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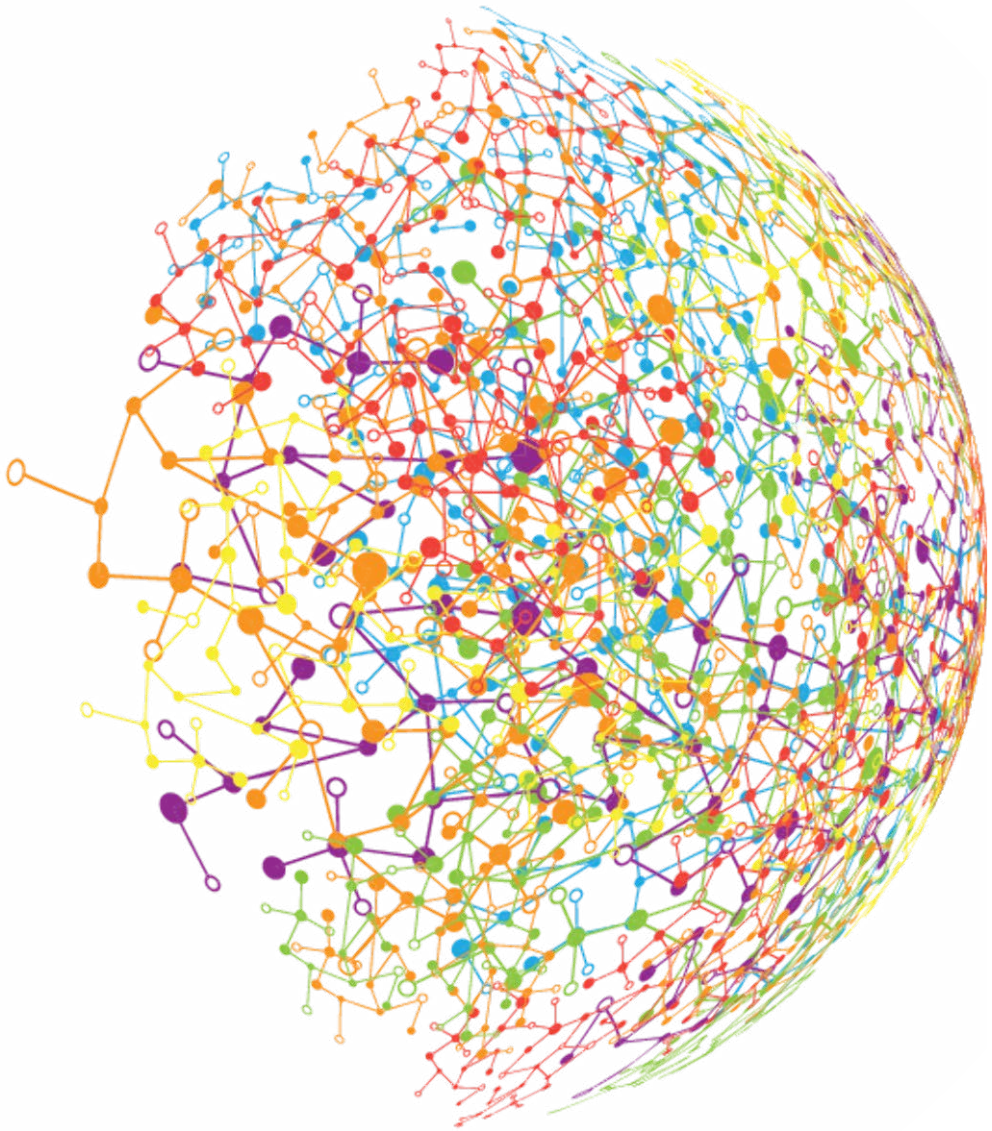


Asset Management Disrupted

Unlocking the Potential of Artificial Intelligence in Fixed Income Investing

Abstract

Like few other technologies, artificial intelligence (AI) has the potential to fundamentally transform virtually any industry. The fixed income asset management sector has not yet, however, fully embraced AI and many sector players have failed to recognize the potential of intelligent solutions.

Three major challenges – low interest rates, exponential growth in data volumes, and increasing regulatory requirements – are driving asset managers to develop new technology-based solutions inside and outside their core business. At the same time, technological progress offers a unique opportunity to solve these challenges.

