

College of Humanities
Master of Financial
Technology-
Fin Tech

Artificial Intelligence for Financial Technology

FNT 626

Lecture 10

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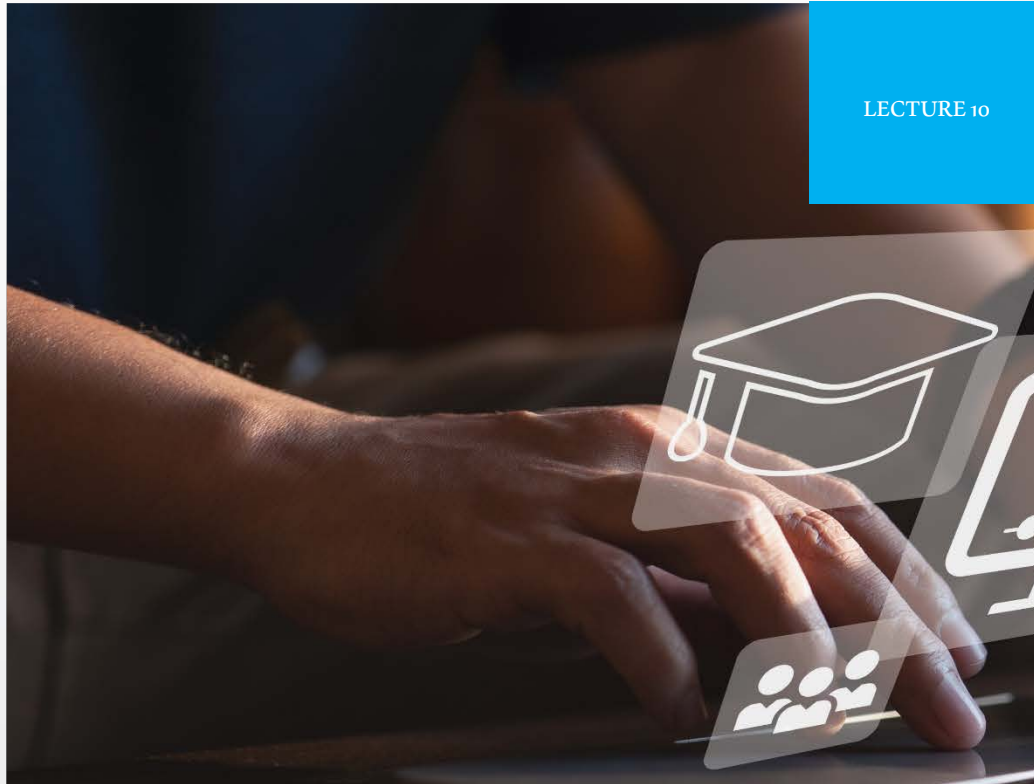


Artificial Intelligence for Financial Technology

10th lecture

FNT626

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**Regulating Artificial Intelligence in
Finance and Other Regulated Industries**



LECTURE 10

Ch. 12- Regulating Artificial Intelligence in Finance and other Regulated Industries

Learning Objectives

1. Understanding the Role of Artificial Intelligence in Regulated Industries
2. Explore the Regulatory Frameworks for AI in Finance and Regulated Sectors
3. Examine the challenges and opportunities associated with regulating AI in finance and regulated sectors
4. Address the ethical considerations related to regulating AI in finance and regulated industries
5. Explore the risk management practices and compliance requirements specific to AI implementation in regulated industries
6. Understand the importance of algorithmic transparency and explainability in regulatory decisions related to AI technologies,
7. Explore the data governance practices and data privacy considerations associated with regulating AI technologies,
8. Explore the future trends and policy implications in regulating AI in finance and other regulated industries,

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CHAPTER OUTLINE

1. INTRODUCTION
2. RISKS: AI IN FINANCE
3. REGULATING AI IN FINANCE: CHALLENGES FOR EXTERNAL GOVERNANCE
4. PUTTING THE HUMAN-IN-THE-LOOP IN FINANCE
5. CONCLUSION

