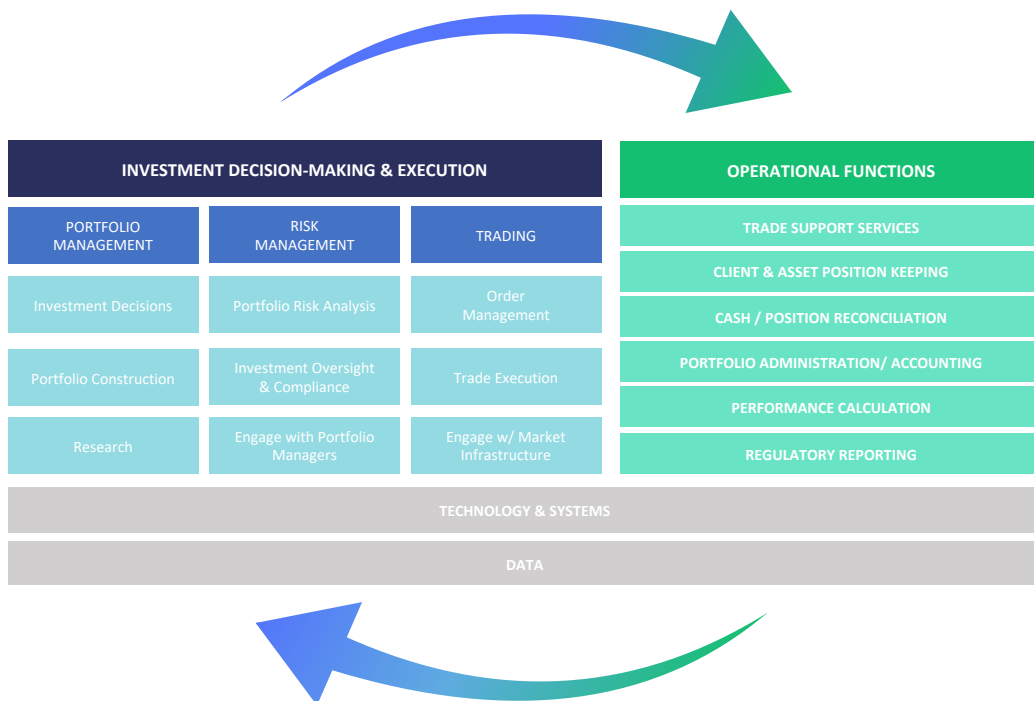
Of the more than 500 investment executives surveyed in [State Street's 2018 "New Routes to Growth"](#) survey, respondents identified emerging technologies as the leading opportunity to grow revenue. Fixed income asset managers can change technology from a headwind to a competitive advantage when it is utilized effectively to improve processes, increase transparency and address the operational burden of regulatory changes.

While fixed income asset managers have a diverse set of investment processes and objectives, the common denominator among all managers lies in their need to leverage technology due to the ever-changing operating requirements of the markets. Bond managers have come to rely upon third party solutions as a cost-effective means of maintaining best-in-class systems, in lieu of building these tools in house. Managers can choose between a front-to-back system which consolidates applications across a single platform or implement a combination of best-of-breed tools where a firm identifies and integrates the applications believed to be best suited for their investment processes.

Understanding the Options: Investment Processes vs. Operational Procedures

The range of tools available in today's market reflects the increased diversity of operations among fixed income managers. To fully understand the role that technology plays in the asset management lifecycle, it is helpful to categorize the technology functions under two universes: **investment decision-making & execution** and **operational functions**, although both are intertwined throughout the portfolio lifecycle. Nonetheless, investment processes and operational procedures can vary significantly from one asset manager to another.

An Asset Manager's Technology System



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While structure and setup of investment decision-making and execution functions may differ between firms, asset managers all conduct elements of portfolio management, risk management and trading. Portfolio managers make investment decisions in order to meet performance objectives while

operating within a set of portfolio objectives and constraints. Investors rely heavily on data, risk models and analytics to inform their investment decision processes. While many asset managers develop risk models and analytical measures internally, it is commonplace for PMs to turn to vendors to provide tools and technology solutions for enhanced reporting and transparency to inform their portfolio management processes.

