Generative A

Banking and Financial Services

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Fundamentals for Business Leaders August 2023



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Foreword

Welcome to the forefront of innovation, where the boundaries of possibility are continually stretched and redefined. In the ever-evolving realm of financial services, where data reigns supreme and decisions hold the power to shape economies, a new force is emerging that promises to revolutionise the way we understand, predict and navigate the intricate world of financial services. That force is Generative AI.

The financial services industry has always been driven by the pursuit of knowledge, seeking the most accurate and insightful tools to guide decisions, mitigate risks and optimise outcomes. In this quest, the synergy between finance and technology has been a driving force, propelling the industry forward at an unprecedented pace. Today, as we stand at the precipice of a new era, Generative AI is poised to become the game-changer that redefines the very landscape of financial services.

This publication brings together the collective wisdom and pioneering work of experts around the globe who have harnessed Generative AI to tackle the industry's most complex challenges. Accubits Technologies have been building AI models, tools and applications for over a decade; and throughout this publication we have created original never-seen-before images using our in-house proprietary Generative AI models to showcase the power of this technology.

I invite you to delve into this publication to explore the frontiers of Generative AI in financial services, and to witness first-hand the power of a technology that has the potential to transform not only the way we conduct business but also the lives of billions.



Sathesh Sriskandarajah

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Introduction

Productivity Revolution

Creative Algorithms Reshaping our Future

In today's technologically advanced world, artificial intelligence (AI) has seamlessly integrated into our lives, revolutionising our day-to-day experiences. From the moment we wake up, AI-powered virtual assistants greet us, offering personalised news updates, weather forecasts and reminders for the day. As we commute to work, AI algorithms optimise traffic routes, providing real-time suggestions for the fastest and most efficient journey. At work, AI tools assist in automating repetitive tasks, allowing us to focus on more strategic and creative endeavours. Even during our leisure time, AI-driven entertainment platforms recommend movies, shows and music tailored to our individual preferences. Ultimately, AI has become an indispensable companion, empowering us to navigate and enhance our lives with unprecedented ease and efficiency.

Generative AI, with its ability to create new content (i.e. text, vision, audio and ideas), is poised to have a profound impact on the workplace. Through harnessing the power of this technology, organisations can streamline various aspects of their operations, resulting in productivity gains, enhanced decision making, increased compliance, better customer service and drive innovation.

The financial services industry is well positioned to harness the power of generative AI given the volume of data these organisations hold, their investment in technology, extensive customer-facing workforce, stringent regulatory landscape and large white collar workforce.

While certain tasks may be automated, it is crucial to recognise that human judgment, critical thinking and emotional intelligence remain invaluable in many professional domains. As the workplace evolves, organisations will need to strike a balance between leveraging generative AI for enhanced efficiency and harnessing the unique abilities of human workers to drive innovation and maintain a human touch.





1. Introduction to Generative AI

1.1. Artificial Intelligence vs Generative AI

Artificial Intelligence (AI) refers to the field of computer science and technology that focuses on creating intelligent machines that can perform tasks that typically require human intelligence. It involves the development of algorithms and models that enable computers and systems to learn from and adapt to data, make decisions, solve problems and perform various cognitive functions.

Artificial Intelligence can be categorised into two types: narrow AI and general AI. Narrow AI is designed to perform specific tasks within a limited domain. Examples of narrow AI include voice assistants, image recognition systems and recommendation algorithms. General AI on the other hand, refers to highly autonomous systems that possess human-level intelligence and can understand, learn and apply knowledge across a wide range of tasks and domains. General AI aims to replicate human intelligence in all its aspects.

There are several subfields within AI, including machine learning, natural language processing, computer vision, robotics and expert systems. Machine learning is a crucial component of AI and involves training algorithms to learn from data and improve their performance over time without being explicitly programmed. Machine learning algorithms are designed to identify patterns and relationships within the data and use them to make predictions or take actions. Deep learning is a subset of machine learning that focuses on neural networks, specifically deep neural networks. Deep neural networks are designed to mimic the structure and function of the human brain, consisting of multiple layers of interconnected artificial neurons. Deep learning algorithms learn hierarchical representations of data by progressively extracting more abstract and complex features at each layer. This allows deep neural networks to automatically learn intricate patterns and representations from raw data.

With ChatGPT and other frameworks exploding onto the scene, Generative AI is a hot topic of discussion amongst businesses across the globe....so what is it?

Generative AI is a type of artificial intelligence (AI) that can generate new content or data based on patterns and rules learned from existing data. Unlike other types of AI that focus on recognising patterns and making predictions, generative AI is designed to create new content or data that is similar to what it has learned from existing data.



Act (output):

- · Make decisions and predictions based on data input
- Take actions based on decisions or predictions

Generative AI:

- Generate written content (natural language)
- Generate new Images, Videos and Music
- Generate new ideas, designs, hypothesis and models

1.2. Why is Generative AI important now?



Figure 2 - Volume of data used to pre-train foundation models over time¹



Generative AI has now been made possible due to:

- Breakthrough in algorithm development: transformer architecture, self-supervised and transfer learning
- Availability of large volume of various types of data, including text, images, video and audio for model training
- Significant increase in available computational power and reduced cost

Just as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don't think AI will transform in the next several years.²

Andrew Ng

Founder & CEO - deeplearning.ai Adjunct Professor of Computer Science - Stanford University Founder - Google Brain (Deep Learning) Project Former Chief Scientist - Baidu



1.3. Foundation Models power future Generative AI applications

A foundation model is a large machine learning model trained on a vast quantity of data at scale, using self-supervised learning techniques, which means they don't require labelled examples for each specific task - they learn from the general patterns and structures present in the training data.