Given these underlying conditions, we have developed three use cases to serve as examples of how AI-enabled technology can solve the challenges of today. Firms may find it beneficial to market those use cases to third parties, rather than exclusively implementing them in-house, due to the nature of AI, the high upfront investment, and certain strategic considerations.

Introduction

AI has created a lasting impact on the financial industry over the past decade. In particular, AI-based solutions like chatbots have revolutionized customer interactions. Especially in the B2C sector, Fintech startups offer the end-user a wide range of robo-advisor services to make AI-based investment decisions. However, the B2B markets, in particular fixed income asset management, have yet to catch up – manual processes based on human interactions and traditional data processing are still the status quo. We have identified three major challenges that are further impeding progress.

First, the persistently low interest rates that were imposed to stabilize the economy after the financial crisis have led to falling margins and forced asset managers to search for potentially higher yields by allocating funds to alternative asset types. Moreover, thanks to a steady drop in management fees for mutual funds, the potential revenues for asset managers have fallen and cost pressures have risen even further. Second, an exponential growth in data volume is raising costs for asset managers, as legacy data management systems and analysis tools simply cannot cope with the extensive processing this data requires. Third, regulatory requirements are increasing. Regulators were determined to make the fixed income market more transparent in the aftermath of the financial crisis. As a result, banks and brokers have taken on the role of intermediaries between bond buyers and sellers.

However, recent technological advances provide the toolset to address the described challenges. In particular, advances in Natural Language Processing, the connection of domain knowledge, and "white-boxing" of intransparent machine learning algorithms increase the viability of AI applications. By using AI to process data, asset managers can carry out deeper and more comprehensive analyses, creating a significant competitive advantage. It is easy to identify the repetitive, standardized tasks and learning processes in fixed income investment management that act as basic levers for disruption. Building on the increasing availability of data and technological innovations, we have developed three use cases in this study to show how AI-based solutions can address some of today's key challenges.

AI applications in the asset management space are cost center-oriented – in-house tasks such as credit risk analysis and research are automated. However, creating a new profit center by offering these applications as a service to competitors could be highly beneficial for three reasons. First, AI-based solutions learn at a much faster pace if additional user data is available to train the models. Second, harnessing new direct revenue streams help to stem the required investments to develop sophisticated technology. Third, companies that persuade competitors to become their customers create a long-term strategic advantage. We will describe how new technological solutions in this field can be built as external businesses.

Challenges

Increasing cost pressure and decreasing profit margins have forced asset managers to rethink their traditional approach to the business of investment management. In numerous interviews we conducted with executives of several large German asset management firms, the findings support our hypothesis that fixed income asset management needs to catch up. In particular, we identified three main challenges: The low interest rate environment, exponential growth in data, and increasing regulation.

Low interest rate environment

In order to revive the economy after the financial crisis, central banks around the world gradually lowered interest rates until the euro zone reached a record low of zero percent in March 2016. This prolonged low interest rate environment in conjunction with bond-purchasing programs as part of quantitative easing have depressed yields for the fixed income portion of investment portfolios. Consequently, asset managers have been pressured to search for potentially higher yields by allocating funds to alternative asset types.

Although many central banks were hinting at a "soft turnaround", interest rates are still historically low, with recent announcements of ECB and FED reinforcing the downside trend. Cyclical contraction in interest rates has been the rule since the early 1980s, driving a steady rise in fixed income prices and yielding substantial gains for investors. After narrowing to the lowest possible interest rate levels, however, fixed income portfolios are more likely to start recording losses. Likewise, it will be an even tougher challenge for active managers to explore alpha going forward.

Low interest rates naturally affect profitability, making them a major concern for fixed income asset managers. And yet, there are ways to counteract plummeting margins and rising cost pressure. In our use cases, we will show how AI can help optimize the relationship between research and portfolio management to generate a higher alpha for clients – and ultimately gain a leading edge in the highly competitive asset management market.

Exponential data growth

The exponential growth of data is one of the main drivers of AI maturity. While there is no doubt that Big Data offers enormous potential in many use cases, dealing with the ever-growing masses of available data also presents a serious problem for most industries, including asset management.

90 percent of data worldwide was generated within the last two years alone.[1] Capturing these data flows and analyzing them to exploit their upside potential requires capabilities that are simply not offered by status quo data management systems and analytical tools. Our interviewees confirm that they would particularly benefit from access to data that is as up-to-date as possible.

By using AI to handle what seems like an explosion of data, asset managers can conduct deeper and richer analyses and gain a crucial competitive edge.