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1. INTRODUCTION

The term **artificial intelligence (AI)** covers a series of technologies and approaches, ranging from ‘if-then’ rule-based expert systems, to natural language processing, to the marriage of algorithms and statistics known as **machine learning (ML)**, involving pattern recognition and inference trained by data rather than explicit human instructions. The rise of ML progressively reduces the role of humans as AI systems expand from supervised learning to unsupervised deep learning neural networks. While AI has a long history of development, recent technological advances and digitization have underpinned an unprecedented evolution, with AI expected to contribute in particular to complex problem-solving. Cost savings, enhanced efficiency, entirely new opportunities and business models explain why financial services companies are expected to spend USD 11 billion on AI in 2020, more than any other industry.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**1. INTRODUCTION**

AI use cases span a range of customer processes, from on-boarding to instant responses to credit applications, and also include operations and risk management, trading and portfolio management, payments and infrastructure, data security and monetization, and regulatory and monetary oversight and compliance. However, AI and automation also raise major concerns, ranging from widespread job losses to the ‘singularity’ – when the capacities of AI surpass those of humans. Central to many of these concerns is the role of humans in the evolution of AI: the necessity of involving people in using, monitoring and supervising AI.

2. RISKS: AI IN FINANCE

2.1 Data Risks

2.1.1 Data collection and analysis

2.1.2 Decision-making and execution of decisions

2.2 Financial Stability Risks

2.3 Cybersecurity

2.4 Legal Risks

2.5 Ethics and Financial Services

2.5.1 AI as non-ethical actor

2.5.2 AI's influence on humans

2.5.3 Artificial stupidity and maleficence

2.6 Risk Typology: Framework of Analysis



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Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2. RISKS: AI IN FINANCE**

AI's potential to process data, seemingly without human bias, is central to its utility, i.e., it can be unbiased in not following its own agenda or having cognitive biases. Yet, the nature of AI creates other risks.

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Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.1 Data Risks****2.1.1 Data collection and analysis**

The availability of highly structured machine-readable data – a major obstacle for AI advancements elsewhere, including healthcare – has increased the ease of adoption of AI in many areas of financial services. From a legal perspective, protected factors come under threat if AI discriminates based on factors, proxies for these factors, or other factors altogether, that describe little more than a part of social and financial relations within society. As both the value of high-quality information and the threats posed by information gaps continue to grow, regulators should focus on the development of widely used and well-designed data standards. Second, the data may be biased, either from data selection issues or data reflecting biases in society at large. Prejudiced decision-makers may mask their biases by wittingly or unwittingly using biased data. Biased data could likewise be selected in efforts to enhance an executive's personal bonus or reduce organizational oversight.

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Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.1.2 Decision-making and execution of decisions**

AI systems may perform similar calculations simultaneously, and one AI's decisions may influence the tasks performed by another, i.e., 'herding' results when actors make use of similar models to interpret signals from the market. Algorithms trading simultaneously in millisecond trading windows have caused extreme volatility events, referred to as 'flash crashes', when unexpected situations arise. While risk management tools such as price limits and stop-loss commands (themselves algorithms) can mitigate some of the risks, these tools are costly and do not address all risks generated by multiple AI performing similar tasks. If several self-learning algorithms discover that cooperation in capital markets is more profitable than competition, they could cooperate and manipulate information and prices to their own advantage.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.2 Financial Stability Risks**

In 2017, the **Financial Stability Board (FSB)** analyzed and summarized a broad range of possible financial stability implications of AI and ML. The FSB noted the substantial promise of AI and ML, contingent upon proper risk management. The FSB stressed that oligopolistic or monopolistic players may surface as a result of additional third-party dependencies caused by 'network effects and scalability of new technologies'. Further, the lack of interpretability or 'auditability' of AI and ML methods has the potential to contribute to macroeconomic risk unless supervisors find ways to supervise the AI. This is particularly challenging because of the opacity of models generated by AI/ML, and AI-related expertise beyond those developing the AI, is limited in the private sector and among regulators.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.3 Cybersecurity**