Foundation models include (but not limited to) large language models (LLMs), vision, audio, code and multi-modal; and serve as a starting point for developing more specialised or domain-specific models. These models have been typically pre-trained on large-scale datasets that include diverse sources of text, images, video, audio, etc.

Once pre-training is complete, fine-tuning is performed on task-specific datasets to adapt the foundation model to specific applications or domains. This involves training the model on labelled examples and specific objectives related to the desired task. The advantage of using foundation models is that they can be leveraged for a wide range of tasks, reducing the need to train separate models from scratch for each specific task. This approach saves time, computational resources, and benefits from the advanced learning the model acquired during pre-training.

One example of a foundation model is OpenAI's GPT (Generative Pre-trained Transformer) series.

Foundation Models Unlock

New Possibilities

Standford University - Human Centered Artificial Intelligence



Foundation models disrupt AI development as we know it. Instead of training multiple models for separate use cases, you can now leverage a pre-trained AI solution to enhance or fully automate tasks across multiple departments and job functions.

Figure 3 - Using foundation models to build specific AI use cases³

1.4. The Rise of ChatGPT

ChatGPT, the popular chatbot from OpenAI, is estimated to have reached 100 million monthly active users in January 2023, just two months after launch making it the fastest-growing consumer application in history

The growth of ChatGPT has been nothing short of extraordinary. From its inception, ChatGPT has captivated millions with its ability to engage in dynamic and meaningful conversations. With each iteration, the underlying AI technology has evolved and improved, pushing the boundaries of what was previously thought possible. Its rapid adoption across various domains, from customer service to creative writing, is a testament to its versatility and impact.

As users continue to embrace ChatGPT's potential, its exponential growth paves the way for a future where AI-powered conversation becomes an integral part of our daily lives.

> Sam Altman ♥ @sama · 5/12/2022 ChatGPT launched on wednesday. today it crossed 1 million users! ♀ 1,102 tl 3,881 ♡ 51.2K il.i 1

~ Stylized Path to 1 Million Users (# of days from launch)







The uniqueness in generative AI lies in its ability to bridge the gap between humans and machines bringing them closer together. It's about machines augmenting humans, not replacing them. When I founded Accubits Technologies, our vision was to create "7 Billion Creative Minds", which I fundamentally believed would be powered by AI. People will be relieved of menial tasks and can concentrate on being creative, which is at the core of being human; and free them up to help solve the world's (or their business') most important problems.

Humans and machines have different relative strengths and weaknesses, and it's about the integration of these two that will allow human creativity and business processes to scale 10x, 100x and beyond over the next decade.



Jithin VG CEO & Co-founder Accubits Technologies



2. Impact of Generative AI in Financial Services

2.1. Impact of Generative AI in Financial Services

Generative AI has the potential to make a profound impact on the banking industry alone, unlocking value through increased productivity equivalent to 2.8 to 4.7 percent of the industry's annual revenues, translating to an additional \$200 billion to \$340 billion. Beyond this financial impact, the adoption of generative AI tools can bring about numerous other benefits. These include heightened customer satisfaction, improved decision-making processes, enhanced employee experience, and reduced risks through more effective fraud and risk monitoring.

The banking industry, known for its reliance on knowledge and technology, has already experienced substantial advantages from previous applications of artificial intelligence in areas like marketing and customer operations. With the introduction of generative AI, further benefits can be realised. Text-based modalities, such as regulations and programming languages, are prevalent in the industry, making it wellsuited for generative AI applications. Moreover, as a customer-facing industry serving both individual consumers and small businesses, the potential for leveraging generative AI to drive improvements and innovation is significant.

Generative AI productivity impact on banking and insurance industries by business function



Note: Excludes implementation costs (eg, training, licenses)

Figure 5 - Generative AI productivity impact on banking and insurance industries by business function⁴

Several characteristics position the financial services industry for the integration of generative AI applications:

• Digital transformation and legacy IT:

Financial institutions have been making continuous investments in technology over the years, resulting in the accumulation of considerable technical debt alongside a complex and fragmented IT infrastructure. Customer and employee interactions with internal and external systems are prime for Al transformation. • Extensive customer-facing workforce:

The financial services industry heavily relies on a large workforce of customer service representatives, including call-centre agents, financial advisors, personal bankers, relationship managers, wealth managers, mortgage specialists, insurance brokers, etc. who directly engage with customers to provide support and guidance. • Stringent regulatory landscape:

Operating in a highly regulated industry, financial institutions face numerous risk, compliance and legal requirements. Compliance with these regulations poses significant challenges, and requires robust systems and processes that can operate with a high degree of accuracy and efficiency to adequately mitigate risk.

• White-collar industry:

The financial services industry contains a large white-collar workforce. From assisting in drafting emails and creating business presentations to other day-to-day tasks, generative AI has the potential to enhance productivity and efficiency across different functions and roles within financial services organisations.

2.2 High Impact Generative AI Use Cases in Financial Services



Business Function	Potential Productivity Lift (of current annual spending)	Global Value Generated (all industries)	
Product R&D	~10% to 15%	~\$230B to \$420B	
Oustomer Operations	~30% to 45%	~\$340B to \$470B	
Marketing	~5% to 15%	~\$340B to \$470B	
Sales	~3% to 5%		
Software Engineering	~20% to 45%	~\$580B to \$1,200B	
Risk and Legal	~5% to 15%	~\$180B to \$260B	

Note: The above business functions were selected where generative AI is prime to make a high impact within the financial services industry

Figure 6 - Potential productivity lift and global value generated across by business function across all industries⁴

McKinsey & Company analysed 63 use cases and concluded that generative AI has the potential to generate \$2.6 trillion to \$4.4 trillion in value across all industries.

Its precise impact will depend on a variety of factors, such as the mix and importance of different functions, as well as the scale of an industry's revenue.

The table presented highlights high impact generative AI use cases for the financial services industry, including estimates on the potential productivity lift and global value generated across all industries for those use cases.

