Financial Institutions and System

Week 14: ML/AI and Big Data in Finance.

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Agenda

1. ML/AI and Big Data in Finance
2. Guest Speaker: Dr. Cory Baird
3. Class Activity

1. ML/AI and Big Data in Finance

Why AI/ML in Finance?

- **Volume**: Massive financial data from markets, transactions, sentiment
- **Velocity**: Real-time high-frequency trading, mobile payments
- **Variety**: Structured (prices, balance sheets) & unstructured (news, audio)

> AI turns information overload into actionable insight.

TABLE 1 | **The most promising AI use case examples (contextualized) across financial services**

Industry	Function	Description	Value delivered
Banking 	Sales and service	Customer service agents receive quick and comprehensive information on all aspects of products, policies and processes from a variety of sources	– Greater agent efficiency – Increased response accuracy – Quicker response time
Capital markets 	Client servicing/ investment management	Firms use AI models to create investment portfolios, offer financial assistance and provide clients with real-time insights anc trading recommendations	– Enhanced client satisfaction and retention – Competitive advantage
Payments 	Fraud management and detection	Pre-emptive fraud detection includes technologies that can proactively seek and identify suspicious behaviour or anomalous events before fraudulent transactions[2]	– Improved fraud protection for customers – Enhanced customer experience by minimizing false positives
Insurance 	Claims	The automation of claims and customer document processing[3]	– Improved workflows – Greater agent efficiency – Streamlined document collection and validation
Across financial services 	Risk management and underwriting	Prediction of fraudulent transactions, more effective underwriting processing and risk scoring	– Reduced internal and external risk – Better protection of data – Improved underwriting processing times – Greater accessibility to established credit scoring and evaluation
	Technology development	Streamlining the software development life cycle, from writing code to automation testing[4] as well as understanding and decommissioning of legacy code environments	– Improved workflow and accuracy – Increased efficiency – Shorter development cycles – Reduction in technology debt

Source: Artificial Intelligence in Financial Services

Impact of AI/ML in Finance

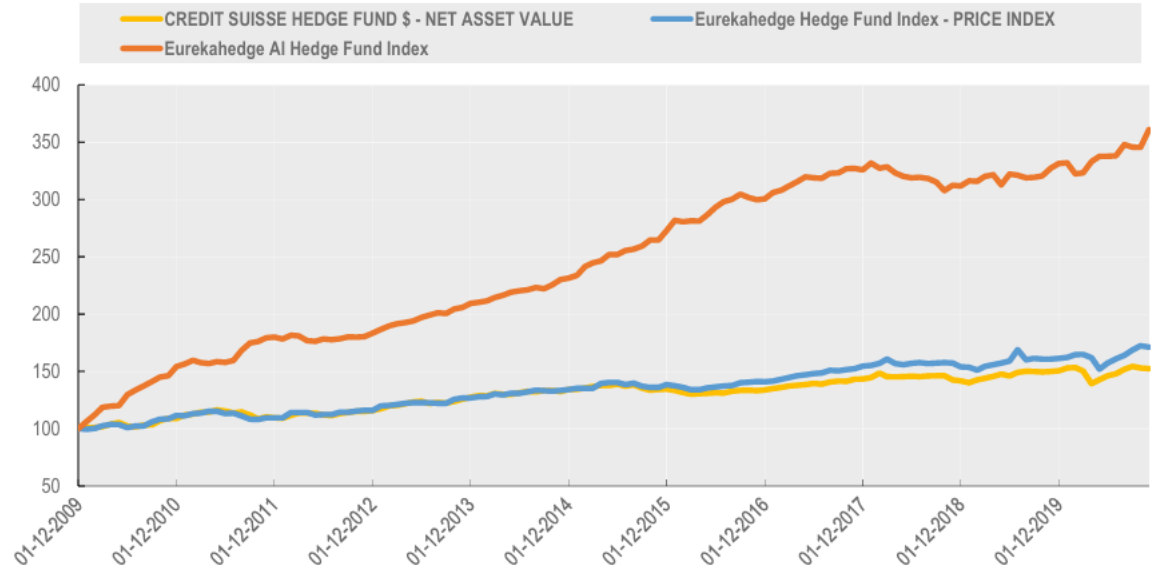
Figure 2. Impact of AI on business models and activity in the financial sector

Source: OECD Staff.

Source: Artificial Intelligence, Machine Learning and Big Data in Finance

Impact of AI/ML in Finance (cont)

Figure 2.3.Some AI-powered hedge funds have outperformed conventional hedge funds