While the volume, speed, and scope of data is increasing, a shift in the significance of data sources can be observed. Asset managers have traditionally based their investment models on official sources with primarily quantitative information, such as corporate filings. The growing volume of data from a growing variety of sources, however, has given unconventional sources such as social media, blogs, press releases, or product reviews an increasingly important role. Users can realize the upside potential by gaining information advantages, making better investment decisions, and ultimately generating higher returns at times of low interest rates. That said, with mostly qualitative information coming from non-traditional sources, it poses an even greater challenge to process this data without sophisticated technology.

Increasing regulation

Ever since the 2008 financial crisis, asset managers have been operating in an increasingly complex and challenging environment. Regulators worldwide have implemented restrictive regulations and increasing scrutiny onto the asset management industry in an effort to promote financial market integrity and reduce the risk for investors.

The responses of the executives we surveyed suggest that the expanding regulatory framework is one of the bigger challenges the industry is facing.

The CRA III Regulation in particular impacted fixed income operations of asset management companies at the European level. After the major credit rating agencies were implicated in the financial meltdown and subsequent worldwide debt crisis, the EU passed the directive in an attempt to prevent over-reliance on external ratings. It requires asset managers to assess in-house the credit risk of externally-rated assets using plausibility checks.

To comply with these regulatory requirements, firms are under pressure to hire additional credit analysts, which, as our interviewees confirm, inevitably leads to higher personnel and overall expenses. The process then becomes even more complex and exerts further downward pressure on the industry's already declining margins. In one of our deep dives in the following use cases, we will point out how firms can leverage automation in general and AI in particular to master the regulatory challenges associated with CRA lll.

[1] https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#357b768260ba

Technology overview

General introduction

Artificial Intelligence (AI) is an area of computer science focused on the design of intelligent machines that perceive their environment and take autonomous decisions and actions to maximize the chance of reaching their goals. AI models are capable of interactions that traditionally required human intelligence, most importantly reasoning from partial or uncertain information. AI is typically trained to suit a specific application and can thus take different forms.

The framework used to train AI models and the key AI technology is machine learning (ML). ML refers to the ability of statistical models to develop capabilities and improve their performance on a given task over time – without the need to follow explicitly programmed instructions to do so. ML technologies are iterative in nature, i.e. they progressively improve in performance on a particular task through data analysis.

Today's ML techniques and AI applications are having a sustained impact on virtually every sector. The research currently being conducted in this area focuses primarily on reducing training effort and making models more robust, safe, and transparent. Other ML research initiatives are centered on finding the ideal combination of human and machine intelligence.

Technology trends

Thanks to four key technological trends in AI (see Figure 1 for an overview), players in the industry have the opportunity to reinvent their business and to overcome present challenges.

Fig. 1 – Overview technology trends

Technology trends	Description
Natural Language Processing	Natural Language Processing (NLP) describes the technology to analyze and understand natural language. NLP thus provides a basis to capture, process and structure textual data for its application within ML models.
Domain-enriched machine learning	In highly complex domains such as financial markets human domain knowledge or expert knowledge improve the learning process of ML technologies.
Connection of knowledge	Knowledge graphs use data from different sources to create a network that comprises entities, their semantic types, properties, and the relationships between entities.
"White-boxing" machine learning models	The transparency and interpretability of algorithms is key, mainly due to regulatory demands and a desire to inspire trust in the ML models among human users. Recent research provides methods designed to "white-box" complex ML models.

Advances in NLP
Natural Language Processing (NLP) is a special application of AI designed to analyze and understand natural language. NLP thus provides a basis for the capture, presentation, and reproduction of spoken and written language.

Language analysis requires a system to not only understand individual words and sentences, but also contexts and meanings. The complexity and ambiguity of human language pose a particular challenge. In order to improve language comprehension, systems must first collect and categorize large amounts of data using ML and Big Data tools.

Advances in NLP allow asset managers to capture and process textual data sources with a new degree of automation, leveraging information that has yet to become established.

Domain-enriched machine learning
ML technologies can rely on either automatic or interactive learning processes. While fully automated ML solutions achieve impressive results in many domains, it can be beneficial to rely on human domain knowledge or expert knowledge in highly complex domains such as financial markets. Here, expert knowledge is typically the most relevant information for inductive learning performance, outweighing all other differences between learning algorithms. Models can incorporate professional expertise specifically via domain knowledge on fixed income investments or on the data representation used. When it comes to interpreting complex patterns or making instinctive decisions in general, however, experts are clearly superior to ML solutions.

