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DATA ANALYTICS

Artificial intelligence and data analytics: Emerging opportunities and challenges in financial services

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DATA ANALYTICS

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CONTENTS

DATA MANAGEMENT

DATA ANALYTICS

DATA INTELLIGENCE

DEAR READER,

Welcome to the milestone 50th edition of the Capco Institute Journal of Financial Transformation.

Launched in 2001, the Journal has covered topics which have charted the evolution of the financial services sector and recorded the fundamental transformation of the industry. Its pages have been filled with invaluable insights covering everything from risk, wealth, and pricing, to digitization, design thinking, automation, and much more.

The Journal has also been privileged to include contributions from some of the world's foremost thinkers from academia and the industry, including 20 Nobel Laureates, and over 200 senior financial executives and regulators, and has been co-published with some of the most prestigious business schools from around the world.

I am proud to celebrate reaching 50 editions of the Journal, and today, the underlying principle of the Journal remains unchanged: to deliver thinking to advance the field of applied finance, looking forward to how we can meet the important challenges of the future.

Data is playing a crucial role in informing decision-making to drive financial institutions forward, and organizations are unlocking hidden value through harvesting, analyzing and managing their data. The papers in this edition demonstrate a growing emphasis on this field, examining such topics as machine learning and AI, regulatory compliance, program implementation, and strategy.

As ever, you can expect the highest caliber of research and practical guidance from our distinguished contributors, and I trust that this will prove useful to your own thinking and decision making. I look forward to sharing future editions of the Journal with you.

Lance Levy, **Capco CEO**

FOREWORD

Since the launch of the Journal of Financial Transformation nearly 20 years ago, we have witnessed a global financial crisis, the re-emergence of regulation as a dominant engine of change, a monumental increase in computer processing power, the emergence of the cloud and other disruptive technologies, and a significant shift in consumer habits and expectations.

Throughout, there has been one constant: the immense volume of data that financial services institutions accumulate through their interactions with their clients and risk management activities. Today, the scale, processing power and opportunities to gather, analyze and deploy that data has grown beyond all recognition.

That is why we are dedicating the 50th issue of the Journal of Financial Transformation to the topic of data, which has the power to change the financial industry just as profoundly over the coming 20 years and 50 issues. The articles gathered in this issue cover a broad spectrum of data-related topics, ranging from the opportunities presented by data analytics to enhance business performance to the challenges inherent in wrestling with legacy information architectures. In many cases, achieving the former is held back by shortcomings around the quality of, and access to, data arising from the latter.

It is these twin pillars of opportunity and challenge that inform the current inflection point at which the financial industry now stands. Whilst there is opportunity to improve user experiences through better customer segmentation or artificial intelligence, for example, there are also fundamental challenges around how organizations achieve this – and if they can, whether they should.

The expanding field of data ethics will consume a great deal of senior executive time as organizations find their feet as they slowly progress forward into this new territory. In my view, it is critical that organizations use this time wisely, and do not just focus on short-term opportunities but rather ground themselves in the practical challenges they face. Financial institutions must invest in the core building blocks of data architecture and management, so that as they innovate, they are not held back, but set up for long-term success.

I hope that you enjoy reading this edition of the Journal and that it helps you in your endeavours to tackle the challenges of today's data environment.

Guest Editor
Chris Probert, **Partner, Capco**

ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS: EMERGING OPPORTUNITIES AND CHALLENGES IN FINANCIAL SERVICES

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ABSTRACT

Artificial intelligence (AI) systems are providing a new opportunity to financial services firms to develop distinctive capabilities to differentiate themselves from their peers. Key to this differentiation is the ability to execute business in the most effective and efficient manner and to take the smartest possible business decisions. AI systems can process large amounts of data with levels of accuracy and consistency that is not possible for humans to achieve, providing a route to more accurate predictions and data-driven analytical decision making. In this paper, we discuss the benefits of AI for improving data analytics and decision making, current and potential applications of AI within financial services, operational challenges and potential solutions for AI adoption, and conclude with requirements for successful adoption of AI systems.

1. INTRODUCTION

Advances in artificial intelligence technologies have seen a step change over the past 10 years, leading to substantial digital disruption of the business world. AI is providing firms with new opportunities to develop distinctive capabilities that can be used to differentiate them from their peers. Key to this differentiation is the ability to execute business in the most effective and efficient manner and to take the smartest possible business decisions. Using advanced technologies, such as AI, to support a firm's distinctive capabilities is instrumental in achieving this end [Davenport and Harris (2017)].