Beyond portfolio management, many fixed income units have a risk management arm that is separate from portfolio managers. Risk managers work closely with PMs to ensure that portfolios are being managed in accordance to set guidelines and various risk parameters. Risk managers also need accurate pricing and security data along with complex models to fulfill their responsibilities.

The third arm of the investment decision-making domain is trading. Trading involves the generation of orders, primarily processed via an order management system ("OMS"), and the execution of those orders with market participants. This is an area that is ripe for technological change as 80% of US Corporate fixed income trades by notional value were executed telephonically [as of 2017](#).

While investment decision-making and execution are the primary front-office functions of the asset management firm, middle- and back-office roles are equally as important. After a trader says "Done", there are a myriad of processes to be completed across the compliance, accounting and investor relations teams. Trades need to be settled, cash must be properly tracked and moved and systems require regular reconciliation to ensure reporting is in line with the firm's IBOR ("investment book of records") where all transactions are recorded and reconciled.

Operational functions of the asset manager can be tedious, manual processes if they are not technology-enabled. Given that middle- and back-office functions are so resource intensive, some asset managers have decided to fully or partially outsource those laborious functions to a number of different vendors.

Data is fundamental to facilitating every action that asset managers perform from portfolio management to operational functions such as settling trades, recordkeeping and compliance. Investors require a large array of data on a

daily or intra-daily basis, requiring them to purchase feeds from multiple vendors. These systems allow PM's to codify and process millions of data points for evaluating investment opportunities, modeling trades and benchmarking historical performance.

Historically, asset managers relied on internally-developed technology solutions in concert with manually maintained spreadsheets. As the fixed income landscape has changed, the effort to ingest, validate and process data has increased significantly, leading many fixed income asset managers to look for more sophisticated data management solutions.

While deploying a combination of third party and internally built systems and tools have become commonplace for asset managers, the surplus of traditional and alternative data sources can overwhelm a fixed income desk.

Assessing Your Technology Stack

Investors can generally take one of two approaches in building out their technology systems, front-to-back systems and best-of-breed applications or tools. Asset managers need to consider whether they want an all-in-one package that will provide straight-through-processing for front, middle and back office functions, or are looking for best-of-breed applications to facilitate the separate elements of the investment process.

There are many front-to-back systems that exist for investors to choose. A prime example comes from Bloomberg. The Bloomberg Terminal provides users with security and market data, risk models and analytics, an order management system, an execution management system and trade confirmations. Bloomberg's system excels in certain areas such as market data but falls short when it comes to operational functions. Beyond functionality, a system like the Bloomberg Terminal will cost an investor over \$20K per terminal per year while also locking users into a multi-year contract. EZE is another vendor that offers front-to-back tools; the vendor provides a suite of applications for different functions of the investment management lifecycle.

Front-to-back systems carry the main advantage of being integrated systems that have several applications interfacing seamlessly with one another across

the front, middle and back office. Front-to-back systems also reduce technology risk, including issues such as implementation time and budget overrun. Managers appreciate the simplicity of maintaining a single supplier relationship relative to managing connectivity with several vendors. Front, back and middle offices can share a single database creating an easy and efficient flow of data between business groups.

While an integrated front-to-back office system offers significant advantages in terms of a simplified technology infrastructure and straight-through-processing, the main drawback is that front-to-back systems often come at the expense of limited functionality. Rather than doing everything very well, users tend to find front-to-back systems perform their functions at a satisfactory level but not as efficiently or proficiently as it could be done.