Text-based information obtained through NLP can be used in addition to expert knowledge to improve AI-based technologies in complex domains. ML technologies can be improved upon if models rely on data taken not only from historic data sets, but also combined with specific domain knowledge and structure. This enables domain-enriched ML algorithms to adapt to industry-specific needs and produce more accurate predictive analyses.

Connection of knowledge
ML-based solutions reveal their inherent limitations in particular where the available data is too limited or too complex. Knowledge graphs, which use data from different sources and represent relationships between these data, are useful in these cases. These diagrams are essentially large networks that comprise entities, their semantic types, properties, and relationships between entities. As the availability of large-scale event data increases, novel insights with knowledge graphs that contain temporal, dynamically-evolving information can be generated. Using NLP at an industrial scale requires an efficient, high-quality knowledge graph for tasks such as entity resolution and reasoning.

By connecting data, knowledge graphs can mimic human abilities to understand meanings from context and produce results with AI solutions that were previously unthinkable. This is a huge support for human intelligence, particularly for complex tasks in financial services.

With the ability to capture semantic data, NLP expedites the in-depth understanding of fixed income concepts. Advanced and dynamically-evolving knowledge graphs allow to assess industry-specific knowledge bases and gain innovative insights to meet the evolving requirements of dynamic ML applications.

Advances in "white-boxing" machine learning models

Implementing ML algorithms in financial institutions is a staggering task. Due to regulatory demands and a drive to inspire public trust in ML models, the transparency and interpretability of algorithms is key. ML is typically described as a black-box approach, meaning it is difficult to track its processing and identify how particular features impact the model output. Any institution that must comply with regulatory requirements must therefore limit its use of ML to transparent methodologies, e.g. simple logistic regression models.

Recent research has revealed methods to open the black-box of ML algorithms in order to increase acceptance among users of complex ML models and to meet the demands of the regulator in the area of asset management. New "white-boxed" ML algorithms identify shortcomings of existing approaches and improve forecasting while also maintaining transparency in the calculation methods.

Use cases

Fig. 2 – Use cases and relevant technology trends

Automated credit scoring

- Natural Language Processing
- Domain-enriched machine learning
- Connection of knowledge
- "White-boxing" machine learning models

Self-driving portfolio optimization

- Domain-enriched machine learning
- Connection of knowledge

Smart search engine

- Natural Language Processing
- Connection of knowledge

Automated credit scoring

The single most important factor for return on fixed income assets is their default risk. Traditionally, asset managers have relied on rating agencies to determine the creditworthiness of companies and other bond issuers. The changes that were introduced into the regulatory landscape after the financial crisis, in particular the implementation of the CRA III, have forced more and more asset managers to assess credit risks in-house. These assessments become even more important, in particular because rating agencies use historical data for credit ratings. As a result, firms have an opportunity to arbitrage predictive information.

Asset managers who perform these assessments in-house do so mainly in a manual process that takes up a disproportionate amount of time. Growth in available data and the frequency of mandatory assessments, however, are steadily increasing the workload of credit analysts. Including qualitative information adds an additional potential issue: While handling quantitative data input with ordinary methods and tools merely creates additional effort, extracting and processing qualitative information is not only a question of time, but also a question of bias when humans perform this task.

Time and human bias are therefore the key limiting factors for the quality of risk assessments and the scalability of the process – there may be more data available and an increased workload, but quality stays the same. Establishing analytical expertise and data-driven processes is therefore crucial to remain competitive in fixed income investing.

AI-based solutions can offer three key advantages compared to current manual approaches: Increased efficiencies, reduced human bias, and improved bases for investment decisions. As a result, asset managers can achieve both higher returns for their clients and higher profit margins for their services.

However, they can only do so, if the AI is trained in advance with available data and able to learn autonomously. The efficiency gains with AI therefore only happen gradually. Especially in complex domains such as credit scoring, it is important to support the ML process with the domain knowledge of experts. Asset managers have a better understanding of contexts through their expert knowledge and can therefore contribute important information for improving the AI-based solution.