AI could be used to harm an economy and threaten national security. Algorithms could be manipulated to undermine economies to create unrest, or to send wrong signals to trading units to seek to trigger a systemic crisis. The cybersecurity dimension is more serious as many financial services firms rely on a small group of technology providers, creating a new form of risk we term TechRisk. That many AI-enabled systems have not been tested in financial crisis scenarios further amplifies this risk. **Important ways to address cybersecurity include to** (1) invest in cybersecurity resources, including in-house expertise and training of employees; (2) have protocols in place to cooperate swiftly with other financial intermediaries, to ensure fast detection of, and responses to, these attacks, with or without involvement of regulators; and (3) building national and international systems for sharing information as well as contingency and defense planning.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.4 Legal Risks**

FAT is an acronym often used to describe AI and ML governance considerations, i.e., fairness, accountability, and transparency. Concerning accountability, many start with an analysis of legal liability and risks. As scholars and practitioners explore how existing liability regimes such as product liability, tort, and vicarious liability may be used to address the legal risks and liability around the use of AI, foundational concepts like causation and damages as they relate to AI and their corporate and individual creators have been acknowledged to be challenging to such liability regimes. Since the 2008 Global Financial Crisis, the legal and regulatory compliance of many financial institutions worldwide has been found wanting. Boston Consulting Group reported that financial institutions, such as 50 of the largest European and North American banks, have paid USD 381 billion in cumulative financial penalties (through the end of 2019). RegTech is increasingly seen as a way to address these shortfalls, and many solution providers are using AI and ML in areas such as onboarding, anti-money laundering (AML), and fraud detection. Yet, some of the largest recent bank fines have arisen from legal risks related to the use of technology.

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Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.5 Ethics and Financial Services****2.5.1 AI as non-ethical actor**

Algorithms do not per se 'feel' nor have 'values'. Training machines in values is difficult, since humans often lack insights into the human psyche. AI's lack of an ethical foundation could create serious harm for the portfolio value of a given financial intermediary if the AI misprices reputational risk. The more data AI has about a certain person, the greater the risk the AI will nudge the person into buying an unsuitable financial product or profile the person for credit determinations. While unethical conduct can be mitigated by more diverse and broadly trained technical teams programming the AI, the core issue remains that the code itself is a non-ethical actor that does not necessarily constantly review, revise and reflect on its performance as we hope humans do. AI needs human monitoring and guidance for ethical decision-making; humans-in-the-loop are essential so that a human or group of humans is responsible for the actions of AI.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**2.5.2 AI's influence on humans**

AI as 'augmented intelligence' could turn an unskilled person into a skilled investor, via recommendations. As the need to develop advanced maths and other sophisticated data analytical capacities decreases with appropriate programs being widely available, humans' data analytic capacities may atrophy. Accordingly, while coaching AI could be used to enhance financial and tech literacy of staff and investors, resulting in better resource allocation, exploitative AI could ask or nudge clients to invest in overpriced financial products that benefit only the product originator. As AI becomes more pervasive in its interaction with users, it potentially generates an increasingly very high degree of trust. AI developers thus bear a high level of responsibility and there is a strong need for ethical restrictions through rules and internal controls of financial institutions and their management.

2.5.3 Artificial stupidity and maleficence

Protection against AI mistakes and unethical behavior is a major concern. Errors and unethical behavior can arise from poor or criminally motivated programming, or from inadequate datasets, or correlations with other events resulting in harmful unforeseen consequences. Another important example could arise if certain conduct results in liability for which consumers sue far more than institutional clients, as an algorithm could decide to avoid consumer relationships, thereby financially excluding them.

2.6 Risk Typology: Framework of Analysis

The risks of AI in finance fall into three major categories;

First, AI enhances information asymmetry about the functions and limits of certain algorithms. **Second**, AI enhances data dependency as data sources are critical for its operation. The effects and potentially discriminatory impact of AI may change with a different data pool.