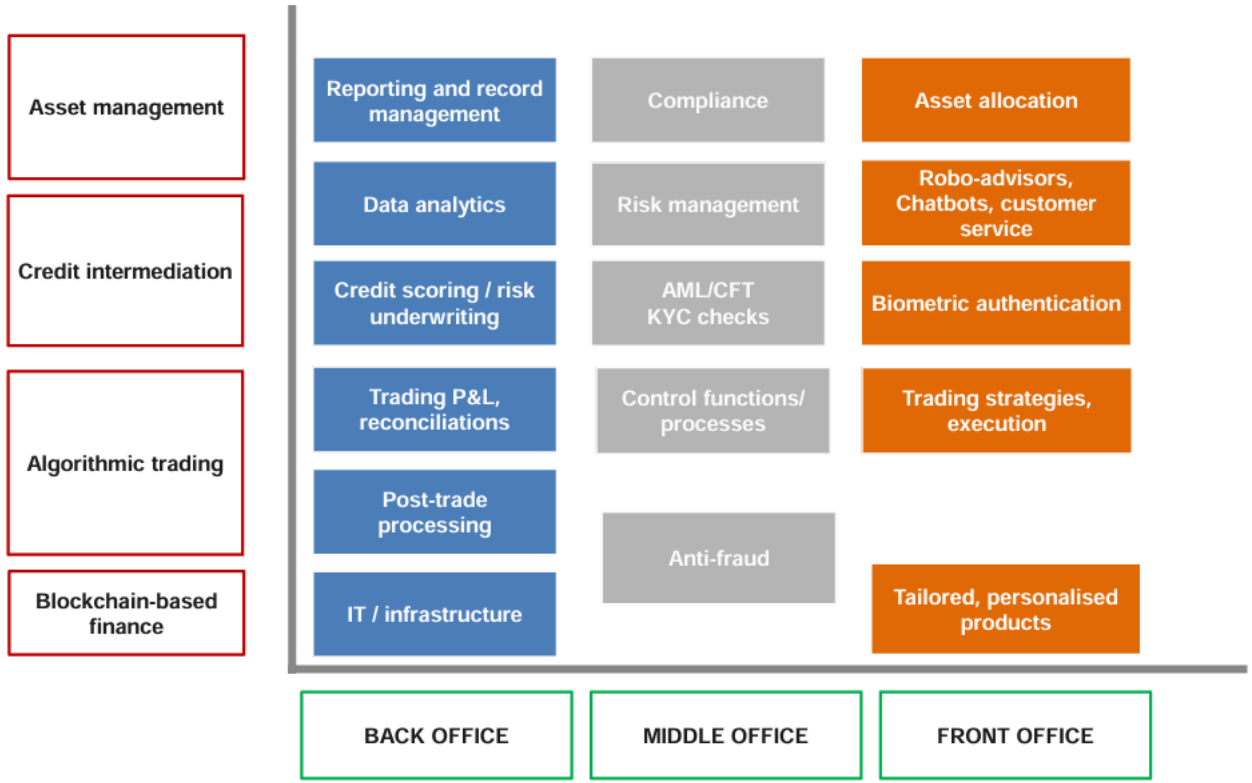


Note: The *Eurekahedge Hedge Fund Index* is Eurekahedge's flagship equally weighted index of 2195 constituent funds. The index is designed to provide a broad measure of the performance all underlying hedge fund managers irrespective of regional mandate. The index is base weighted at 100 at December 1999, does not contain duplicate funds and is denominated in local currencies. The *Eurekahedge AI Hedge Fund Index* is an equally weighted index of 18 constituent funds. The index is designed to provide a broad measure of the performance of underlying hedge fund managers who utilize AI and ML theory in their trading processes. The index is base weighted at 100 at December 2010, does not contain duplicate funds and is denominated in USD. The *Credit Suisse Hedge Fund Index* is an asset-weighted hedge fund index and includes open and closed funds.
Source: Eurekahedge; Datastream, Thompson Reuters Eikon.

Source: Artificial Intelligence, Machine Learning and Big Data in Finance

AI applications in Finance

Figure 2.1. Examples of AI applications in some financial market activities



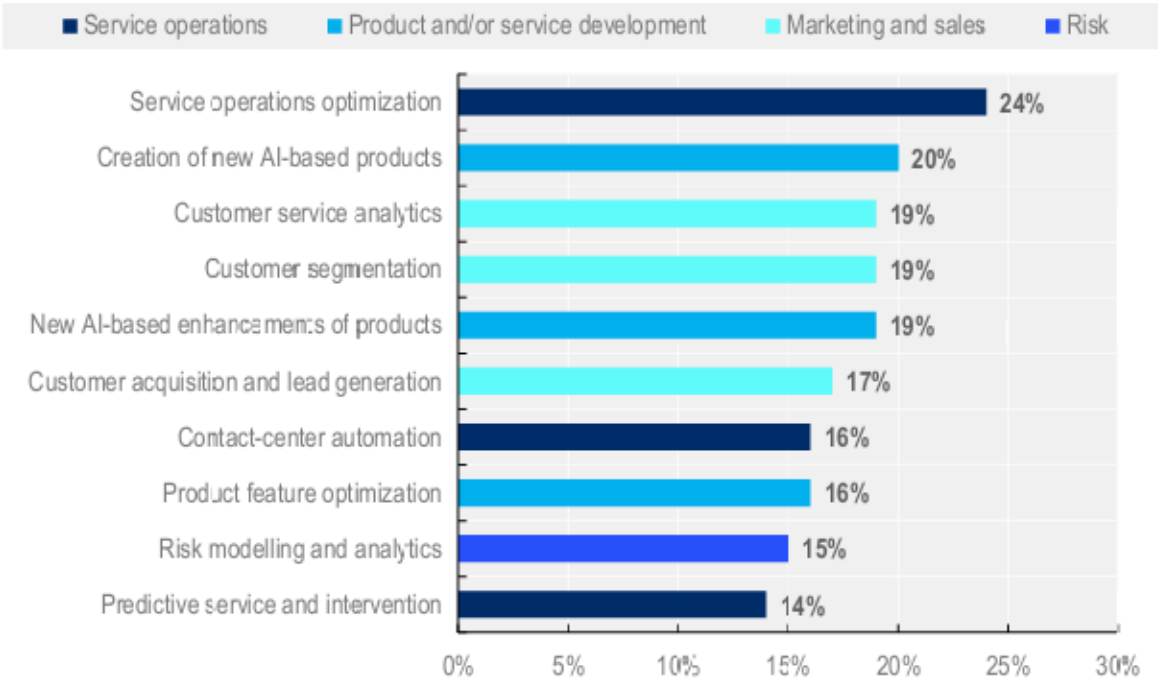
Source: OECD staff illustration.

