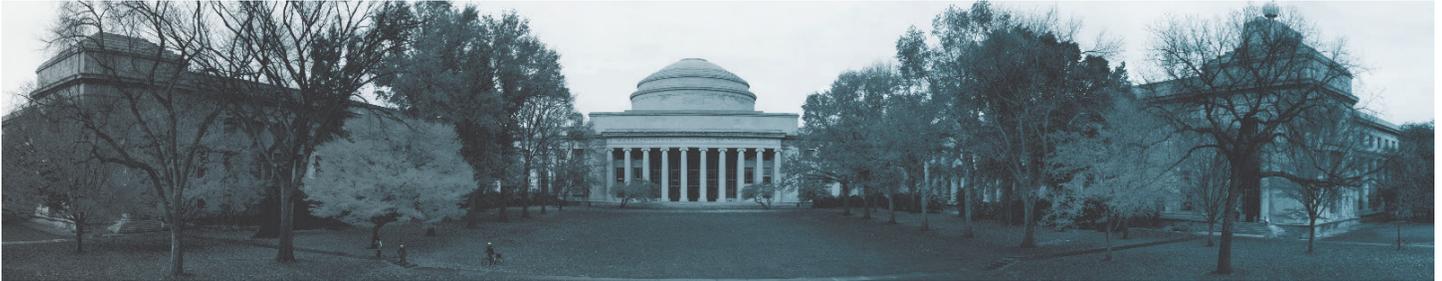# MIT and Financial & Banking Industries

*MIT's Industrial Liaison Program (ILP) can bring the intellectual power of MIT to your organization by providing a direct connection to the knowledge, experience and resources at MIT in these areas – giving you the ideas to stay ahead. For more information about how the ILP can put the resources of MIT to work for you, call us at 1-617-253-2691, e-mail us at liaison@ilp.mit.edu, or visit http://ilp.mit.edu.*

### MIT and Financial & Banking Industries

The Massachusetts Institute of Technology (MIT) is a  leading center of research and education on topics important to the financial, banking, and related industries such as:

- *Banks, Economy, Policy, Regulations*
- *Big Data, Computation, Analysis*
- *Currency*
- *Cybersecurity, Cryptography, Data Security*
- *Digital Economy*
- *Economics and Management*
- *Entrepreneurship, Venture Capital*
- *Finance, Financial Engineering*
- *Global Development, Local Innovation Systems*
- *Real Estate*
- *Social Networks, Collaborative Intelligence, Mobility*

Below are brief descriptions of a selection of MIT centers, departments, groups, and labs conducting research and education in these areas. Please note that this is not a comprehensive summary of research being conducted at MIT in the topic areas listed above and the center or lab, etc., may fall into more than one category.

## BANKS, ECONOMY, POLICY, REGULATIONS

The mission of the MIT *Center for Finance and Policy (CFP)* is to serve as a catalyst for innovative, cross-disciplinary and non-partisan research and educational initiatives that address the unique challenges facing governments in their role as financial institutions and as regulators of the financial system. Initiatives supported by the CFP are organized into three main tracks: Evaluation and Management of Government Financial Institutions; Regulation of Financial Markets and Institutions; Measurement and Control of Systemic Risk.

The *Institute for Work and Employment Research (IWER)* conducts research and educational activities on the broad range of work, employment, and labor market issues and policies. IWER's goals are to create and advance knowledge on these topics, to education and train the next generation academic leaders in the field, and to make positive contributions to improving the public policies, organizational practices, and institutions that shape the world of work.

The *Political Economy and Technology Policy* program applies theories and methods from the discipline of political economy to examine issues in science and technology policy. The program focuses on:  Emergent technologies; uncertainty and environmental decision-making; regulation and the management of business risk; and north-south financial and technology transfers. Political economists from the social sciences work closely with MIT technologists and humanists, government, nongovernmental organizations, and private firms, and with academic partners at Cambridge University, the Stockholm School of Economics and Chalmers University, the Swiss Federal Institutes of Technology (ETH) and the University of Tokyo.

The purpose of the *World Economy Laboratory (WEL)* is to strengthen the links between the department and policymakers, central banks, and business economists. The WEL is organized around the Central Banks-MIT research network, and aims to

develop relationships between MIT and central banks. WEL hosts occasional meetings in Cambridge and visits by central bank researchers to the MIT Economics Department, where the working group environment is aimed at discussing policy issues at a relatively technical level. The meetings are attended by the heads of research of many central banks, as well as faculty and students working on international finance and macroeconomics policy issues. WEL is financed by membership contributions, which are used to organize the meetings and to support policy-oriented research by junior faculty and students.

## BIG DATA, COMPUTATION, ANALYSIS

*BigData @ CSAIL* researchers are investigating how to transform big data into big insights. The initiative's approach brings together world leaders in parallel architecture, massive-scale data processing, algorithms, machine learning, visualization, and interfaces to collectively identify and address the fundamental technology challenges faced with Big Data. The approach is focused on the themes of Computational Platforms; Scalable Algorithms; Machine Learning and Understanding; and Privacy and Security.