Third, AI enhances interdependency by interacting with other AI with unexpected consequences, enhancing or diminishing its operations in finance.

3. REGULATING AI IN FINANCE: CHALLENGES FOR EXTERNAL GOVERNANCE

3.1 General AI Frameworks

3.1.1 AI principles

3.1.2 Data protection and privacy

3.2 Financial Regulation and AI

3.3 The Inadequacy of External Governance

3.3.1 Authorisation of AI

3.3.2 Regulatory outsourcing rules and e-personhood

3.3.3 AI as key function holder?

3.3.4 Fit and proper test

3.3.5 Sanctioning



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3. REGULATING AI IN FINANCE: CHALLENGES FOR EXTERNAL GOVERNANCE

3.1 General AI Frameworks

3.1.1 AI principles

The first mover in what was to be a remarkable flurry of activity in this space was the United Kingdom House of Lords AI Select Committee, which defined five general principles of AI development and treatment in late 2017. The most influential of all the initiatives that followed occurred in May 2019, when the **Organization for Economic Co-operation and Development (OECD)** introduced its AI Recommendation and together with its principles (1) AI must be beneficial; (2) AI system design must comply with general legal principles such as the rule of law; (3) AI systems must be transparent and secure; and (4) AI developers must ensure AI complies with these principles.

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3.1.2 Data protection and privacy

Data protection and privacy commissioners have increasingly viewed the governance of AI as being within their purview. For instance, **the 40th International Conference of Data Protection and Privacy Commissioners** in 2018 endorsed six guiding principles as core values to preserve human rights in the development of AI:

1. fairness;
2. continued attention, vigilance, and accountability;
3. AI system transparency and intelligibility;
4. AI system responsible development and design by applying the principles of privacy by default and privacy by design;
5. empowerment of individuals; and
6. reduction and mitigation of unlawful biases/discrimination arising from AI data use.

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3.1.2 Data protection and privacy

Article 22 of the **European General Data Protection Regulation (GDPR)**, titled 'Automated individual decision-making, including profiling' states that a data subject has the right to not be subject to a decision based solely on automated processing, including profiling, which produces legal effects. Caveats apply if the decision is necessary for the entering into, or performance of, a contract between the data subject and the data controller, or in other specific cases.

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3.2 Financial Regulation and AI

Globally, regulators have started considering how AI impacts financial services and have begun to issue regulatory guidance. In 2016, the **European Supervisory Authorities (ESAs)** published a draft report on Big Data risks for the financial sector, which included AI. The ESAs' final report in 2018 found that Big Data risks are best addressed by existing data protection/cybersecurity/consumer protection legislation, even though such legislation may not have been written specifically to address such risks. This legislation includes the GDPR, the second Payment Services Directive (PSD2), the second **Markets in Financial Instruments Directive (MiFID II)** and the Insurance Distribution Directive. They emphasize business principles such as acting honestly, fairly and professionally, refraining from misleading conduct, ensuring products suit the needs of clients, and establishing fair claims/complaints-handling processes.

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3.2 Financial Regulation and AI

Other financial regulators and international organizations are likewise increasingly engaging with AI, including:

- the **Monetary Authority of Singapore (MAS)** introduced the new **Fairness, Ethics, Accountability and Transparency (FEAT)** Principles to promote responsible use of **AI and data analytics (AIDA)** in November 2018.
- De Nederlandsche Bank issued principles for responsible use of AI, namely **soundness, accountability, fairness, ethics, skills and transparency (or SAFEST)** in July 2019.
- The WEF suggested in October 2019 that AI should be held to higher standards than humans and present systems, due to AI's potential impact on the financial services industry.
- The **Hong Kong Monetary Authority (HKMA)** issued its 12 'High-Level Principles on Artificial Intelligence' in November 2019.