In addition to domain-enriched ML, better results can be achieved through text mining and NLP in particular. Text mining approaches like word or sentence frequency, embedding, or red flags, could enable the research departments of asset management firms to capture the data overload through automated selection and aggregation. In combination with NLP technologies, preliminary assessments can be fully automated – reducing the human workload to validation only. Finally, by training the AI to learn over time, forward-looking analyses and hence credit ratings can be improved significantly. This results in a time-saving advantage and an opportunity to outperform the market.

Self-driving portfolio optimization

Portfolio managers rely on exclusive research and information to create a competitive advantage and generate alpha for their clients. Many asset management companies therefore have no choice but to maintain very large research departments or to outsource research activities to costly external suppliers.

The way how research departments are structured, however, is likely to change fundamentally in the near future. As data volumes increase, asset managers will need more sophisticated tools to optimize their portfolios. In order to generate higher yields, ML models can help portfolio managers to predict price movements and volatilities by detecting the right signals in Big Data streams.

This not only applies to quantitative data, but also to qualitative data and even audio files. Using text mining or NLP models, sentiment indicators can be derived from a variety of sources, such as social media, and give portfolio managers an indication of possible future market developments. By connecting data through knowledge graphs in particular, AI solutions can analyze contexts. Investment decisions will therefore be based on harmonized, quantifiable assessments, rather than expertise that varies in nature and scope, minimizing the uncertainty factor of human bias. This will fundamentally change research departments and portfolio management. The ability of technology to evaluate Big Data streams to an unprecedented extent will support human analysts and not only handle a large part of the fundamental market and financial analyses, but also even provide investment recommendations based on intelligent algorithms.

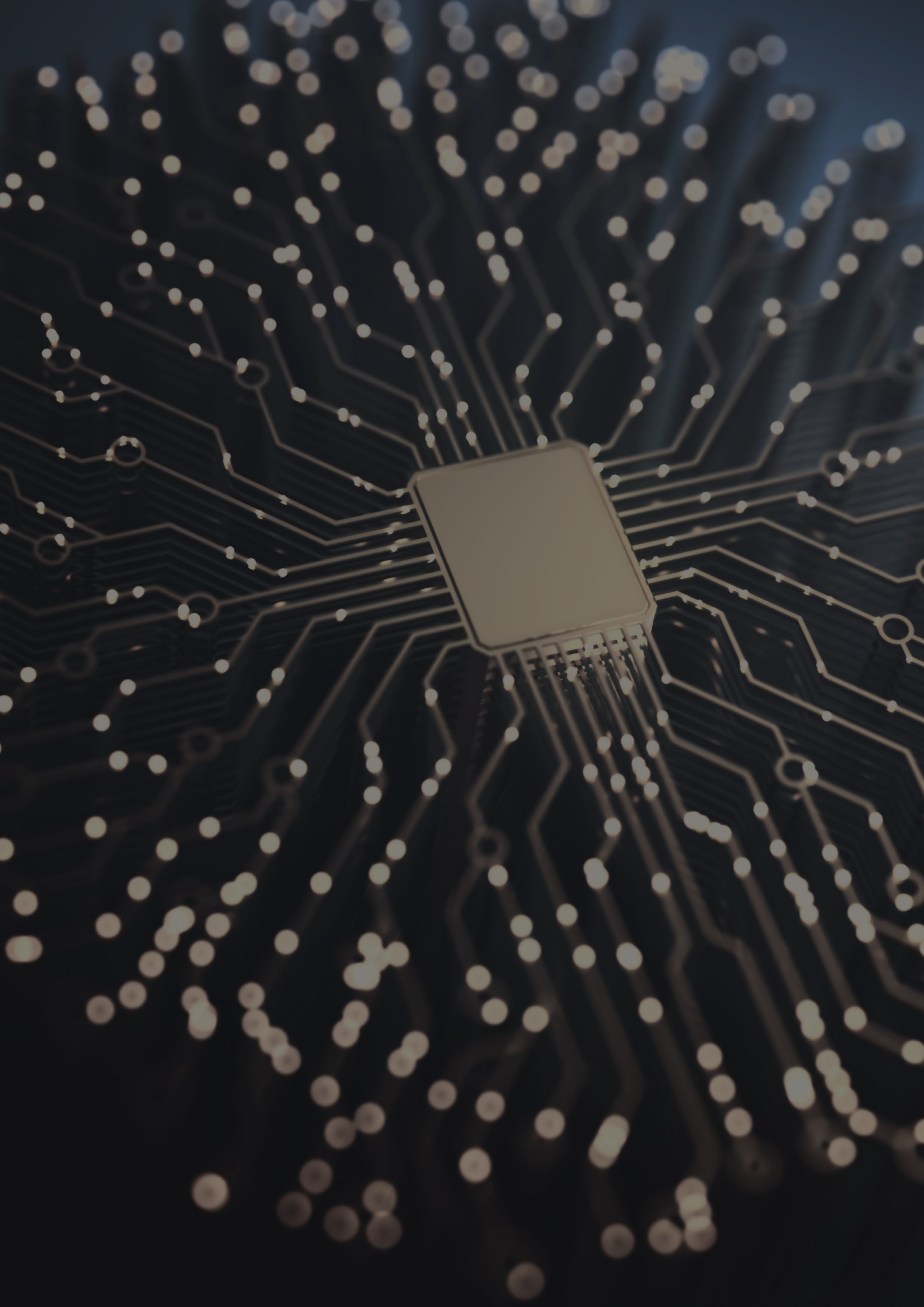
The time and effort saved can then be shifted towards personalized services for customers, increasing customer loyalty and retention thanks to a higher level of perceived individual attention.