Despite being a quantitative field, the financial services industry was initially slow to adopt AI, when compared to other functions such as marketing and supply chain management, for example. Adoption rates have, however, improved in recent years, and the financial services industry was reportedly among the top three users of AI in 2018 [Chui and Malhotra (2018)]. AI is now being used for compliance, risk management, credit rating and loan decisions, fraud prevention, and trading/portfolio management, among others. In 2016, for example, JPMorgan Chase used AI-based software to analyze commercial loan contracts, and it was able to analyze 12,000 loan documents within seconds, compared to 360,000 human hours for the same task [Economist (2017)].

Historically, decision making in financial service firms has largely been reliant on a combination of descriptive analytics (such as reports, scorecards, and dashboards) that only provide information about past events and predictive analytics (such as linear regression analysis) using historical data to understand patterns and predict the future. These techniques rely on data generated from past events and lack the sophistication to handle the vast quantity of data required for more accurate predictions [Davenport and Harris (2017)]. With the advent of big data there is a ready supply of data for more accurate predictive decision making. However, this big data is frequently unstructured and is constantly changing at a rapid pace. AI systems have been designed to process large amounts of data with levels of accuracy and consistency that are not possible for humans to achieve [Wall (2018)].

Consequently, the application of AI for data analytics makes it possible to generate more accurate predictions and solving time variant problems [Bahrammirzaee (2010), Buchanan (2019)]. Makridakis (2017) suggests that the increasing use of AI will result in interconnected firms and decisions based on advanced analytics and extensive use of big data, promising widespread competitive advantage to the firms employing the new technology.

2. BENEFITS OF AI FOR DECISION MAKING

For many firms, the key driver of adopting AI-based systems and technologies is cost reduction. In a global survey conducted by Deloitte, covering 1,219 executives from 24 countries, around 76% of the respondents stated that adoption of AI was aimed at reducing costs and increasing productivity. 36% of the respondents reported that AI capabilities met expectations while 47% reported that they exceeded expectations.[1]

Using AI in the workplace enables more efficient operations, which ultimately results in cost-savings. It allows automation of mundane and repetitive tasks, allowing employees and managers to spend more time decision making and developing action plans for the future [PwC (2019a)]. PwC reports an average improvement of 40% in volumes with just two staff members along with 200 virtual assistants achieving the output of 600 full-time employees. PwC undertook the automation of 3 million transactions per month, which translated into a 200% return on investment (RoI) in one year, and 35% automation of their back-office work has brought 650-800% RoI in three years. They witnessed a 76% improvement in processing times [PwC (2019)a].

PwC is also using AI to combat cyber attacks. According to a Global CEO survey, 76% of U.K. leaders see cybersecurity as the second largest threat their businesses faces. PwC uses a digital game that stimulates the experience of a cyber attack for the employees. This helps employees detect cyber attacks cases faster and be better prepared to deal with such an attack [PwC (2019b)].

Thus, from the above examples and statistics, it is clearly visible that there is great scope for transforming the way firms operate using AI. If the AI technology is used effectively, it can boost organizational performance through improved efficiency, consistency in operations, and allowing employees to focus on taking actions in light of the available analysis rather than spending workhours on the analysis process itself. This provides the firm with a more focused approach to making faster and smarter decisions.

In the following sections, we will discuss existing and potential applications of AI systems, with specific examples pertaining to financial services, the operational challenges and solutions for AI adoption in financial service firms, and the requirements for successful AI adoption.

3. POTENTIAL AND EXISTING APPLICATIONS OF AI FOR FINANCIAL SERVICES

AI has already been applied in a wide range of financial service functions from auditing to assessing market risk. Some of these will be discussed below.

3.1 Auditing

Given the growing population size and increased complexity of transactions, the use of AI in auditing appears inevitable. Over the last two decades complex AI systems have been developed, in the form of expert systems and neural networks, to assist auditors in decision making. The primary objective of the development and adoption of these AI-based systems is to eliminate potential bias and omissions that may occur in manual audit processing [Omoteso (2012)].

When using AI systems, it is important that auditors do not over-rely on AI decision recommendations, but use them as an aid to inform their decision making. This is because current AI cannot replicate the versatility or judgment of the human auditor. However, use of AI systems ensures efficiency and effectiveness, consistency, improvement in decision-making accuracy, and reduced decision-making time. For example, a study of 96 auditors to test the value add of using an expert system to help assess the risk of management fraud found that it enhanced the auditor's ability to discriminate between various levels of management fraud compared to the use of traditional checklists and logit statistical models [Omoteso (2012)].