Source: Artificial Intelligence, Machine Learning and Big Data in Finance

AI applications in Finance (cont)

Figure 1.4. Most commonly adopted AI use cases by financial institutions, 2022

In % of industry survey respondents



Source: McKinsey survey of financial institutions, (McKinsey, 2022[6]).

Source: Generative artificial intelligence in finance

Big Data in Financial Systems

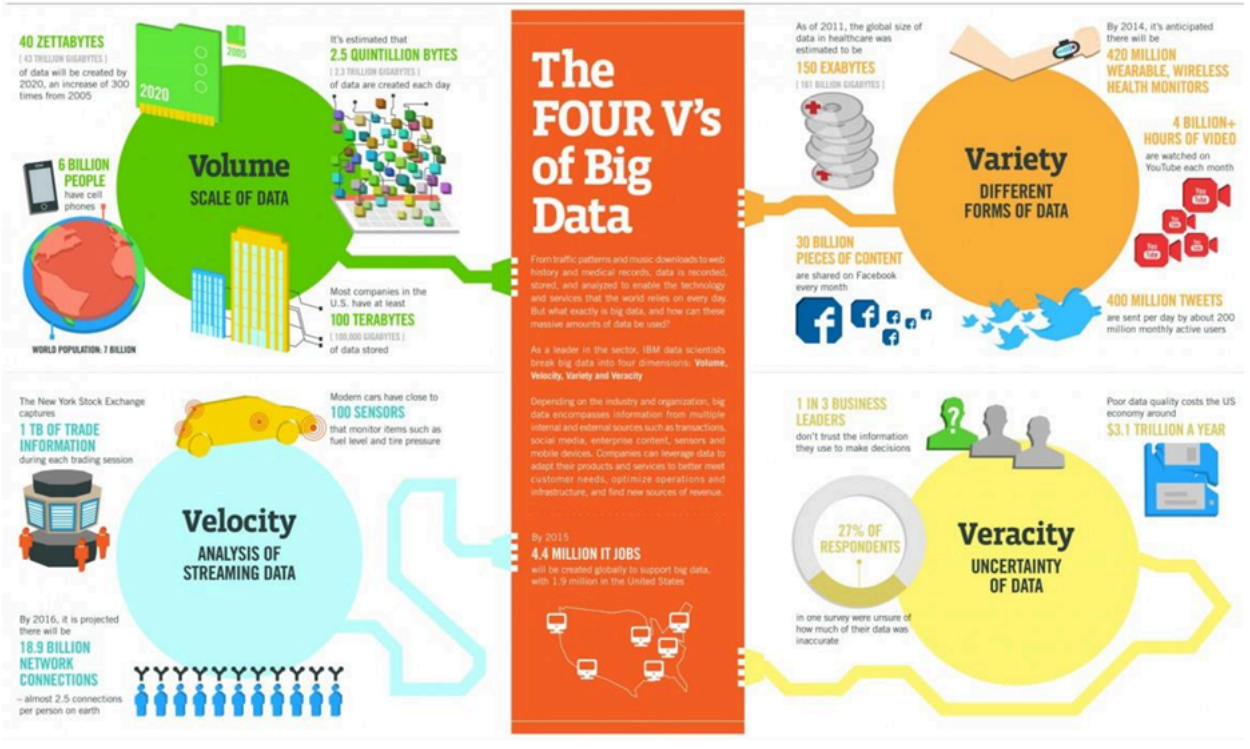
- **Sources**: Credit cards, IoT, mobile apps, ESG databases, satellite imagery
- **Storage & Processing**: Cloud infrastructure, distributed computing (e.g., Hadoop, Spark)
- **Key Tools**: Python, R, SQL, TensorFlow, PyTorch, AWS, Azure

Applications:

- Credit scoring (alternative data)
- AML (fraud networks)
- Insurance underwriting (wearables, GPS)