Smart search engines

Our interviews confirmed that the exponential growth in data leads to an increase in the time and resources required to structure, filter, and analyze data.

This problem is aggravated by the fact that more and more regulatory requirements are forcing companies to obtain increasingly larger and more granular data in real time for the purposes of reporting, risk management, and operational control. As a result, companies lack the capacity or time to conduct sufficient analysis of financial data.

AI-based solutions make it much easier to process large amounts of financial information, present it in a straightforward manner, and prioritize the information that asset managers need by creating a smart search engine. These search engines help companies to cut costs while providing better information to managers through filter functionalities and improved data presentation, offering two main advantages: First, a smart search engine allows users to categorize data based on its level of quality, its source or an asset manager's specific requirements. Multiple cataloging tools enable users to correlate and analyze the data more comprehensively across categories. Cataloging can also be done by domain, helping the search engine to search for domains of high interest. Advanced AI solutions can even detect domains and domain relationships between datasets. Second, an AI-based search engine has the advantage of allowing the system to merge large volumes of complex data into knowledge paths. This gives asset managers the ability to gain deep insights into data origination and impact analysis.



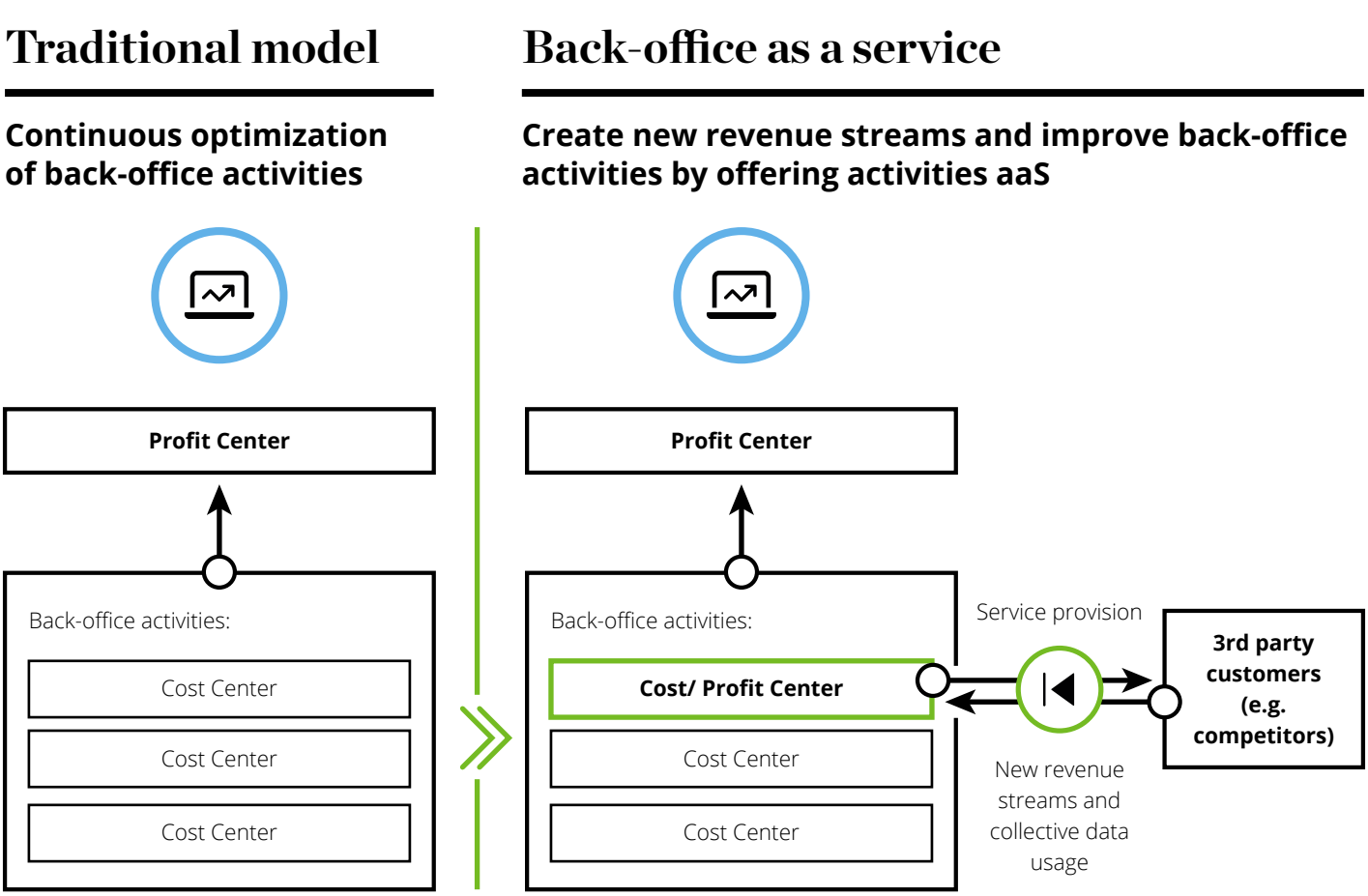
From use cases to business building

From cost center to profit center

Traditionally, technological solutions in the back-office are designed and implemented to improve efficiency and lower costs. They optimize and automate certain processes or activities such as fund administration or reporting in order to create a cost advantage over the competition. In the mid- to long-run, however, some competitors always manage to catch up or replicate those efficiency-boosting capabilities and in turn limit a firm's ability to defend its cost advantages.

However, AI-enabled use cases have a huge potential to be marketed externally, rather than merely be used internally to cut costs. This "back-office as a service" model uses AI-enabled technologies to increase efficiencies in a firm's own back-office while also providing it to third-party customers or competitors at the same time.

Fig. 3 – From cost center to profit center