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Ch. 12- Regulating artificial intelligence in finance and other regulated industries**3.2 Financial Regulation and AI**

Singapore's Personal Data Protection Commission's Proposed AI Governance Framework, which has two guiding principles: (1) that organizations must ensure that decision-making using AI is explainable, transparent and fair; and (2) that AI solutions should be human-centric. Similarly, in Hong Kong, the HKMA encouraged authorized institutions in May 2019 to adopt and implement Hong Kong's Office of the Privacy Commissioner for Personal Data's Ethical Accountability Framework for the collection and use of personal data, and its Data Stewardship Accountability, Data Impact Assessments and Oversight Models that were introduced in 2018. Specifically, the Principles reinforce that banks should possess sufficient expertise; ensure explainability of AI applications; use data of good quality; and conduct rigorous model validation, amongst others.

3.3 The Inadequacy of External Governance

Five examples will be discussed below to support the thesis on the inadequacy of external governance regimes in addressing the risks of AI in finance.

3.3.1 Authorisation of AI

One potential response to AI-based threats is a licensing requirement for AI used by financial institutions. If a business model seeking authorization relies on AI, the business and operations plan must detail the functioning of the AI, the client protection features, the regulatory capital assigned to financial and operational risks for the AI-performed services, and the back-up structure in case the AI fails. AI authorization may, however, have several undesirable side effects, such as limiting innovation given authorization is costly and slow. Rules would also struggle to cope with the often almost daily minor amendments and improvements to AI programs. Re-authorisation of the code is expensive, meaning minor improvements of existing AI may be uneconomic. Finally, for self-learning AI, the authorized code will not be performing in practice, as by definition self-learning AI develops its code while performing its services.

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3.3.2 Regulatory outsourcing rules and e-personhood

In regulatory rulebooks worldwide, crucial supplier frameworks apply for AI owned and operated by a separate services provider. However, financial services AI may increasingly be owned and operated in-house by the financial intermediary's own staff. One option for regulating in-house AI is the granting of limited legal personality to the algorithm itself, paired with minimum capital requirements. The arguments against such limited e-personhood are similar to those against authorizing AI, i.e., the calculation of capital requires a clear delineation of risks created by the AI. Further, authorities have cheaper ways to restrict AI use, without an AI's own regulatory capital. These include reporting requirements for AI-prompted damages upon intermediaries that employ AI, and responding to such reporting by issuing orders limiting, or prohibiting, the use of the AI.

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3.3.3 AI as key function holder?

In some jurisdictions, executive functions can be assigned to legal entities, or the law is silent on the entity status of executives. In those jurisdictions, it may be lawful to appoint an AI as a board member, if necessary, by embedding the AI in a special-purpose vehicle as its sole activity. Regarding practicality, an AI may function as a board member for certain routine tasks (**e.g., securitization vehicles in a corporate group**), and for procedural monitoring, but a human board majority may be required to ensure continuing operations when challenges exceed the AI's programmed limits. For example, AI alone is poorly adapted to handle compliance matters because they lack ethical screening abilities, and because rules are incomplete on purpose. Financial services are heavily regulated by rules which do not always operate in 'yes/no' terms because their meaning depends on context.

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3.3.4 Fit and proper test

AI will likely influence regulatory practice in the fit and proper test for key function holders (i.e., senior management or executives) and the board of directors in two ways; **First**, some existing requirements may be redundant or need modification when AI is used. **Second**, new requirements will reflect the greater reliance on AI, and some office holders may have new qualifications. However, AI experts may have accumulated their AI experience outside the financial sector. Financial supervisors will need to modify some of their experience requirements as many have for licensing requirements for FinTechs.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**3.3.5 Sanctioning**

Financial regulation typically imposes sanctions on a firm for its overall conduct and/or that of individual staff usually by proving negligence or ill intent. With AI, these cases will be increasingly hard to make. Where AI fails and supervisors are incapable of establishing an AI's processes and limits with certainty, determining the culpability standard and burden of proof to be applied while retaining incentives to innovate will be very challenging. With holding compensation, naming and shaming, and imposing financial penalties as sanctions have little meaning for AI. Similarly, director disqualification, as well as civil and criminal liability, provide limited steering effect for AI in its current form. AI-adapted regulation could possibly (1) require blame-free remediation in which organizations are able to learn from failures and make improvements; (2) encourage collaboration to promote early detection and the avoidance of unexpected AI failures; and (3) employ fit-for-purpose explainability in which frameworks are utilized to decide 'if' explainability is a requirement and 'how' explainability should be achieved.