⁶⁶ This [AI] is going to impact every product across every company.⁵

Sundar Pichai CEO - Google and Alphabet

2.3. Maturity of Emerging Technologies in Financial Services



accubits

The Gartner Hype Cycle introduces financial services leaders to the technology themes underpinning the concept of autonomous finance, that will drive the cycle of technology evolution in financial services over the next decade.

Two key areas of focus are **Decision** Intelligence, that drives efficient and effective organisations; and Intelligent Applications that are augmented with AI and connected data, from transaction and external sources, to generate systems that provide contextualised features, experiences, and processes, and can continually learn, improve and adapt.

The above combined with **AI Governance** and **Hyperautomation in Finance** will allow organisations to spend more time on the most critical areas of their business and use their limited in-house AI or outsourced resources to build business-specific AI-driven solutions to drive productivity.

Over the next 2-5 years, these technologies are expected to reach the 'Plateau of Productivity' where the high growth adoption phase starts. It is important for financial institutions to begin laying the foundations and integrating these technologies with their workforce to optimally position themselves for this new productivity era.

Figure 7 - Gartner Hype Cycle for Emerging Technologies in Finance 2023⁶



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Embedded finance, using smart and automated decisioning has been spoken about for many years. But the real blockers of credit assessments, fraud, privacy and identification have been huge hurdles to overcome. Generative AI will finally allow real-time, intelligent financial decisions to be made in context of the processes that are being experienced by the customer. Being relevant and contextual when allowing automatic financial decisions to be made in real time is crucial. And learning from every embedded transaction will allow many financial "processes" to become not only automatic, but to be hidden from the customer and executed purely as a facilitative, 'back office' task.



Chris Wilson

Former Senior Partner & National Fintech Lead (Deloitte) Co-founder 1835i (ANZ Bank's Innovation and Venture Capital Partner)

2.4 Generative AI Framework for the Financial Services Industry



The following diagram depicts where generative AI technology can be used within the financial services ecosystem:



· Virtual Screening for Recruitment Activities

3. Applications of Generative Al in Financial Services

3.1 Build Effective and Safer Models utilising Synthetic Data Generation

Generative AI creates synthetic data by leveraging deep learning techniques, specifically generative models such as generative adversarial networks (GANs) or variational autoencoders (VAEs). These models learn from existing real data to generate new data samples that closely resemble the original data distribution.

The generated synthetic data aims to capture the essential characteristics, patterns and statistical properties of the real data it was trained on. However, it's important to note that the synthetic data is not a perfect replica of the original data and may still have some inherent biases or differences.

Care should be taken to evaluate the quality and representativeness of the synthetic data, taking into consideration factors such as diversity, bias and similarity to the original data, to ensure its usefulness and validity for specific applications. Additionally, financial institutions must adhere to relevant privacy, security and regulatory guidelines to protect customer information, as well as maintain data integrity.

Examples:

- **Training and Testing Models:** Synthetic data that simulates realistic industry scenarios can be used to train and test machine learning models without relying solely on real customer data. It helps in maintaining privacy, security and compliance, while ensuring that the models are trained on diverse and representative data.
- **Data Sharing and Collaboration:** Synthetic data that preserves the statistical characteristics and patterns of the original data allows financial institutions to share insights and collaborate with external parties, such as research institutions or regulatory bodies, while protecting sensitive customer information.
- Model Validation and Benchmarking: Synthetic data can be used to validate and benchmark models. Financial institutions can create controlled datasets with known ground truths and assess the performance and accuracy of their models in a controlled environment.
- **Risk Assessment and Fraud Detection:** Synthetic data that mimics fraudulent or risky behaviours allows financial institutions to train and test their fraud detection algorithms more effectively. It helps in improving the robustness and accuracy of fraud detection systems by simulating diverse fraudulent patterns.
- Scenario Analysis and Stress Testing: Synthetic data can be employed to model various economic scenarios and perform stress tests. Financial institutions can simulate different market conditions, customer behaviours, and financial scenarios to assess the resilience and performance of their systems and portfolios.

Generation of Synthetic Data to Improve Fraud Detection Models -J.P. Morgan⁷

J.P. Morgan's AI Research team generates synthetic datasets to accelerate research and model development in financial services. Through its research, J.P. Morgan has identified several methods to create synthetic data and has learned that different methods may apply to different types of data. For example, you can create realistic synthetic data by understanding the process that generates the real data, and then model the process itself to produce the synthetic data. The model can be declarative or captured in simulations. In addition, you can directly use the real data to train generative neural networks (GNNs), which have been successfully used to generate a variety of other synthetic data.

J.P. Morgan have used synthetic data to multiply examples that may be rare in the real data, in order to train machine learning algorithms more effectively. The new samples offer insight on data that otherwise may be left undiscovered. Another benefit is that the synthesised new samples have properties of real data but cannot be mapped back to the original sources. Furthermore, if a new idea shows promise on the synthetic data, they can consider advancing it for real deployment and use it on the real data.

One critical area for J.P. Morgan's research is fraud detection model training where AI models are given examples of normal and fraudulent transactions in order to learn suspicious transaction patterns. Since the number of fraudulent cases is extremely small compared to non-fraudulent cases, modelling approaches struggle to effectively train models on fraudulent behaviours from the available data. However, synthetic data can be used to train a model on anomalous behaviour. The process renders a greater percentage of transactions that do not fall in line with expected behaviour, thus generating more synthetic samples of the fraud cases for improved model training.

Leveraging these techniques and others, the synthetic datasets that J.P. Morgan's AI Research has developed also include Anti-money laundering (AML) behaviours, customer journey events, market execution data and payments data for fraud detections.