Big Data 4 Vs

Infographic 1.1. The four Vs of Big data

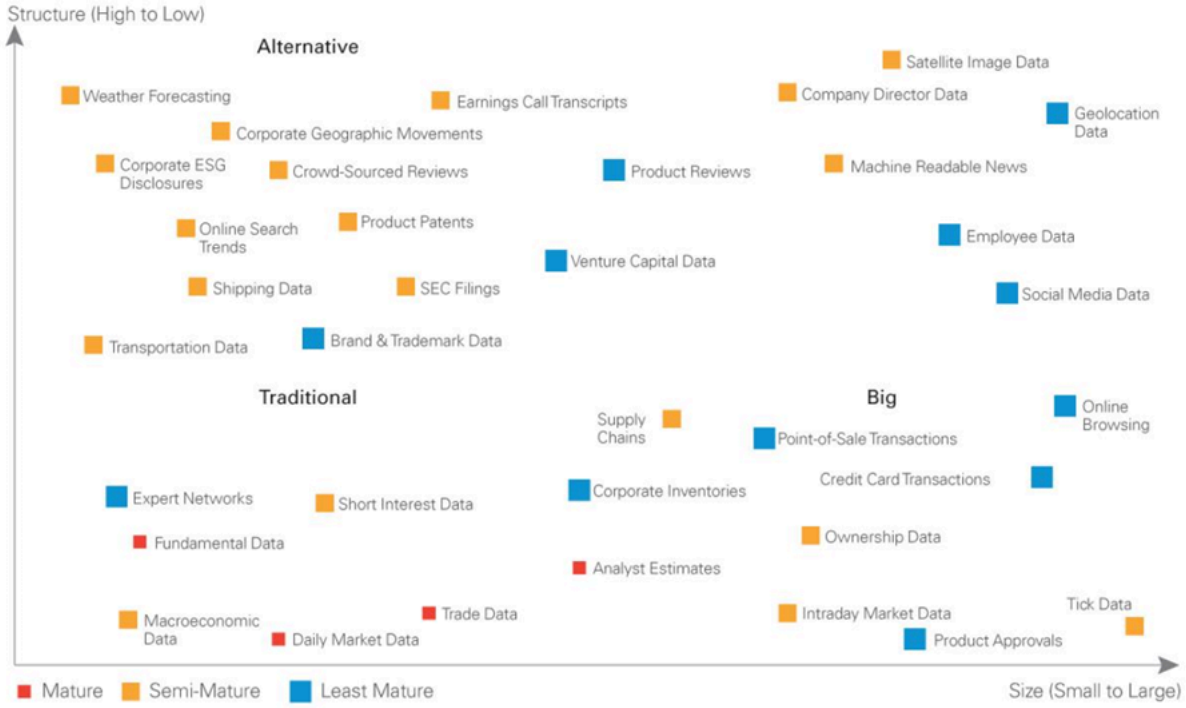


Source: (IBM, 2020[11]).

Source: Artificial Intelligence, Machine Learning and Big Data in Finance

Big Data sources

Figure 1.3. Big data sources



Source: Dell Technologies.

Source: Artificial Intelligence, Machine Learning and Big Data in Finance

ML in Asset Management

Use Cases:

- **Robo-advisors** (e.g., Betterment, Wealthfront)
- **Portfolio optimization** (reinforcement learning)
- **Sentiment-driven trading**

Example:

> Use of NLP to process central bank statements and forecast yield movements

ML in Credit Risk

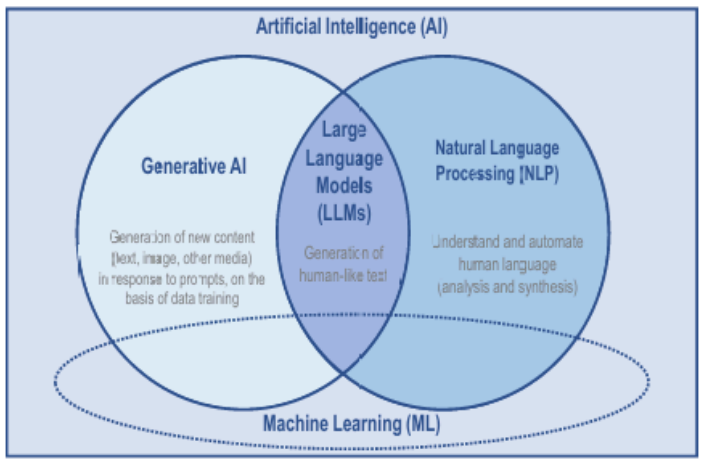
- **Traditional**: Logistic regression on limited variables
- **ML**: Random Forests, Gradient Boosting, XGBoost
- **FinTech**: Use of psychometric, telecom, social media data

Result: Broader inclusion + faster, more granular credit decisions

Generative AI (GenAI) in Finance

- **Report automation** (earnings, analyst reports)
- **Chatbots** for financial services (e.g., Klarna, JPMorgan)
- **Personalized wealth management** (GenAI + client profiling)
- **Synthetic data generation** for stress testing, simulation