4. PUTTING THE HUMAN-IN-THE-LOOP IN FINANCE

4.1 Personal Responsibility Frameworks in Finance

4.1.1 Australia: Banking Executive Accountability Regime

4.1.2 United Kingdom: Senior Managers and Certification Regime

4.1.3 Hong Kong: Securities Firm Manager-in-Charge Regime

4.1.4 Singapore: proposed senior manager guidelines

4.1.5 European Union

4.1.6 International Organization of Securities Commissions consultation



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4. PUTTING THE HUMAN-IN-THE-LOOP IN FINANCE

While regulators expect financial institutions to deploy AI responsibly, develop and use new tools to safeguard the financial system, we have shown that, given the severe information asymmetry, data dependency and interdependency that arise with AI, external governance is not well-suited to ensuring the responsible use of AI in finance. Given these 'black box' issues in AI for regulatory and supervisory authorities, measures focusing on personal responsibility requirements that put the 'human-in-the-loop' should be central to regulating AI-enabled systems in finance. The first approach involves using technology to monitor staff behavior and identify issues before they arise, i.e., RegTech. An increasing range of regulatory systems strengthen personal responsibility of designated senior managers. These frameworks seek to produce cultural change and an ethical environment in financial institutions through personal responsibility of directors, management and, increasingly, individual managers.

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Ch. 12- Regulating artificial intelligence in finance and other regulated industries**4.1 Personal Responsibility Frameworks in Finance****4.1.1 Australia: Banking Executive Accountability Regime**

The Australian Prudential Regulation Authority (APRA) administers the Banking Executive Accountability Regime (BEAR), which came into effect on 1 July 2019 for smaller banks (collectively, authorized deposit-taking institutions – ADIs must provide individual accountability statements to APRA which clearly outline individual responsibilities and provide an accountability map showing accountability allocation across an institution. In response to the recommendations of the Royal Commission into Misconduct in the Banking, Superannuation and Financial Services Industry, the Australian government has proposed expanding BEAR into the Financial Accountability Regime (FAR), with legislation proposed to be introduced in late 2020 to cover securities firms after public consultation. The underlying structure of FAR resembles BEAR, with several key differences, including: the Australian Securities and Investment Commission (ASIC) would join APRA in co-regulating FAR obligations; and FAR expands regulatory scope to all APRA regulated entities, not just ADIs.

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4.1.2 United Kingdom: Senior Managers and Certification Regime

The 2016 Senior Managers and Certification Regime (2016 SMCR) is regulated by the Prudential Regulation Authority (PRA) and the Financial Conduct Authority (FCA) and applies to all individuals performing a 'senior management function' at banks, building societies, credit unions, and PRA-designated investment firms. The regime was expanded to cover insurance firms in 2018, and expanded again, for FCA-regulated financial institutions, to apply to asset managers and designated activities of investment firms (Extended SMCR) from December 2019. The 2016 SMCR is structured around: (1) a Senior Managers Regime for individuals who require regulatory approval; (2) a certification regime for regulated firms to assess the fitness and propriety of employees carrying out a 'significant harm' function; and (3) conduct rules which apply to most bank employees. Conduct rules for senior managers specify a 'duty of responsibility' that ensures the firm's business is controlled effectively and that they comply with the regulatory framework. Senior managers must take reasonable steps to ensure that responsibility is delegated to an appropriate person, and that the delegated responsibility is effectively discharged. Senior managers are responsible for the firm's policies and procedures for countering financial crime risks: such as money laundering, sanctions, fraud, tax evasion and cybercrime, amongst others.