There are three main arguments that support using AI-based solutions not only in-house, but also offering them as a service to third parties (see Figure 4 for an overview).

Fig. 4 – Key arguments to market solutions externally

Improve technical solutions
New technologies (e.g. AI) are dependent on data and user interactions – offering them externally accelerates improvement in digital solutions

Create revenue streams to drive investment
Required investments for new technologies might be non-viable if used internally only – new revenue streams increase the return on investments

Create long-term strategic advantage
Improving operational efficiency creates a short-term advantage – pushing competitors into consuming own IP and the pull of new data creates long-term strategic advantage

First, AI-based solutions are dependent on the data available and user interactions. AI-based solutions are therefore only as good as the accessible data. Offering them to third parties results in more user interactions and therefore accelerates the learning pace of the AI leading to a better solution, faster.

Second, given the scale required for many AI applications to become economically viable, the costly development of new technological solutions might not be worthwhile for in-house purposes only. Offering the service to third parties creates an additional revenue stream and increases the return on investment.

Last, implementing AI solutions for your organization alone may create an advantage in the short-term, but your competitors are bound to catch up in the mid-term. Creating the IP of a proven AI model as a service forces your competitors into the role of consumers of your IP, creating a more sustainable advantage, particularly as your IP benefits from external usage.

Three ways to build an external business

There are three fundamental approaches to developing a new external business. Each has its own advantages and disadvantages and the choice will depend on a company's core objectives.

Building a new venture via the "intrapreneurial approach"
Using the "intrapreneurial approach", key people from the core organization are at the center of the new venture. These so-called "intrapreneurs" do not cut ties with the core, but rather collaborate closely. This approach is similar to installing a new organizational unit and facilitates an efficient transfer of knowledge and a change in culture while ensuring some degree of agility and autonomy for the new company. The main disadvantage of this approach is a slower ramp-up and higher associated costs than an "entrepreneurial approach".