Figure 1.1. Generative AI

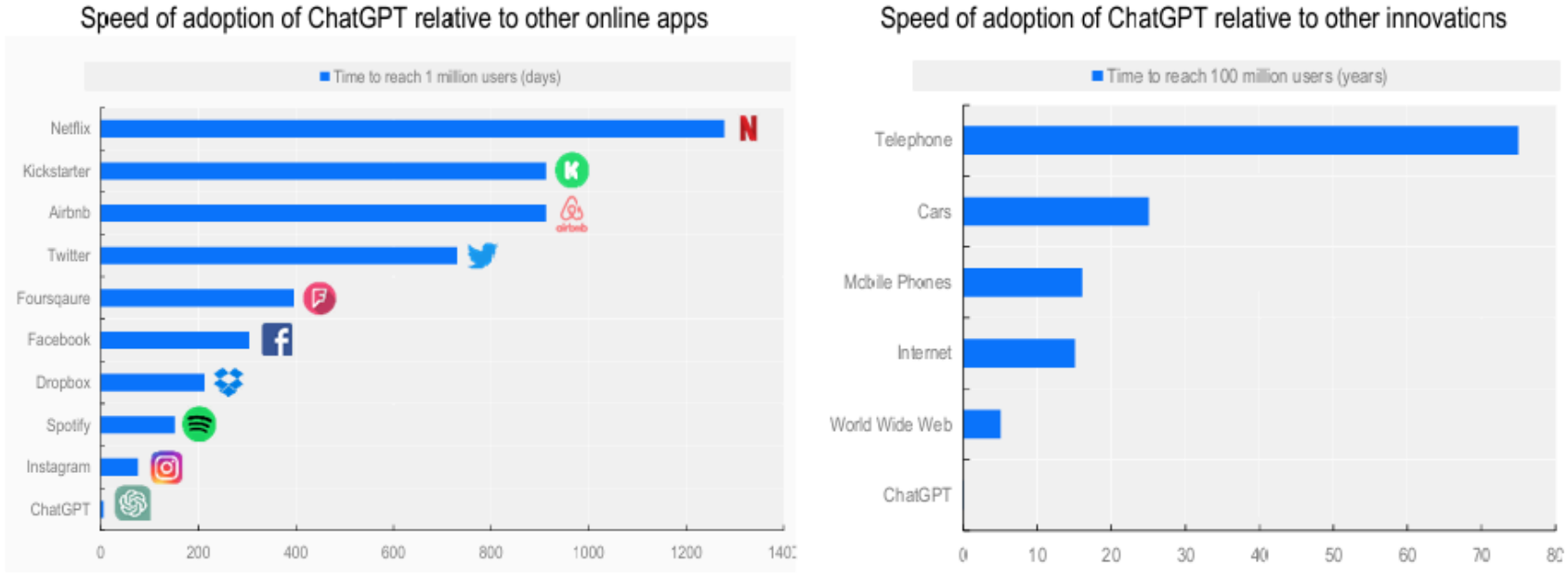


Note: indicative, non-exhaustive representation of AI domains.
Source: OECD authors' illustration.

Source: Generative artificial intelligence in finance

Chat GPT adaptation in Finance

Figure 1.3. Speed of adoption of some GenAI applications



Source: Statista and OECD calculations.

Source: Generative artificial intelligence in finance

Chat GPT adaptation in Finance (cont)

Table 1.1. Select types of GenAI applications by financial services firms

	Segment	Service	Description
Goldman Sachs	Corporate and Investment Banking	Code generation	ChatGPT-style AI in-house to assist developers with writing code
JPMorgan Chase & Co.	Corporate and Investment Banking	Code generation	Toolkit called Senatus to facilitate the software development process through features such as code recommendations
Deutsche Bank	Corporate and Investment Banking	Financial analyst assistant	Testing Google's generative AI and large language models (LLMs) at scale to provide new insights to financial analysts
Bloomberg	Financial research	Financial assistant	Finance-specific LLM trained on Bloomberg data
Brex	FinTech	Expense management	ChatGPT-style CFO tools. Provides insights on corporate spend and answer critical business questions in real time
الآن ALAAN	FinTech	Expense management	Integration of OpenAI's advanced AI technology onto its user platform to provide insights on corporate spend and answer critical business questions in real-time

Source: Generative artificial intelligence in finance

Chat GPT adaptation in Finance (cont)