Investors can alternatively build a best-of-breed system by customizing a suite of the strongest applications they need to facilitate their unique investment processes. The number of best-of-breed tools greatly outnumbers the amount of front-to-back-systems. Tools such as Blackrock Aladdin, Market Axess and Simcorp IBOR are examples of the types of tools investors will use concurrently. Blackrock Aladdin works as a tool for an order management system amongst other things. Market Axess is an execution management system in which investors can trade electronically. Simcorp IBOR streamlines and easily maintains compliance and accounting functions. Used together, these tools offer the asset manager the ability to effectively handle the entire investment lifecycle.

Best-of-breed tools are generally more user-friendly and perform specialized functions better than the comparable solution in a front-to-back system. However, these systems are typically limited by an application's ability to connect and interact with systems and tools from other vendors. Maintaining multiple systems provides limited out-of-the-box cross connectivity, which creates maintenance and integration challenges. Information technology teams (IT) and investment operation resources are required to maintain these points of connectivity and overcome the challenge of integrating tools and systems. As an organization expands and requirements multiply, best-of-breed systems may not be able to handle new requirements, forcing the addition of another system or tool.

Third Party Vendors to Asset Managers – Data and Systems

	DATA		SYSTEMS			
	SECURITY & PRICING DATA	MARKET INDICES	RISK MODELS & ANALYTICS	ORDER MANAGEMENT SYSTEMS	TRADE EXECUTION SYSTEMS	ACCOUNTING SYSTEMS
BlackRock			X	X		
Bloomberg	X	X	X	X	X	
CBXmarket	X	X	X	X	X	
Charles River				X	X	
Clearwater Analytics			X			X
Eagle Investment Systems (BNY Melon)						X
Eze Software Group				X	X	X
FactSet			X		X	
Fidessa				X		
FIS (FKA SunGard)			X	X		X
Fitch Ratings	X		X			
Flextrade					X	
IHS Markit	X	X	X	X	X	
Intercontinental Exchange	X					
ITG					X	
Linedata				X	X	X
MarketAxess					X	
Moody's Analytics	X		X			
PAM (State Street)						X
S&P Dow Jones	X	X	X			
Simcorp				X		X
SS&C Technologies			X	X		X
Thomson Reuters	X				X	
Tradeweb					X	

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Evaluating Options

Many things need to happen before deciding whether to employ a front-to-back system or a best-of-breed solution. Choosing the best option for your firm requires senior managers and stakeholders to conduct a thorough operational review of the business. This includes defining the system requirements to facilitate the investment process; considering the capabilities and limitations of the IT organizations; and conferring with personnel in the front, middle and back office to understand available support resources.

Beyond these preliminary steps, firms should develop a long-term technology strategy that has buy-in across the organization before evaluating different options to pursue. Only once the strategy is formed and buy-in is

fostered is the organization properly armed to evaluate whether a front-to-back or best-of-breed solution is best for them. Considering the pros and cons to each approach, it is even more important for managers to involve their entire organization in the decision-making process.

If a firm does decide to employ a best-of-breed strategy, they will need to focus on how the tools work together to create an efficient ecosystem. The ability to create a functional ecosystem is essential for success because workarounds or connectivity limitations will undermine the effectiveness of any single tool, inevitably resulting in more manual processes or redundancies. The table below illustrates that while there are many technology vendors, there isn't one that does everything that is needed in the fixed income lifecycle.