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4.1.3 Hong Kong: Securities Firm Manager-in-Charge Regime

Since 2016, senior management, in relation to Hong Kong securities firms, are defined as directors, ‘responsible officers’ of a corporation, and ‘managers-in-charge’ (MICs). Licensed corporations must appoint an MIC as primarily responsible for, amongst others, each core function, overall management oversight, risk management, finance and accounting, IT, compliance, and AML/CFT. General Principle 9 of the Securities and Futures Commission (SFC) Code of Conduct for Persons Licensed or Registered with the SFC (SFC Code of Conduct) states that senior management shall bear primary responsibility for the maintenance of appropriate standards of conduct and adherence to proper procedures. The board must approve and adopt a formal document clearly setting out roles, responsibilities, accountability, and the reporting lines of senior management. Paragraph 14.1 of the SFC Code of Conduct specifies that senior management should properly manage the risks associated with a firm’s business, including performing periodic evaluation of its risk processes, internal control procedures and risk policies; and understanding the extent of their own authority and responsibilities. Senior management are ultimately responsible for the adequacy and effectiveness of the firm’s internal control systems.

Ch. 12- Regulating artificial intelligence in finance and other regulated industries**4.1.4 Singapore: proposed senior manager guidelines**

In June 2019, the MAS issued Proposed Guidelines on **Individual Accountability and Conduct** ('IAC Proposed Guidelines'). The IAC Proposed Guidelines make senior managers responsible for the management and conduct of '**core management functions**' (CMFs), for the actions of their staff, and the conduct of the business. Financial institutions should apply CMF definitions which reflect the actual responsibilities of a particular senior manager. Responsibility is described as 'principles-based' and thus there is no list of mandatory responsibilities. MAS states that the level of responsibility should reflect the senior manager's roles vis-à-vis the financial institution's Singaporean operations. Senior managers are responsible regardless of their title or whether they are based overseas.

4.1.5 European Union

The European Union (EU) joint internal governance guidelines were published by the **European Banking Authority (EBA)** and **European Securities and Markets Authority (ESMA)** to build upon the Commission Delegated Regulation (EU) No 604/2014 criteria that identifies categories of staff whose professional activities have a material impact on a financial institution's risk profile. Responsibilities of the management body (in particular the chief executive officer and other key executives) include setting, approving, and overseeing implementation of the overall business strategy and the key legal and regulatory policies, overall risk strategy, internal governance and control, and risk capital, amongst others. Key function holders such as heads of internal control functions including risk management, compliance and audit functions have a crucial role in ensuring that the institution adheres to its risk strategy, complies with legal and regulatory requirements, and has robust governance arrangements. Key function holders should know and understand the extent of risk appetite and risk capacity for their role and contribute to internal communications regarding the institution's core values and staff expectations.

4.1.6 International Organization of Securities Commissions consultation

In June 2020, the Board of the **International Organization of Securities Commissions (IOSCO)** published a consultation report relating to guidance on the use of AI and ML by market intermediaries and asset managers. Its very first measure is that Regulators should consider requiring firms to have designated senior management responsible for the oversight of the development, testing, deployment, monitoring and controls of AI and ML.' If implemented at the national level, this guidance will help instill a personal responsibility framework for securities regulators across the world.

5. Conclusion

The chapter shows that The financial services sector globally is one of the leaders in AI use and development. However, AI comes with numerous technical, ethical and legal challenges that can undermine the objectives of financial regulation with respect to data, cybersecurity, systemic risk and ethics, in particular relating to 'black box' issues. As shown, traditional financial supervision focused on external governance which is unlikely to be sufficient to address the risks created by AI. Accordingly, even where supervisors have exceptional resources and expertise, supervising the use of AI in finance by traditional means is extremely challenging. To address this weakness, it is suggested that the internal governance of financial institutions be strengthened through the use of external governance to impose personal responsibility requirements to put a 'human-in-the-loop', based on existing frameworks of managerial responsibility.

This course is concluded through;

- integrating intended learning outcomes (ILOs),
- key scientific findings,
- contemporary theories/trends,
- and linking everything cohesively to course themes.