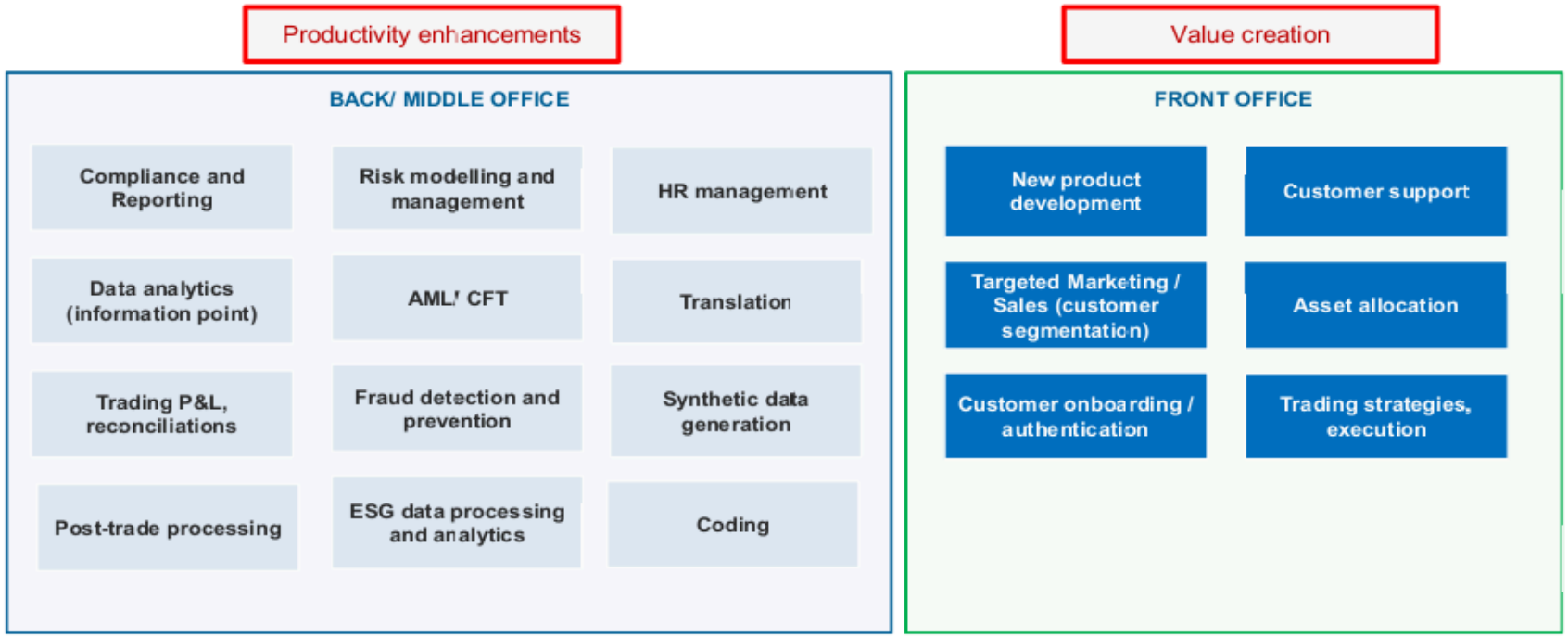
	Segment	Service	Description
CLEO	FinTech	Financial assistant	App connects to bank accounts and gives clients proactive advice and information on finances, including timely nudges, helping stay on top of their spending
CITADEL	Hedge fund	Code, software development, information management	From helping developers write better code to translating software between languages to analyse various types of information
Morgan Stanley	Wealth management	Financial advisor assistant	Financial Advisors to use GPT-4 capabilities to ask questions and contemplate large amounts of content and data exclusively from MSWM content and with links to the source documents
Morgan Stanley	Wealth management	Sales and marketing	Next Best Action is an internally-built AI-based engine that delivers timely, customized messages to clients and prospects guided by the Financial Advisor
Klarna.	FinTech	Product recommendations	Highly personalized shopping experience through curated product recommendations to users asking for advice
TROVATA	FinTech	Treasury tool	Generative AI Finance & Treasury Tool

Note: Non-exhaustive and based on reported information by financial market participants.
Source: OECD based on web research; (2023[15]), Venture & Growth 2023 Outlook, https://vgb.lazard.com/lazard-vgb-insights-2023-outlook/#FinTech; Dadan and Shetty (2023[16]), Generative AI in Finance and Beyond, https://whitesight.net/generative-ai-in-finance-and-beyond/.

Source: Generative artificial intelligence in finance

GenAI applications in Finance

Figure 1.6. GenAI use cases in finance



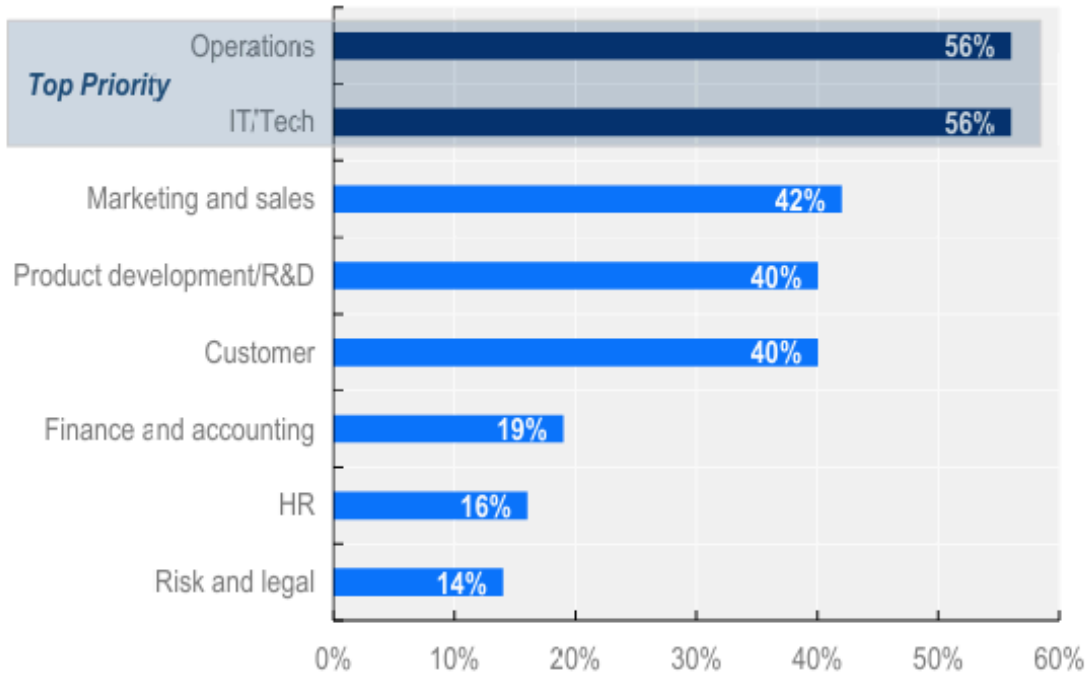
Source: OECD authors' illustration.