Emerging Technologies: The Future of Fixed Income

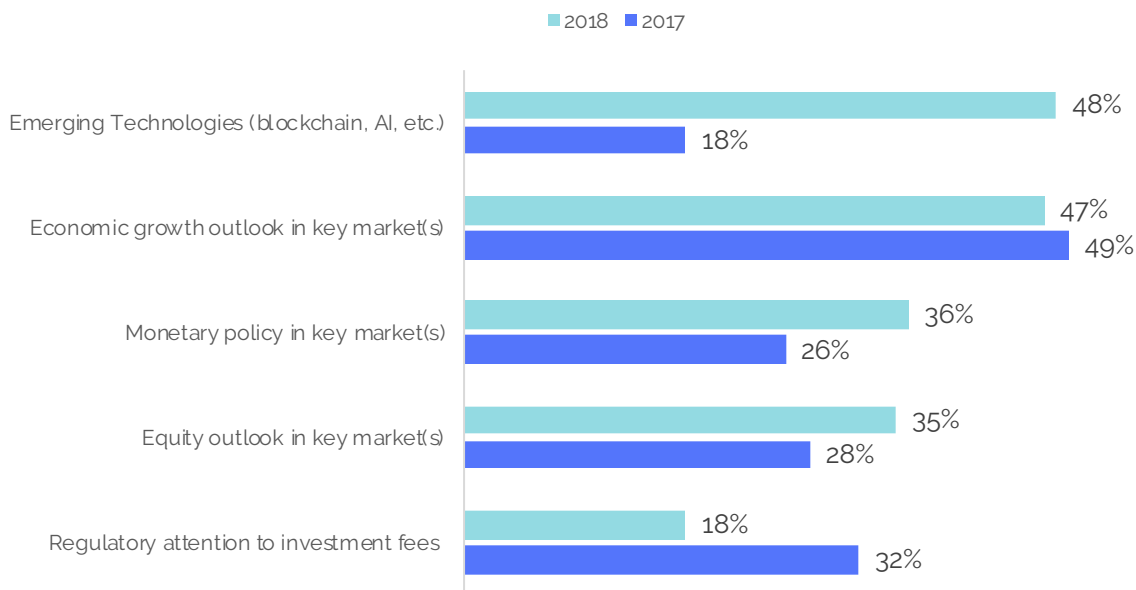
As mentioned earlier, around [80% of all US corporate bond](#) volume (based on dollar amount) is still traded telephonically, while 90% of all US equities volume (based on dollar amount) is traded electronically. This disparity is quite shocking on the surface, but when you look under the hood of the two markets one can understand why this is the case. Equity markets are much simpler than fixed income markets. While a company such as Ford has a single equity ticker, it has 17 different bonds outstanding with varying price levels and liquidity. Equities typically trade over an exchange while bonds trade over-the-counter, meaning liquidity is much more visible for equities compared to debt. Additionally, the bond market is less transparent in pricing and trades less frequently than equity markets.

In 2017, the total US stock market dollar volume was [roughly \\$98T](#) while the US Corporate and Municipal Bond market trading volume in 2017 [totaled ~\\$15T](#). The simplicity of equities and the size of the market led to a technological leap forward that fixed income has yet to experience. However, automation and artificial intelligence can help solve many of the operating inefficiencies of fixed income markets beyond trading telephonically. They can resolve many of the problems that are detrimental to settlement, market data, reconciliation and other crucial functions in the fixed income markets.

Between 1996 and 2017, the amount outstanding in fixed income markets has [grown nearly 400%](#) from \$11T to \$41T. The growth of fixed income markets begets technological change in the space, and blockchain, automation and AI have the potential to create massive change for the marketplace.

The transition from idea generation to trade execution in fixed income is still very inefficient. The analyst provides fundamental and quantitative research, screens, then filters investment ideas. The portfolio manager then has a discussion with the analyst, chooses bonds and manually builds the order. The trader then goes to market to execute the trade, with no guarantee that the liquidity exists for the bonds chosen. This process can take anywhere from one day if things run smoothly to multiple weeks if there are speed bumps along the way. In fixed income trading, timing is everything, particularly when yields and liquidity are not at their peaks.

[Factors Cited as Greatest Opportunity for Growth Over the Next 5 Years](#)



Emerging technologies will enable efficiencies to be realized that allow bond managers to transform the state of their investment operations. Historically siloed functions—fundamental research, quantitative research and liquidity analysis—can all happen in tandem via technological systems, namely a

decision enhancement tool that can filter through bonds and provide the portfolio manager with a list of viable investment options. The portfolio manager decides which bonds are the most attractive and then the trader can execute the trade with more insights around where he or she can find liquidity across the broadest swath of the market.