3.2 Credit rating

Credit-reporting firms such as Experian PLC, Equifax Inc., and TransUnion have been using AI to improve identity verification. The main driving factor for this shift is the growing amount and complexity of information that needs to be analyzed in describing and verifying the identity of a person. For example, Experian has a database of around 1.2 billion consumer credit-history records. Using AI technology will allow Experian to verify

[1] It is reported that a Fortune Global 100 biopharma company that set up an AI/cognitive center of excellence (CoE) realized 10-15% savings on its baseline costs [Aguilar and Girzadas (2019)].

the identity of a customer more effectively while asking fewer questions. One way in which this is achieved is by analyzing a number of data points when a person enters their username and password for internet banking. The data points would include analyzing the IP address, device identifiers, speed of entering the details, etc. [Council (2019)]. Experian has been working on the development of the AI technology for 18 months and during the testing phase it was seen that around 20% of the identities it believed were fake previously, turned out to be true while 5% of the identities they believed were real, turned out as fake.

3.3 Mergers and acquisitions (M&A)

AI is rapidly redesigning the way M&A transactions are being undertaken. Traditionally, M&A required tedious calculations using Excel spreadsheets and the manual review of documents and contracts that were extremely time consuming. Now, with AI powered analytical tools it is possible to undertake a real time in-depth analysis of the specific elements of the target company. Such manual work is not only time-consuming and costly but can also lead to important information contained in several amendments and pages to be over-looked or missed [Deloitte (2018)]. AI based tools allow for quick and accurate calculations and swift extraction of relevant provisions. Young et al. (2018) suggest that AI systems can be used for all transactions and phases during an M&A cycle – diligence, negotiation, and post-merger integration, as well as for divestiture and spin-off decisions.

- **Due diligence:** during the due diligence step, AI tools enable real time and accurate financial analysis of the target company. It makes it possible to get a better understanding of the target's real growth-drivers and undertake more in-depth analysis of their customer retention efforts and profit margins at the group as well as business section levels; for example, by product, geography, type of consumer, etc.
- **Negotiation:** AI tools provide more in-depth and valuable details during the due diligence and contract review process, enabling the deal team to quickly decide whether to further engage with the target company, provide a counteroffer, etc. The tool also identifies the potential risks involved.
- **Post-merger integration:** AI tools play a crucial role post-merger in identifying opportunities for synergies and growth potential, as well as contributing to business optimization strategies.

AI can achieve all this with cost savings of up to 20% and in nearly half the time [Young et al. (2018)].

3.4 Insurance

Insurance companies have been investing in AI technology in earnest since 2014, with key growth areas including robotic process automation, deep learning, embedded solutions, machine learning, video analytics, and natural language processing [Jubraj et al. (2018)]. AI can be applied across all insurance functions, from the front to the back office. It is estimated that AI can help the insurance sector achieve cost saving of up to U.S.$390 bln by 2030 [Nonninger (2019)]. In the front office, AI can be used in the form of chatbots to speed-up and streamline the claims process for consumers and mitigate the number and magnitude of fraudulent claims for the insurers. Insurance companies can also use AI to improve operational efficiency, by, for example, analyzing vast amounts of data to calculate a more accurate pay-out amount. Intelligent First Notification of Loss (i-FNOL), for example, uses computer vision and machine learning that analyzes images of an accident to establish who was at fault [Jubraj et al. (2018)]. In the middle office, AI plays an important role in improving fraud detection and in the back-office it plays a crucial role in risk assessment and accurate calculation of claim amounts [Nonninger (2019)].

Insurance companies are also using AI to get a better understanding of insurance risks to improve pricing and for developing new products. In the case of property insurance, AI is being used to analyze building permits for code violations, structural modifications, etc. Insurance companies are also trying to speed up claim processes by allowing people to send images of damage via an app. While the adoption of AI in the insurance industry is still in the early stages it has a vast potential for presenting new competitive opportunities [Murawski (2019)].