Source: Generative artificial intelligence in finance

GenAI applications in Finance (cont)

Figure 1.7. GenAI use cases in finance, 2023

In % of industry survey respondents



Source: (KPMG, 2023[10]).

GenAI Risk and Compliance Tools

- ESG report drafting (e.g., BloombergGPT)
- Explainable AI (XAI) integration with GenAI outputs
- Automated compliance & disclosure document review

> GenAI is becoming a co-pilot in risk and compliance functions.

GenAI Risk and Compliance Tools (cont)

Figure 2.1. GenAI risks and challenges

Bias, discrimination, unfair outcomes

- Inadequate/ poor quality data, use of proxies
- Exacerbated in GenAI models (Can train on data available online, incl. user interaction)

Lack of explainability +++

- Why and how the model generates results -- accentuated in GenAI models
- Incompatible with supervisory frameworks', inability to adjust strategies in time of stress

Data-related risks

- Output quality only as good as training data
- GenAI autonomous self-learning capacity
- Privacy and confidentiality, IP and copyright

Model robustness and reliability of output

- Subpar outcomes for investors/consumers, hallucinations
- Possible degradation due to feedback loops with users

Other risks

- Possible future negative employment effects
- Changing skills needs
- Environmental impact of GenAI model creation

Competition

- Market domination given costs involved
- Data concentration

Financial stability

- Market concentration (models or data)
- Herding and one-way markets, volatility
- **Cheap tool for massive deception; market manipulation / cyber-risk**

Governance

- Lack of accountability, transparency
- **Users not necessarily aware of tools' limits**
- Outsourcing of models, 3rd party dependencies, IP questions (incl. authenticity)

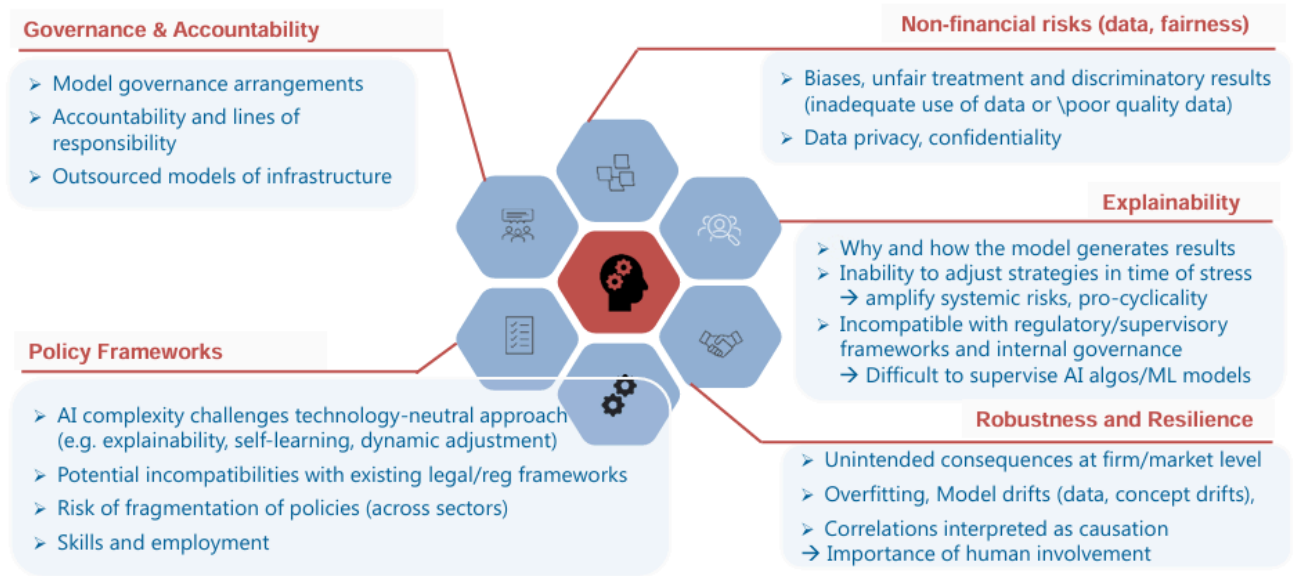
Note: Non-exhaustive list.
Source: OECD authors' illustration.

Source: Generative artificial intelligence in finance

Challenges and Risks

- **Bias** in data (historical inequality)
- **Black-box models** → Low interpretability
- **Cybersecurity** threats with automated systems
- **Regulatory lag** vs tech evolution

Figure 1. Relevant issues and risks stemming from the deployment of AI in finance



Source: OECD staff illustration.