Automation will play a key role in improving a multitude of processes in the fixed income lifecycle. Robotic Process Automation ("RPA") essentially takes the robot out of the human. The average knowledge worker employed on a middle- and back-office process has a lot of repetitive, routine tasks. RPA is a type of software that mimics the activity of an individual in carrying out a task within a process. It can do repetitive tasks more quickly, accurately and tirelessly than humans, freeing workers to do other tasks requiring human strengths such as emotional intelligence, reasoning, judgment and interaction with the colleagues and customers. There are three main areas where RPA can play a key role in fixed income.

The first is trade processing: Using RPA to help with trade processing automates exception handling to create and send intelligent alerts based on certain exception criteria. It also eliminates the need to manually upload data files to back-office systems since systems interact with one another. RPA also improves process quality and transaction processing volume by reducing the potential for human error.

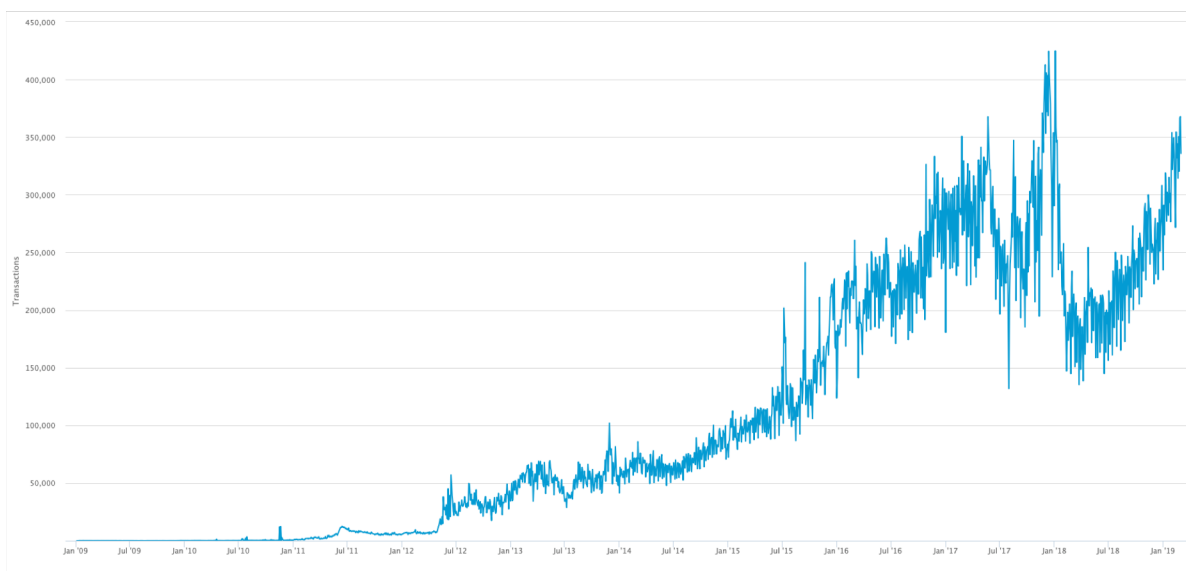
RPA can also add value with reconciliation. Automated systems can help retrieve data in numerous forms from external parties and internal accounting and recordkeeping systems. Tools can format the information, compare data sets and—based on defined rules—make corrections and adjustments. RPA can eliminate time-consuming reconciliation performed manually with spreadsheets. "Compared to human effort, [RPA can retrieve and prepare data sets](#) in many different formats from external parties and compare based on predefined rules."

The third is fund administration. Validation checks can be automated across multiple segments of the financial reporting process where the reporting is repetitive and rules-based. Eliminating the risk of human error from financial reporting would enhance operational efficiency and reduce overhead for bond asset managers.