3.5 Anti-money laundering (AML) compliance

Adoption of AI for AML compliance has been slow compared to other areas of financial services. However, interest in this area is increasing due to pressures from increased volumes of international transactions, frequent changes in regulatory requirements, and the use of economic sanctions by governments. The workload in the AML compliance and know your customer (KYC) space is continuously increasing. Banks and financial institutions have to hire large numbers of employees due to the manual nature of this tedious and time-consuming work. The banks face several important challenges, such as high numbers of false positives, poor data quality, and manual updating and comparison processes [Breslow et al. (2017)].

To improve efficiency and effectiveness, banks have been investing heavily in three areas: data-aggregation platforms, AI-based statistical modeling tools, and AI-based visualization tools. These steps are expected to reduce error rates by up to 30%, bring down false positives from 90% to under 50%, and reduce the risk of being penalized [Breslow et al. (2017)]. HSBC recently partnered with a startup providing AI-based solutions for automating their AML compliance processes with the aim of improving efficiency. Since implementation, HSBC has seen a 20% reduction in the number of cases referred for further investigation [Irrera (2017)]. Similarly, when United Overseas Bank (UOB) launched an AI pilot program for AML compliance, for transaction monitoring it saw a 5% increase in true positives and a 40% decrease in false positives. Furthermore, in individual/corporate name screenings, the bank observed a 60%/50% drop in false positives. Operational efficiency rose by 40% [Singh et al. (2018)].

3.6 AI and market risk

Market risk refers to the risk associated with trading and investing in financial markets. Trading in financial markets involves the use of risk management models and AI has been used to perform stress tests of such models – also known as model validation. Investment firms are making use of unsupervised learning of the AI systems to identify new patterns of relationship between financial assets. AI systems also play an important role in helping trading firms gain an understanding of the impact of their trading on market pricing. These firms are making use of clustering methods to avoid large exposure in illiquid markets [Aziz and Dowling (2019)]. These advanced AI systems can notify investors to change their trading patterns whenever necessary. The primary advantage of using AI capabilities, as opposed to manual trading advice, is that the system can provide realtime feedback and analyze far more data to improve predictions [Aziz and Dowling (2019)].

We can see from the preceding sections that AI has a vast and diverse potential to improve how businesses, and in specific financial services companies, operate and grow. However, firms may face several barriers in implementation. The next section will elaborate on such barriers and detail the existing and potential measures to overcome them.

4. OPERATIONAL CHALLENGES AND POTENTIAL SOLUTIONS FOR AI ADOPTION

Despite the many benefits associated with the use of AI, there are various barriers to its implementation that need to be identified and effectively managed in order to fully benefit from its application with financial services.

4.1 Availability of data

The basic requirement for implementing AI is the availability of a large labeled and categorized dataset. The full benefits of AI cannot be realized unless there is a rich set of data available, since AI systems are not programmed but "trained" on this vast dataset. In some domains, organizing and labeling large datasets could be challenging. One solution to this problem is the use of unsupervised or semi-supervised approaches to "train" the system. This could include two methods:

- **Reinforcement learning:** this technique involves training the system through trial and error. It uses the "carrot and stick" methodology – the system or algorithm receives a reward (such as a high score) when it successfully performs a task and low score otherwise. Microsoft used this method for its decision services to adapt to user preferences. Another potential application of this method is in the use of AI-driven portfolio management, where the score is based on the gains and losses in value.
- **Generative adversarial networks (GANs):** under this technique two systems compete against each other to improve their understanding of a concept. GANs train a generative network by framing the problem as a supervised learning problem with two sub-models: the generator network that we train to generate new examples and the discriminator network that tries to classify examples as either real (from the domain) or fake (generated) [Brownlee (2019)].

4.2 Explainability and transparency

Another challenge arises from being able to explain how the AI system has arrived at a solution or decision. This is particularly a drawback in cases where the user needs to know the reason behind a particular prediction and the prioritization process of key decision criteria that led to the decision outcome. This can important for lending decisions in the European Union (E.U.), where under the guidelines of General Data Protection Regulation (GDPR) citizens have a right to know how the decision was derived. Two techniques used to make AI more transparent include:

- **Local interpretable model agnostic explanations (LIME):** LIME identifies the parts of the input that were most relevant to arriving at a decision
- **Attention techniques:** these highlight the parts of the input that the model focused on while arriving at a decision.