3.2 Increase Efficiency and Effectiveness of Customer Operations with Chatbots and Virtual Assistants

Generative AI can be used to create chatbots and virtual assistants through a combination of natural language processing (NLP) techniques and deep learning models. Generative AI plays a key role in creating chatbots and virtual assistants by enabling them to understand user inputs, generate contextually appropriate responses, and provide interactive conversational experiences. Through training models on financial institution specific datasets, the chatbots can better understand and interpret customer queries, allowing for more accurate and context-aware responses.

In the process of developing chatbots or virtual assistants, a large dataset of textbased conversations is collected for training. This dataset can consist of real conversations between humans or be generated through simulations. A deep learning model is then trained on this dataset to predict the next word or response in a given context. The trained model is fine-tuned specifically for chatbot applications by exposing it to additional data and feedback, refining its behaviour and aligning it with desired objectives. Dialogue management techniques are implemented to enable the chatbot to understand user inputs, maintain context, and generate appropriate responses. Once trained and fine-tuned, the chatbot is integrated into the desired platform or system, connected to relevant APIs and databases, and deployed to interact with users through various channels.

It is important to ensure that generative AI models used in chatbots and virtual assistants for financial institutions are developed and deployed with rigorous security protocols and compliance measures to protect sensitive customer information and adhere to industry regulations.

During the deployment phase, continuous monitoring and evaluation are crucial to identify and address any issues or limitations in the chatbot's performance. Iterative improvements and updates should be implemented based on user feedback and ongoing usage data.

- **Customer Personalisation:** Chatbots and virtual assistants can provide personalised customer support and assistance. These AI-powered bots can answer customer queries and guide users through various processes. Through understanding customer intent and context, these virtual assistants can deliver personalised experiences, improving customer satisfaction and reducing response times.
- **Customer Operations Efficiency:** Streamline your financial institution's processes by automating repetitive tasks and workflows. Chatbots equipped with generative models can handle routine customer requests, such as balance inquiries, fund transfers, transaction summaries, bill payments, or educational content based on user queries without human intervention, thereby improving efficiency and reducing response times.
- Fraud Detection and Security: Chatbots can leverage generative AI to enhance fraud detection and security measures. Through analysing transactional patterns, user behaviour and historical data, generative AI models can identify suspicious activities or potential fraud attempts, enabling chatbots to provide proactive alerts and assist customers in safeguarding their accounts.
- **Customer Service Training:** Financial institutions can create realistic chatbot scenarios for training purposes. They can use these scenarios to train customer service representatives and improve their ability to handle customer inquiries effectively. Using generative AI to create these scenarios, financial institutions can simulate a wide range of scenarios and prepare their customer service representatives for a variety of customer interactions.
- Virtual Financial Advisors: Financial institutions can empower chatbots to act as virtual financial advisors. Through integrating advanced generative models, chatbots can simulate conversations akin to those with human financial advisors. They can provide guidance on budgeting, financial planning, investment strategies, or retirement planning, helping customers make informed decisions.

Chatbot Implementation to Educate and provide Realtime Information to Customers -Crypto.com⁸

Crypto.com, a leading cryptocurrency exchange company is trusted by more than 80 million customers worldwide and is an industry leader in regulatory compliance, security and privacy. They are expanding their innovation pipeline by introducing their very first Artificial Intelligence (AI) powered initiative called Amy. Crypto.com is currently conducting a pilot program with Amy to gather valuable insights before expanding the AI-powered resource and other future AI capabilities on a wider scale.

Amy is an AI companion, designed to assist users in understanding the crypto industry by offering near real-time information on specific tokens and projects, as well as detailed price listings and historical events. This initiative seeks to serve as a reliable crypto expert for the average user, leveraging deep learning and data to help them seize opportunities in the rapidly evolving crypto sector. The underlying technology for Amy is based on OpenAI's ChatGPT, which is further enhanced through targeted training with specific case examples. This enables Amy to deliver more accurate and relevant results to Crypto.com users.

This pilot project is in its Beta phase and is currently available to select users. Access to Amy will be steadily scaled to more Crypto.com users over time. Amy does not provide financial or investment advice, given it is in a pilot Beta phase. The technology is continuously learning and these learnings from the pilot will be applied to Amy's continued rollout, as well as future AI-powered projects from Crypto.com.

We see incredible potential and opportunity in the convergence of AI with the crypto industry and our platform specifically. We are bullish on the innovation of AI in crypto, and we look forward to continuing to enhance the utility of Amy and deploy additional AI-powered capabilities."



Abhi Bisarya Global Head of Product Crypto.com







3.3 Deliver Personalised Marketing Campaigns and Product Offers Efficiently and Increase Conversion

Generative AI can be used to create personalised marketing content that is tailored to individual customer preferences and behaviours by analysing vast amounts of customer data, including but not limited to transaction history, demographics, browsing behaviour and social media activity.

Leveraging the data available at the organisation, AI algorithms can segment customers into different groups based on their preferences, needs and financial behaviours. This segmentation helps financial institutions understand their customers better and enables the generative AI to create targeted marketing campaigns and targeted offers for products or services that are most relevant to each customer.

Examples:

- **Content Generation (Written):** Generate personalised marketing content, including advertisements, blogs, whitepapers, copy for digital or print and social media posts. Through understanding customer preferences, browsing patterns and demographic information, AI algorithms can generate tailored content that resonates with individual customers. This approach allows financial institutions to deliver personalised messages and product information to their target audience, increasing engagement and conversion rates.
- Content Generation (Visual): Create commercials, how to videos, new images, music and jingles aligned with your brand voice to help market and promote new product offerings.
- **Predictive Analytics:** Leverage predictive analytics to forecast customer behaviour and preferences. Through analysing historical data and market trends, AI models can predict future customer needs, anticipate life events, and identify potential cross-selling or up-selling opportunities. Financial institutions can use these insights to design personalised product offerings and marketing campaigns that align with customers' future requirements.