In 2018, State Street published a survey of 500 investment executives following a 2-year study to identify growth drivers for the industry. They found that emerging technologies such as blockchain and AI were believed to be the leading opportunity for growth of their businesses over the next 5 years. Most shocking was the increase between 2017 and 2018, where this statistic [jumped from only 18% to 48%](#) of the surveyed population.

There are many emerging companies, and innovation teams at large financial institutions, working on developing applications using these technologies to address many of the structural issues that have plagued the fixed income markets. AI, machine learning and blockchain stand to create ground-shifting change across such verticals as securities origination and distribution, clearance and settlement processes, credit underwriting and trade finance.

[Confirmed Blockchain Transactions Per Day](#)



Clearing and settlement of securities transactions have perennially hampered the middle- and back-office operations of broker dealers and asset managers. The fact that the normal corporate bond takes two days to settle has a lot to do with how our financial infrastructure was built. Today, a simple bank transfer—from one account to another—has to bypass a complicated system of intermediaries, from correspondent banks to custodial services, before it can be accounted for on the records of an investor. Counterparties' bank balances must be reconciled across a global financial system, comprising traders, funds, asset managers and more.

Distributed ledger technology could enable transactions to be settled directly and provide more effective chain of custody reporting relative to existing protocols, like SWIFT. Rather than using SWIFT to reconcile each financial institution's ledger, an interbank blockchain could provide a single source of truth for transaction records. This means that instead of having to rely on a network of custodial services and correspondent banks, transactions could be settled directly among counterparties. Blockchain and distributed ledger technology also allows for transactions to clear and settle when a payment is made. This stands in contrast to current banking systems, which clear and settle days after a transaction occurred.

The future of technology will cut out middle men and shorten transaction times, clearing the way for asset managers to offload busywork and focus on expending human capital where needed.

Implementing a Solution

As discussed throughout this piece, the changing regulatory environment and increased competition among investors have altered the operating landscape for bond managers. The compression of margins and increased appetite for alpha have led many asset managers to revisit not only their investment strategies, but also how their organizations utilize technology.

Technology, despite being slowly adopted by fixed income managers, has the unique ability to help an organization reach its potential. With more data to ingest than ever before, the task of collecting it, performing calculations and gleaning insights can quickly become an organizational headwind if not appropriately managed. Turning a technological weakness into a strength requires business leaders to take a consultative approach to determine the best solution for their organization. Many tools today are built both with functionality and usability in mind, the latter being often overlooked in the past.

The efficacy of a solution is only maximized when there are high utilization rates. Spec'ing out automation and workflows needs to be coupled with a strategic approach to managing the implementation. Asset managers require a high-touch and custom implementation process that will complement their investment processes. Key stakeholders and all users across the organization

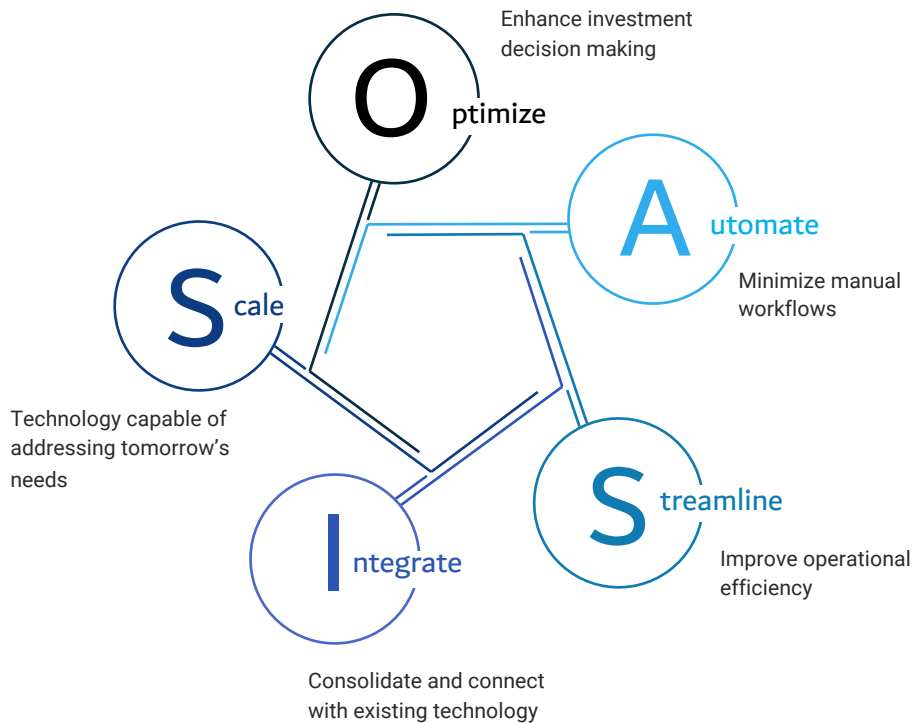
need to buy into and understand the value of the transformation process. The CBXmarket team works very closely with customers to ensure that the entire process is managed for success.