4.3 Challenge of exclusivity

Unlike humans, AI systems are not able to transfer their learning from an experience or task to another. Thus, whatever the system has achieved working on a task remains exclusive to that task. For another task the company would have to train another model. This can be overcome through the following techniques:

- **Transfer learning:** here, the AI model is trained to complete a task and apply the learning to a different activity. This technique can allow diverse functionality.
- **Generalized structure:** this method involves the use of a generalized structure to train a model to solve a number of problems instead of just one.
- **Meta-learning:** this technique can be used to automate designing of the neural network itself. Google has developed AutoML for this purpose. This reduces the workforce requirements of designing a new model for different tasks.

4.4 Shortage of skilled workforce

Another critical challenge facing financial services firms in adopting AI is the acute shortage of skilled workforce. A McKinsey report states that there are approximately 10,000 AI-related job vacancies globally. Adoption of AI in financial services has picked up speed due to high technical feasibility and nature of work, i.e., working with large amount of structured data. For example, AI-optimized fraud-detection systems are expected to become a U.S.$3 billion AI market by 2020 [Bughin et al. (2017)].

5. REQUIREMENTS FOR SUCCESSFUL ADOPTION OF AI SYSTEMS

There are several broad prerequisites for the successful adoption of AI systems.

First, is the availability of a vast amount of historical data. The AI system uses this data to understand patterns and behavior over time to reach a decision or to predict the future occurrence of an event. A lack of big data will limit a firm's ability to fully capitalize on the potential AI offers.

Second, the quality of the AI-based analysis and predictions will depend on the level of human skills available to design the systems. If there is an error in the algorithm or if the data is "labeled" in a faulty manner, this too will hamper the quality of the output [Davenport and Ronaki (2018)].

Third, firms must acknowledge that not all applications of AI will be successful. Firms need to be careful leveraging any technological advantages of the new systems. Many AI projects have failed due to a high level of expectation and overambitious objectives. Firms must understand which technology will be best for which task – one size does not fit all. Firms should rank in order of priority the portfolio of projects based on the needs of the business and viability of use. The best approach to initiate the adoption of AI is an incremental approach rather than transformative. Firms must use the technology to support human capabilities rather than immediately attempting to replace them [Davenport and Ronaki (2018)].

Fourth, AI helps provide employees with accurate data and good quality predictions, enabling firms to make the smartest possible decisions. This kind of intelligence will be of lesser value if decisions cannot be made quickly in response to a situation. This is most likely to occur in firms with a rigid senior level approval or authorization-based structure. It is imperative that in modern firms, employees at all levels have some degree of decision-making power, especially in cases of critical and time sensitive issues. While it is not possible for every employee to be a data scientist, the firm adopting the use of AI must train its employees to at least have some basic knowledge of how to use and interpret data and the new AI systems. Otherwise, the extensive availability of data and decentralized decision making would be of no real value to the firm [Fiore (2018)].

These requirements will take time for a financial services firm to address. Consequently, the AI adoption journey is likely to comprise of a number of stages. Thomas Davenport argues that firms are likely to transition through three stages of AI adoption:

Stage 1: Assisted intelligence: during this stage, companies utilize big data programs, cloud-based technologies, and science-based approaches to make data-driven decisions. The utility of assisted intelligence is to assist humans in doing routine tasks faster. The human is still taking some of the key decisions and AI is executing the task.

Stage 2: Augmented intelligence: this stage involves developing the machine learning capabilities using the existing information management systems to support human analytical competencies.

Stage 3: Autonomous intelligence: this is the stage of achieving automation in processes. AI is used to digitize processes and actions. In this stage, the machine, bots, and systems can take decisions from the information, algorithms, and intelligence used to develop the machine learning [Mittal et al. (2019)].

Thus, the firm will begin the AI journey using assisted intelligence and as they become more technically advanced, they would transition to the use of augmented intelligence followed by autonomous intelligence.

6. CONCLUSION

It is clear that AI provides tremendous opportunities for transforming financial service firms. If AI is adopted effectively it can provide new operational benefits to the firm, customers, and employees. For example, applications of AI could provide higher quality and wider variety of customized products and services to customers, as well as opportunities to upskill employees and enhancing their career development.

Reaping the benefits of AI systems for financial services is likely to rest on the ability of firms to manage bias in the big data used for training algorithms and recruiting sufficient numbers of AI skilled workers. These two factors are the building blocks of AI adoption. The ability of the machine to "learn" depends largely on the quality of the data and human workforce "training" it. Well-trained employees are also needed to be able to correctly understand the output from AI systems and make informed decisions and/or action plans.

Putting these two building blocks in place will help drive the cultural change of data-driven decision making and ensure that financial services firms can integrate new AI systems with their existing information systems.

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