- **Product Recommendations:** Generative AI algorithms excel at recommendation systems. Through analysing customer data and understanding their financial goals, risk tolerance and investment patterns, AI models can suggest personalised financial products and services. These recommendations can include investment opportunities, insurance plans, loan options, or savings accounts that align with the customer's specific needs and preferences. More detailed examples include:
 - **Personalised Mortgage Offers:** Create personalised mortgage offers based on customer data. Through analysing customer behaviour and credit history, financial institutions can create offers that are tailored to each customer's individual needs and financial situation, improving the likelihood of successful mortgage applications.
 - **Personalised Credit Card Offers:** Create personalised offers for credit cards and other financial products based on customer transaction data. Through analysing customer behaviour and preferences, financial institutions can create targeted offers that are more likely to be relevant to each customer. For example, if a customer frequently purchases groceries at a particular store, generative AI can create a personalised offer for a credit card that provides cashback rewards for grocery purchases.
- **Personalised Email Campaigns:** Create personalised email marketing campaigns by analysing customer behaviour and preferences, and then creating email marketing messages that are tailored to individual customer needs and interests. This can increase customer engagement and improve the effectiveness of marketing campaigns.

Advanced Chatbot to close Knowledge Gaps and provide Personalised Client Experiences

-Morgan Stanley[°]

Morgan Stanley is introducing an advanced chatbot that leverages OpenAI's latest technology to assist the bank's extensive network of financial advisors. After conducting tests with 300 advisors, the bank plans to deploy the chatbot widely in the coming months.

The primary objective of this tool, which has undergone a year-long development process, is to empower the bank's approximately 16,000 advisors with easy access to its vast reservoir of research and data. Through combining search capabilities with content creation, the model enables wealth managers to promptly locate and customise information for any client, regardless of the situation.

Operating on GPT-4, a more advanced iteration of the underlying technology behind ChatGPT, the tool swiftly addresses advisors' queries. Instead of drawing responses from the entire expanse of the internet, it generates answers solely from the roughly 100,000 meticulously reviewed research pieces that Morgan Stanley has authorised for this purpose. This focused approach aims to minimise errors. Additionally, the bank employs human oversight to ensure response accuracy and further mitigate potential mistakes. The bank is confident in deploying the tool over time with highquality information, better models and an ongoing monitoring process.

"People want to be as knowledgeable as the smartest person in our firm. This is like having our chief strategy officer sitting next to you when you're on the phone with a client."



Jeff McMillan Head of Analytics, Data and Innovation Wealth Management Division Morgan Stanley





3.4 Reduce Tech Debt and Deliver Software Faster through Code Generation

Generative AI offers tremendous potential in revolutionising code generation for financial institutions, enabling them to tackle technical debt and expedite software delivery. Through harnessing the power of machine learning models, generative AI can analyse large codebases, identify patterns, and generate code snippets or complete modules based on desired functionalities or specifications. Financial institutions can now automate repetitive tasks, improve code quality, expedite development cycles and enhance their software offerings. As a result, financial institutions can reduce the likelihood of introducing errors and inconsistencies, improve customer experiences and maintain a competitive edge in the rapidly evolving financial services industry.

However, it is important to note that while generative AI can accelerate code generation, it does not replace human developers. Rather, it complements their skills and expertise, providing them with powerful tools to streamline and augment their coding processes, allowing developers to focus their efforts on more critical and creative aspects of software development.

Examples:

- Enhance Code Quality and Maintain Consistency: Machine learning models can learn from existing high-quality code examples and generate new code that adheres to the same standards. This consistency not only reduces the chances of introducing bugs but also facilitates collaboration among developers and promotes maintainability.
- **Refactoring Legacy Code:** Through analysing patterns and best practices from well-structured codebases, AI models can identify areas in legacy code that require improvement or optimisation. This capability enables financial institutions to address technical debt systematically, improving code quality, enhancing performance and reducing the risk of system vulnerabilities.
- Scalability and Efficiency: Financial institutions can scale their software development efforts through automating repetitive coding tasks, such as generating similar components or modules so developers can build applications more efficiently. This enables financial institutions to handle larger workloads, rapidly prototype new features and respond to market demands quickly.

- Accelerating Software Development Cycle: Through automating certain coding tasks, developers can focus on higher-level design and problem-solving, enabling faster turnaround times for new features, bug fixes and software updates. This agility is particularly valuable for financial institutions operating in a competitive landscape, where rapid software delivery is crucial for staying ahead of customer expectations and market trends.
- Knowledge Transfer and Onboarding: Through analysing existing codebases and generating code snippets with explanations, AI models can help new team members understand the financial institution's coding practices and internal frameworks more effectively. This reduces the learning curve, promotes faster integration into development teams, and facilitates knowledge sharing within the organisation.
- **Rapid Prototyping and Experimentation:** Developers can leverage AI models to generate code skeletons or initial implementations, providing a starting point for building new features or exploring innovative ideas. This accelerates the prototyping phase, enabling faster iterations and feedback loops, ultimately leading to more robust and feature-rich finance applications.
- Legacy System Integration: For financial institutions with legacy systems, generative AI can assist in bridging the gap between old and new technologies. AI models can generate code snippets that facilitate seamless integration between modern software components and existing legacy systems. This helps financial institutions modernise their infrastructure, leverage new technologies and enhance the functionality of their legacy applications.
- **Continuous Improvement:** Through collecting feedback from developers, analysing code quality metrics, and monitoring the performance of generated code, AI models can adapt and refine their code generation capabilities. This iterative process ensures that the generated code aligns with evolving development practices and specific requirements of the financial institution.