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Course Conclusion

The Major Intended Learning Outcomes (ILOs) of AI in Fintech

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By the end of this course, learners are expected to:

1. Master the application of advanced AI and Machine Learning (ML) techniques to solve core financial problems such as Fraud Detection, Algorithmic Trading, and Credit Scoring.
2. Bridge the gap between abstract financial theories and practical, data-driven solutions to implement robust financial models.
3. Optimize decision-making processes and enhance operational efficiency within the financial sector through personalized services and automated workflows.

The major AI in FinTech ILOs connected with the theories and practical findings

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ILO #1: Master the application of advanced AI and Machine Learning (ML) techniques to solve core financial problems such as Fraud Detection, Algorithmic Trading, and Credit Scoring.

Theories & Practical Findings:

Theories of Supervised & Unsupervised Learning: Utilizing classification models (for credit scoring) and anomaly detection (for fraud) to identify patterns human analysts miss.

Practical Finding: Traditional credit scoring models often exclude "thin-file" customers. The course teaches that AI models using alternative data significantly increase financial inclusion and predictive accuracy.

Connection: This ILO moves the student beyond "knowing" what AI is to "mastering" the specific algorithms that drive modern FinTech security and trading platforms.

The major AI in FinTech ILOs connected with the theories and practical findings

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ILO #2: Bridge the gap between abstract financial theories and practical, data-driven solutions to implement robust financial models.

Theories & Practical Findings:

Modern Portfolio Theory (MPT) vs. Neural Networks: Connecting classical theories like MPT with deep learning to handle high-frequency market data and non-linear relationships.

Practical Finding: Research shows that purely theoretical models often fail in "Black Swan" events. The course highlights how data-driven AI models can adapt in real-time to shifting market regimes.

Connection: This ILO ensures that students don't just build models in a vacuum but ground their AI solutions in established financial economic theory, ensuring regulatory and economic relevance.

The major AI in FinTech ILOs connected with the theories and practical findings

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ILO # 2: Optimize decision-making processes and enhance operational efficiency within the financial sector through personalized services and automated workflows.

Theories & Practical Findings:

Optimization Theory & Bayesian Decisions: Using probabilistic models to find the most efficient allocation of resources or the most accurate personalized recommendation.

Practical Finding: Financial institutions using AI-driven automation report a 20-30% reduction in operational costs. Personalized AI recommendations significantly boost customer retention rates.

Connection: This ILO prepares graduates to enter an organization and identify specific processes that can be streamlined, making them valuable assets to financial institutions seeking "lean" operations.

The major AI in FinTech ILOs connected with the new Trends and the future of AI in FinTech

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Course ILO	Evolutionary Path	New Industry Trend
Fraud & Risk Mastery	From detecting fraud to Proactive Autonomous Intervention.	Explainable AI (XAI): Moving from "Black Box" models to AI that can explain its reasoning to regulators and users.
Bridging Theory & Data	From static datasets to Synthetic Data Generation.	Generative AI (GenAI): Using LLMs and GANs to simulate market stress tests and create synthetic financial histories.
Personalized Services	From basic "product suggestions" to Hyper-Personalization.	Conversational Finance: Using Generative AI agents (Robo-advisors 2.0) to provide natural language wealth management advice.
Decision Optimization	From assisted decisions to Autonomous Financial Agents.	Self-Driving Money: AI that automatically manages a user's entire financial life (bills, investments, savings) with zero-click interaction.

Conclusion

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The "AI in FinTech" course ILOs act as the technological gateway. By mastering the fundamentals of ML and financial theory integration, graduates are not just learning current tools but are building the cognitive framework required to navigate and implement the next wave of Generative and Explainable AI in the global financial market.

Artificial Intelligence for Financial Technology

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Recommended Readings

Chishti, S., 2020. The AI book: the artificial intelligence handbook for investors, entrepreneurs and fintech visionaries. John Wiley & Sons.

The End of Lecture

Thank You