CBXmarket was founded to address some of the systemic issues that we observed through years working in the technology industry. At CBXmarket, we take a thoughtful approach to implementations, working with clients as partners, and developing process automations to accommodate the unique needs of investment organizations. CBXmarket's OASIS system was developed as a best-of-breed portfolio management solution to address many of the challenges fixed income investors face today that were discussed in prior sections. The platform addresses many of the nuanced business requirements of bond managers.

Powered by a comprehensive bond market database, process automation and portfolio optimization capabilities simplify investment decisions and support higher touch client engagement. OASIS empowers investors to proactively monitor client accounts, automatically construct and rebalance portfolios and ensure adherence to client- or strategy-specific guidelines. The system helps streamline time-intensive investment management and related processes from pro-forma trade analysis to scenario analysis across a plethora of portfolios at once.

The system includes tools to support risk and compliance teams and provide PMs with a solution for portfolio rebalancing and performance reporting. With OASIS you can enhance investment decision-making, minimize manual workflows, improve operational efficiency, consolidate and connect with existing technology. OASIS is unique in that our team is constantly developing and deploying new tools and features on the platform to ensure that users will always benefit from the latest innovations to support their portfolio management operations.

OASIS Defined



CBXmarket's OASIS connects with custodians' systems for automatic daily portfolio updates, so maintaining connectivity between the separate applications deployed in best-of-breed strategies will no longer be a headwind for asset managers.

OASIS also has a world-class optimizer to ensure a list of bonds generated will be ideally suited to your portfolio needs. The optimizer utilizes machine learning and employs proprietary algorithms to recommend transactions for your portfolio like maximizing yield or to minimizing duration. OASIS enables the user to send the suggested transactions from the optimized portfolio to its state-of-the-art trade blotter and order management system. OASIS provides seamless connectivity with your external EMS so your traders won't have to enter the same thing into two systems. This reduces a redundancy, providing a more efficient solution for traders to manage execution.

A survey of 500 investment executives in State Street's 2018 "[New Routes to Growth](#)" survey, concluded that the top two challenges faced were integrating new technologies with existing infrastructure and processes & lack of expertise to manage the implementation process across the organization.

CBXmarket's team has expertise deploying complex systems across some of the largest Fortune 500 companies, accounting for not only system design but also organizational buy-in and knowledge transfer.

CBXmarket works intimately with its clients to ensure the roll-out across the organization goes smoothly and seamlessly. Our unique implementation model breeds user engagement and buy-in from an early stage. CBXmarket not only blends a collaborative approach to implementation alongside an emphasis on technology & development, but also works to build an ongoing partnership with your company.

As technology continues shifting towards a streamlined future, AI and automation will play integral roles in alleviating the pain points of inefficient manual processes. A best-of-breed system can give your team a customized upper hand in realizing long-term strategic goals. With OASIS at the forefront of portfolio optimization solutions, CBXmarket offers solutions that enable you navigate hurdles and maximize your firm's potential in the digital age.

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