Code Generation and Testing to Increase Efficiency in Software Development

-Goldman Sachs¹⁰

Goldman Sachs is currently conducting internal experiments with generative AI tools to support its developers in automating code generation and testing. Although still in the "proof of concept" stage, the bank's developers are already utilising some assisted coding technology. While not all critical workloads are immediately transitioned, the focus is on exploring the potential of generative AI. In recent years, Goldman Sachs has made significant investments to transform into a more technology-driven organisation.

Goldman Sachs CIO Marco Argenti emphasises that AI should not replace software developers but rather serve as a complementary tool to enhance their productivity. According to him, developers have experienced up to 40% automation in code writing using generative AI. The software is utilised for both code testing and code generation.

However, there is recognition that using GPT-like technology to test the code or generate tests for GPT-generated code creates a dualistic scenario. It involves testing the machine and leveraging the machine to test the developers' work. This approach ensures comprehensive code evaluation and fosters a collaborative relationship between developers and generative AI tools.

"I've been in technology probably almost four decades or so, and this is one of the biggest disruptions I've ever seen. Probably comparable to the internet, apps, the cloud — it's that order of magnitude."



Marco Argenti Chief Information Officer Goldman Sachs





3.5 Increase Efficiency in Document Review and Generation for Legal, Risk and Compliance Teams

Generative AI provides extensive support to legal, risk and compliance teams, revolutionising their operations and enabling more efficient and effective processes. Through harnessing the capabilities of machine learning models, generative AI can analyse vast volumes of legal documents, regulatory guidelines and compliance frameworks. This advanced technology allows for the quick and accurate identification of relevant information, automating document review processes, and ensuring adherence to legal and regulatory requirements.

Implementing generative AI use cases for legal, risk and compliance teams yields numerous advantages. These include heightened efficiency and productivity, improved accuracy and compliance, proactive risk management, significant time and cost savings, enhanced regulatory compliance, streamlined processes and access to valuable data-driven insights.

Financial institutions that capitalise on these benefits can operate more effectively, mitigate risks proactively, ensure regulatory compliance, optimise resource allocation and foster a more streamlined and efficient workflow.

Examples:

- **Document Review Automation:** Through analysing vast volumes of legal documents, regulatory guidelines and compliance frameworks, generative AI systems can quickly identify relevant information and ensure adherence to legal and regulatory requirements. This automation saves time and effort, enabling professionals to focus on higher-value tasks that require human judgment and expertise.
- **Risk Assessment and Mitigation:** Leveraging historical data and utilising predictive analytics, AI models identify patterns and predict potential risks or compliance issues. This empowers the generative AI to document and provide to management appropriate risk mitigation strategies to proactively address threats to the financial institutions operations, reputation and regulatory compliance.

- Legal Document Drafting: Generative AI streamlines the drafting of legal documents within the department. Utilising predefined templates, legal clauses and language patterns, AI models generate initial drafts of contracts, policies or other legal documents. This accelerates the document creation process while ensuring accuracy and compliance. Legal professionals can then review and refine these drafts, leveraging the AI-generated starting point to save time and effort in the initial drafting stages.
- Monitoring and Analysing Regulatory Changes: Through processing and interpreting updates to legal and regulatory frameworks, AI systems highlight relevant changes, ensuring that the bank remains up to date with evolving compliance requirements. This capability enables generative AI to proactively address modifications needed in internal policies, procedures and risk management practices, reducing compliance gaps and maintaining regulatory compliance.
- Automation of Compliance Tasks: Generative AI can automate routine compliance tasks, such as Know Your Customer (KYC) checks and Anti-Money Laundering (AML) processes. AI algorithms can analyse customer data, identify potential risks and flag suspicious activities more efficiently. Generative AI can create the required compliance documents for internal and audit purposes. This streamlines compliance processes, reduces manual effort and improves the accuracy and effectiveness of risk detection. Automation enables the department to handle larger workloads, enhance efficiency and maintain a robust compliance framework.

Custodial Agreement Generation to Increase Efficiency of Internal Legal Processes -BNY Mellon¹¹

BNY Mellon embarked on an initiative to automate the process of generating custodial agreements, leveraging AI powered by machine learning (ML) and natural language processing (NLP). This implementation aimed to streamline contract generation, review and management, simplifying the stages of the review process. Customised AI tools were developed to evaluate new custodial agreements based on BNY Mellon's internal rules, guidelines and processes.

The generative AI technology automatically generates tailored initial contracts and coordinates digitally with the relevant internal stakeholders to obtain approval for special terms. It efficiently identifies non-standard language and alerts the appropriate legal team members, automating the decision-making process and freeing up attorneys to focus on strategic tasks. As a result, BNY Mellon can create, customise, update and track contracts in significantly less time. This automation of manual tasks has shortened and streamlined the onboarding process, ultimately enhancing the client experience.

BNY Mellon aims to further improve contracting efficiency and establish timely and appropriate escalation protocols for deviations from standard contract language. The digitisation of agreements enables the bank to generate an instant "best first draft" customised for each client, reducing the back-and-forth in contract negotiations.

Looking ahead, BNY Mellon plans to embrace the future of AI by utilising both NLP and ML to monitor risk exposure in contracts. AI will be leveraged to identify nonstandard contract language, establish an alert system for ongoing obligations, unsigned contracts, upcoming renewal dates and continuously monitor compliance as regulations evolve. This proactive approach will enhance risk management and ensure compliance in an ever-changing regulatory landscape.



4. Delivering Generative AI Applications



4.1 Generative AI Delivery Methodology

To successfully implement Generative AI applications within any organisation takes proper planning, design, implementation and ongoing monitoring. Our experienced AI team has developed a methodology to help organisations introduce Generative AI capabilities into their business.