Source: Artificial Intelligence, Machine Learning and Big Data in Finance

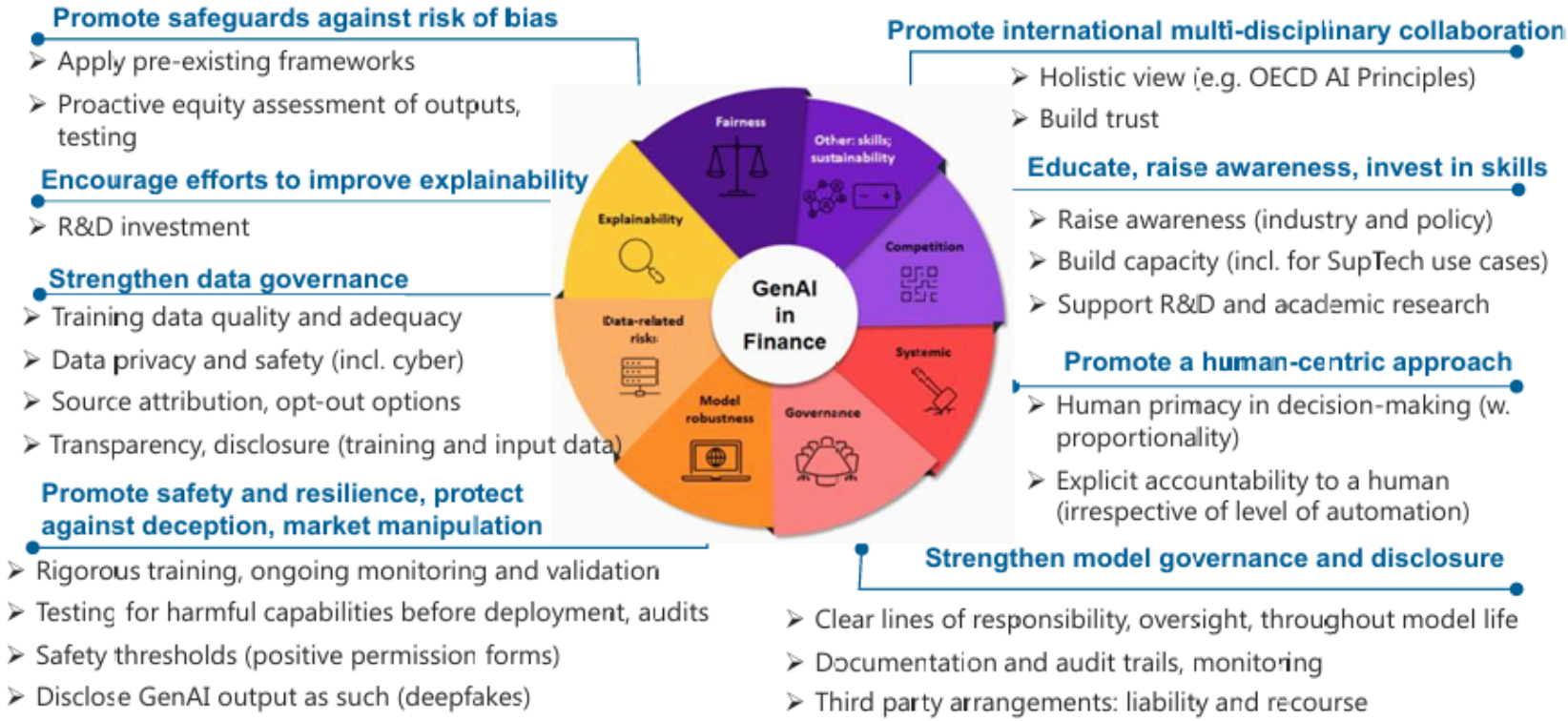
Regulatory Landscape

- **EU AI Act**: Risk-based classification
- **US SEC**: AI & financial advisors' fiduciary duty
- **OECD/WEF**: AI governance frameworks

> Financial AI requires explainability, accountability, fairness.

Policy considerations

Figure 3.1. Potential policy considerations to address GenAI risks in finance



Source: OECD authors' illustration.

Source: Generative artificial intelligence in finance

Key Takeaways

- ML/AI & Big Data are transforming finance
- GenAI adds new opportunities in personalization, reporting, simulation
- Regulation, ethics, and interpretability are critical to adoption
- Institutions must balance innovation and responsibility

Discussion and Q&A

- Which financial function will AI disrupt most?
- Should financial firms adopt open-source or closed-source models?
- How can regulators keep pace with innovation?

Suggested Readings

- OECD (2023). *Artificial Intelligence in Financial Markets*
- WEF (2025). *AI in Financial Services*
- Bank of England. *Machine Learning in UK Financial Services*
- Bartram et al. (2021). *AI in Asset Management*

2. Guest Speaker: Dr. Cory Baird

Dr. Cory Baird

- Senior Analyst, GeoQuant (Fitch Group)
- Visiting Professor, University of Tokyo
- LinkedIn: Cory Baird

Academic Background

- **PhD in Public Policy, University of Maryland**
  - Focus: ML & NLP for Central Bank Communication Analysis
- **Master's in Public Policy, University of Tokyo**
  - Focus: Asian Financial Markets & FX Reserve Management

Professional Expertise

- Develops **NLP systems and MLOps/LLMOps infrastructure** at GeoQuant.
- Analyzes the intersection of **monetary policy and financial markets** using ML models.
- Combines **academic research with industry applications**, enhancing data-driven decision-making.

3. In-class Group Activity

Your Takeaways from the Guest Speaker:

- What are the key insights from Dr. Baird's presentation?
- How can you apply these insights to your own research or work in finance & banking?

Any QUESTIONS?

Thank You!

Next Class

- (June 13)
  - Current Issues on Challenges and Risks in the Modern Financial System: students' presentations