Building a new venture via the "entrepreneurial approach"
A new venture built using the "entrepreneurial approach" is completely separate from the core company. Key people are sourced externally and the new structure is created from scratch. This gives the new venture a high degree of autonomy, especially in the choice of agile workflows, though the core organization can take on the role of strategic investor and provide resources and guidance where needed. Largely disconnected from core structures, this new venture can ramp up significantly more quickly, while strong founder incentives can speed up scaling. Faster execution means lower costs and allows for faster pivots or a potential early stop if results are not promising. Knowledge transfer and cultural change are lower as well, however, and may impede buy-in and acceptance within the core organization.

Buying an existing venture
Acquiring an existing venture that caters to the identified back-office use case is the third option to consider. The clear advantage is a faster go-to-market with a potentially mature and proven product. That said, three key disadvantages need to be considered: First, the solution may not – or only to a limited extent – apply to the firm's own internal use case, as it is less tailored to the need. Second, existing shareholder structures make it more difficult to acquire the same level of strategic control compared to Greenfield approaches. Third, startups with an initial track record and a proven product solution come with an expensive price tag – especially if the purchaser aims to acquire a controlling share.

Conclusion and outlook

AI has had a lasting impact on the financial industry in recent years. While Fintech startups are entering the B2C market and initiating disruptive solutions, the B2B market, and in particular fixed income asset management, still relies on manual processes and traditional data processing.

Low interest rates, increasing data volumes and strict regulations are forcing asset managers to reconsider their traditional business approach and impressive technological advances in AI are paving the way. Natural Language Processing (NLP), domain-enriched machine learning (ML) and connection of knowledge are particularly worthy of note here.

To underscore the potential of AI, we have developed three use cases that show how AI-based software can be used: Automated credit scoring, self-driving portfolio optimization and smart search engines. These use cases show only a fraction of what is actually possible.

What is more, firms can sell their AI solutions on the broader market, which has the potential to create additional monetary, technical and strategic advantages.

With $24.6 billion invested worldwide in 2018 venture funding of AI and ML companies has reached a record high, continuing the exponential rise of an industry that started less than a decade ago.[2] This represents a 128 percent increase in investment over the prior year – and the strong upward trend is expected to continue over the next few years. In fact, AI is becoming more the status quo, rather than a mere temporary or exclusive trend. So, the question is not if, but much more when, it will replace non-intelligent solutions.

That said, asset managers are still lagging behind. The findings of a recent study provide a vivid example: It found that only 17 percent of the institutional investors surveyed are currently using AI technology such as ML or NLP for the purpose of news and data analysis.[3]

Now is the time for asset managers to take advantage of the new technological opportunities. By applying AI, incumbents can not only fend off new entrants and differentiate from existing competitors – they can create a winning strategy by creating new businesses in a new playing field.

[2] https://pitchbook.com/blog/do-european-and-american-investors-use-data-differently

[3] https://www.institutionalinvestor.com/article/b18ts4fwfg53c0/Asset-Managers-Plan-to-Boost-AI-Spending-a-Greenwich-Survey-Shows

How Deloitte is involved

With a diverse team of dedicated consultants, data scientists, technical engineers, and subject matter experts, Deloitte channels 360-degree expertise to help clients in the asset management industry innovate their businesses using untapped technologies. Deloitte services range from identifying opportunities in the field of automation in general or AI in particular to developing custom strategies aligned with the organization's business goals and supporting implementation of innovative solutions and cutting-edge technology.

The Deloitte Investment Management Operations team offers broad and profound industry knowledge, extensive experience with clients in asset management, and a deep understanding for their specific needs. To date, the team is already working with large banks and asset management firms to assess the opportunities emerging with the steady evolution of AI and to develop individual use cases at the Deloitte Greenhouse in Berlin, Germany.

The Deloitte Analytics Institute (DAI), as the center of expertise in Big Data and Advanced Analytics, operates at the intersection of business, science, and technology. At the DAI, data scientists develop user-centric cognitive systems and data solutions focused on generating maximum impact for clients and stakeholders alike. From ideation to transformation, the institute enables organizations to become truly insight-driven.

Finally, Deloitte Digital Ventures (DDV) is Deloitte's dedicated venture building unit, assisting clients in developing and rolling out new digital businesses to secure alternative revenue streams. From strategic assessment and conceptual design to implementation, interim management and technology transfer to a standalone company – DDV always acts as an entrepreneurial partner.

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