1. Define Goals and Use Cases	2. Assess Data Required	3. Select a Framework	4. Build a Team
 Define clear goals for implementing generative AI. Identify specific use cases where generative AI can add value. This could involve analysing existing processes, identifying pain points and determining where generative AI can improve efficiency or accuracy. 	 Generative AI requires large amounts of high-quality data to be effective. Assess the availability and quality of data within the organisation. Determine if additional data is required from external sources. 	• There are several generative AI frameworks available. Select a framework that aligns with your organisation's goals, use cases and technical capabilities.	 Build a team of experts that include data scientists, engineers and domain experts who can work together to design, implement and maintain the generative AI system. To ensure responsible development of AI systems, refer to section 6 of this report - "Developing generative AI capabilities responsibly."
5. Design and Train the Model	6. Test and Validate	7. Integrate and Deploy	8. Monitor and Maintain
 Develop the architecture and select the training data. Design and train the generative AI model using the selected framework. Fine-tune the model to achieve the desired outcomes. 	 Test and validate the model for accuracy and effectiveness. Compare the results generated by the model to actual outcomes and evaluate how well it performs in different scenarios. 	 Integrate model into existing systems and deploy across the organisation. Develop APIs or other interfaces to allow different systems to communicate with the model. Provide training and perform change management activities to support integration with your workforce. 	 Continuous monitoring and maintenance are essential to ensure that the generative AI model remains effective and accurate over time. This involves monitoring performance metrics, updating the model as needed and addressing any issues or errors that arise.



4.2. Technical Pathways and Organisational Requirements

The organisational requirements for generative AI range from low to high, depending on your technical pathway



Technical pathway	Costs	Tech talent	Proprietary data	Process adjustments
Use software-as-a- service (SaaS) tool				
Build software layers on model API				
Fine-tune open-source model in-house				
Train a foundation model from scratch				

The technical pathway an organisation selects will impact the organisational requirements needed for a successful implementation.

The impact across cost, technology talent, proprietary data and process adjustment will range from low to high, depending on the generative AI use case selected.

Use case selection will require a balance of return on investment, risk, culture and the organisation's in-house capability.

I would say the most scarce resource today is actually talent, because AI needs to be customized for your business context.²

Andrew Ng

Founder & CEO - deeplearning.ai Adjunct Professor of Computer Science - Stanford University Founder - Google Brain (Deep Learning) Project Former Chief Scientist - Baidu

Figure 9 - Organisational requirements for generative AI based on technical pathway selected¹²



5. Challenges and Risks when implementing Generative Al

Mitigating the risk of Generative AI requires more than just technical expertise - it demands a multidisciplinary approach

In order to fully harness the advantages of adopting generative AI, it is crucial for boards and senior management to cultivate a thorough strategic comprehension of generative AI technology and formulate a corresponding plan. This entails understanding its potential applications, both intended and unintended within the organisation, as well as comprehending the implications from a risk management standpoint.

Whenever an exciting new technology emerges, there is always a risk of misuse if it is launched without the appropriate checks and balances in place. Ensuring responsible development and implementation of these technologies is paramount to attaining their intended objectives while minimising organisational risks. This can only be accomplished by implementing a comprehensive end-to-end production process that diligently addresses and mitigates all potential risks to an appropriate level before the technology is deployed.

Some Al risks are technical and require technological tools and support to overcome



Other Al risks are social, economic and ethical and need a different set of tools to manage



Risks with both technical and other elements



Figure 10 - Generative AI Risk Ecosystem¹³

6. Developing Generative Al Responsibly

Responsible AI is an approach to developing and using AI that takes into account the potential impacts and consequences of AI on individuals, society and the environment. It aims to ensure that AI is developed and used ethically, transparently, and in a way that promotes fairness, accountability and sustainability.

Financial institutions need to consider the ethical and social implications of AI at every stage of the AI development life cycle, from data collection and model training to deployment and monitoring. It also involves including diverse stakeholders, such as ethicists, social scientists, policymakers and community representatives, in the development and deployment of AI systems.

Some key principles of responsible AI include:

- Fairness and Non-Discrimination: AI systems should be designed to treat all individuals fairly and without bias or discrimination.
- **Transparency and Explainability:** AI systems should be transparent and explainable, so that individuals can understand how the system works and how it is making decisions.
- **Privacy and Security:** Al systems should be designed with strong data privacy and security protections to ensure that sensitive data is not misused or compromised.
- **Accountability:** Al developers and users should be accountable for the decisions and outcomes of Al systems, and should be able to explain and justify how the system is making decisions.
- Accuracy and Reliability: Depending on the type of AI system deployed, accuracy based models should be designed to produce consistent outputs to similar prompts.
- Social and Environmental Impact: Al should be developed and used in a way that promotes social and environmental sustainability, and does not have negative impacts on individuals or society as a whole.

Responsible AI aims to ensure that AI is developed and used in a way that maximises its benefits while minimising its potential harms. Through adopting responsible AI practices, financial institutions can build trust with their customers, employees and stakeholders, contributing to a more just and equitable society.







7. Organisation Wide Considerations

To remain competitive - leaders within the financial services industry need to be proactive and resilient

As we head into the 'Productivity Revolution' over the next decade, doing nothing is no longer an option. Leaders within financial institutions need to be proactive in laying down the foundations (people, process and technology) to tap into this powerful technology to remain competitive in the future; however, they also must be resilient and build adequate processes to manage risks.

Implementing generative AI is multi-disciplinary approach. We have provided some high level organisation wide questions below for business leaders, that are more broader than technology for consideration:

- How can our organisation swiftly seize the potential value highlighted in this report, while effectively managing the risks associated with generative AI?
- How will generative AI and other artificial intelligence impact the composition of job roles and required skills within my workforce in the coming years?
- How will my organisation facilitate these workforce transformations through its hiring strategies, retraining initiatives and other human resources considerations?
- Does my organisation bear a responsibility in preventing the deployment of generative AI in "negative use cases" that may have detrimental effects on society?
- How can my organisation proactively and transparently share its experiences in scaling the use of generative AI within and across industries, as well as with governments and society at large?

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A well-planned, evidence based and empathetic approach to the people side of change, is essential to achieving successful and safe organisational transformation when it comes to Generative AI. It not only activates long lasting change, but also safeguards against potential psychosocial risks.

Assessing what could create threat and reward states for employees, what are the social and cultural norms (of the organisation and impacted teams), how are barriers to change being removed and enablers being enhanced, and designing interventions and experiences accordingly, will assist in activating embedded, sustained and scalable change.



Michelle Teunis Founder & Principal - Collabwise Global Change & Transformation Leader Former UBank, CBA, Westpac & Suncorp



8. Building Blocks for the Productivity Revolution

The building blocks for enterprise grade generative AI applications are maturing at pace

Gartner's Emerging Technologies and Trends Impact Radar portrays the maturity, market momentum and influence of technologies. It allows product leaders to identify and track the technologies and trends that will help them improve and differentiate their products, remain competitive and capitalise on market opportunities.

Below we have identified the suite of technologies that will enable the scaling of generative AI applications over the next few years.

- Smart World: The world as we know it is changing, and thanks to AI, everyday objects are getting smarter, interactions are shifting from only physical to virtual and hybrid. Multimodal UI are transforming human-machine interaction, making it more natural, as well as enabling a new era of intelligent software powered by AI.
- Critical Enablers: Recent AI advancements in Foundation Models, are improving model intelligence and functionality. As mentioned earlier in section 1.3, foundation models are augmenting the accuracy of transcription, language processing and text analytics. In addition to AI, hardware also plays an important role in enabling future application advancement. For example, Hyperscale Edge Computing and Neuromorphic Computing will provide higher compute capability, which means more complex and larger algorithms can run closer to the point of data generation, delivering real-time intelligence and insight. These hardware developments, in conjunction with the aforementioned software advancements, will enable the next generation of high-performing AI applications.
- Productivity Revolution: Key AI tools such as Synthetic Data and Model Compression are enabling organisations to overcome AI adoption inhibitors such as access to sufficient data and model size. As mentioned earlier in section 3.1, synthetic data is the synthetic generation of datasets to help organisations overcome data access challenges to AI adoption. On the other hand, model compression can significantly reduce a model's size, with negligible performance impact, meaning larger, more complex algorithms can be deployed on resource-constrained devices. Together, these technologies will unlock new potential for existing and future AI and Generative AI applications.

Transparency and Privacy: The organisation's adoption and scaling of generative AI in the smart world will depend not only on its capabilities, maturity and ability to deliver business values; but also its sharp focus with regard to the transparency of AI decisions and regulatory compliance. Technologies enabling transparency and privacy include Digital Ethics, Responsible AI, Human-Centred AI and Decentralised Identity. This challenge requires tech providers and financial institutions to be ethical and responsible with AI-enabled systems from the design phase to mitigate AI risks, deliver equitable outcomes, respect privacy and enable explainability of AI-based outcomes. Many technologies in this segment will uncover hidden sources of value within data but will accomplish this in an ethical and responsible way, as well as provide a path to protecting privacy in a future smart world.



Figure 11 - 2023 Gartner Emerging Technologies and Trends Impact Radar¹⁴

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Generative AI applications can benefit from decentralised identity by tailoring their outputs based on individual user preferences and behaviour. Users can grant access to specific elements of their identity, enabling AI models to create personalised content without exposing sensitive information. In addition, implementing strong encryption and privacy protection measures through decentralisation, reduces the risk of data breaches and unauthorised access. This fosters trust among users, encouraging them to participate more willingly in generative AI applications across the financial services ecosystem. Our Block Identity platform is taking this one step further, whereby information that is propagated without consent is able to be tracked back to the originator who shared the information. This has the benefit of being able to enforce and govern self-sovereign privacy and consent controls that stop data misuse and proliferation.



Robert Morrish Chief Executive Officer Cybe

Final Thoughts

Throughout history, emerging technologies have consistently reshaped societies. Artificial intelligence, in particular, has already revolutionised our daily lives and professional landscapes. From enabling our phones to understand our speech, providing product recommendations, to assisting in email composition, AI has quietly worked its magic. Yet, its true potential lies in the rapid advancement of generative AI, which is poised to amplify the overall impact of AI. This transformative technology has the potential to generate trillions of dollars in additional value annually while fundamentally transforming the very essence of work as we know it.

The financial services industry is well positioned to harness the power of generative AI given the volume of data these organisations hold, their investment in technology, extensive customer-facing workforce, stringent regulatory landscape and large white collar workforce. It has the potential to transform the financial services industry by improving customer experiences, enhancing operational efficiency, reducing fraud and risk, and ensuring compliance with regulatory requirements.

However, as with any new technology, there are also significant risks and considerations that financial institutions must take into account when implementing generative Al models. These include the potential for bias and ethical concerns, security risks, accuracy and reliability issues, over-reliance on the technology, as well as legal and regulatory compliance. To successfully implement generative AI models, financial institutions must carefully consider these risks and take appropriate measures to mitigate them. Following a proven AI methodology for implementation, financial institutions can reap the extraordinary benefits of generative AI while ensuring that they are using the technology in a responsible and ethical way that benefits all its stakeholders.

While certain tasks may be automated, it is crucial to recognise that human judgment, critical thinking and emotional intelligence remain invaluable in many professional domains. As the workplace evolves, financial institutions will need to strike a balance between leveraging generative AI for enhanced efficiency and harnessing the unique abilities of human workers to drive innovation and maintain a human touch.

In the ever-evolving realm of financial services, where data reigns supreme and decisions hold the power to shape economies - generative AI promises to revolutionise the way we understand, predict and navigate the intricate world of financial services.



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