The *Database Group (DBg)* at MIT conducts research on all areas of database systems and information management. Projects range from the design of new user interfaces and query languages to low-level query execution issues, ranging from design of new systems for database analytics and main memory databases to query processing in next generation pervasive and ubiquitous environments, such as sensor networks, wide area information systems, personal databases, and the Web.

The *Mathematics Department* at MIT is one of the top-ranked mathematics departments in the U.S.— a world center in Pure and Applied Mathematics. In pure mathematics, the department explores exciting current research directions in most of the major fields. The pure math group studies many aspects of algebra, analysis, geometry, mathematical logic and foundations, number theory, probability and statistics, and representation theory. The applied math group focuses on combinatorics, computational biology, computer science, scientific computing, numerical analysis, and areas of physical applied mathematics.

The mission of the *MIT Institute for Data, Systems, and Society (IDSS)* is to advance education and research in state-of-the-art, analytical methods in information and decision systems; statistics and data science; and the social sciences, and to apply these methods to address complex societal challenges in a diverse set of areas such as finance, energy systems, urbanization, social networks, and health. IDSS research is rooted in three core disciplines: statistics and data science,

information and decision theory, and human and institutional behavior.

## CURRENCY

The *Digital Currency Initiative* strives to be a neutral leader of world-class research to push the boundaries of knowledge around cryptocurrency and its underlying distributed ledger technology. The group seeks to clarify the real-world impact of these technologies, inspired by their potential for public good and mindful of the risks and ethical questions attached to them. The initiative acts in support of the MIT and open-source cryptocurrency communities and yet is open to collaborating with all sectors of society.

## CYBERSECURITY, CRYPTOGRAPHY, DATA SECURITY

The *ALFA group: Anyscale Learning For All* studies scalable machine learning technology and data science frameworks for knowledge mining, prediction, analytics and optimization. Application areas include Cyber-Security/Tax Evasion Detection (formalism of law, co-evolutionary dynamics); Scheduling (hyper-parameter optimization, machine learning and evolutionary algorithms for batch selection and job sequencing); as well as, Clinical Medicine Knowledge Discovery; MOOC Technology; and Wind Energy.

The *Computer Systems Security Group* researches and builds secure, practical, and flexible systems. The group's work spans operating systems, computer architecture, distributed systems, programming languages, and web browsers.

The goal of **CyberSecurity@CSAIL** is to identify and develop technologies to address the most significant security issues confronting organizations in the next decade. CyberSecurity@ CSAIL aims to provide an integrated and formal approach to the security of systems, combining design and analysis methods from cryptography, software and hardware.

The **Cryptography and Information Security Group (CIS Group)** seeks to develop techniques for securing tomorrow's global information infrastructure by exploring theoretical foundations, near-term practical applications, and long-range speculative research. The group aims to understand the theoretical power of cryptography and the practical engineering of secure information systems, from appropriate definitions and proofs of security, through cryptographic algorithm and protocol design, to implementations of real applications with easy-to-use security features. Research examples include: Micropayments; Digital Signatures; Electronic Voting; Private Information Retrieval.

# MIT and Financial & Banking Industries

The MIT *Geospatial Data Center (GDC)* is dedicated to large-scale simulation, cyber physical security, big data, and holistic system data visualization. The GDC is working on a framework that exploits different perspectives of the same financial data and assigns risk scores to entities (e.g. payment documents) to improve false positive ratios and assist the identification of fraudulent activity in huge and unlabeled financial data, and on a global IT infrastructure simulator that evaluates the performance, availability and reliability of large-scale computer systems of global scope.

The *MIT Internet Trust Consortium* uses its expertise and knowledge-base to develop new technological building blocks that underlie the emerging personal data ecosystem. These blocks can be combined to address issues like identity management & authentication, authorization & consent management, data security, data mining & privacy-preservation, and digital death & meaningful archiving.

## DIGITAL ECONOMY

The *Center for Information Systems Research (CISR)* conducts field-based research related to how companies will design themselves and manage for success in the digital economy. CISR's mission is to develop concepts and frameworks to help executives address the challenges of leading increasingly dynamic, global, and information-intensive organizations. The relevance of CISR's research is ensured by the active participation of corporate sponsors from a range of industries. Research results are shared with CISR Patron/Sponsor community through working papers, research briefings, an annual conference, and sponsor forums.

The *Initiative on the Digital Economy (IDE)* is a major effort focused on the impact of digital technology on businesses, the economy, and society. Drawing on MIT Sloan's strengths in technology and innovation, its internationally recognized faculty, and more than a decade of research and partnership with MIT Sloan's Center for Digital Business, the IDE is analyzing the broad sociological changes brought about by the advance and spread of digital technology.

## ECONOMICS AND MANAGEMENT

The *MIT Sloan Fellows Program* offers experienced executives and mid-career professionals (with a minimum of 10 years work experience) the opportunity to enter this one year in intensive collaboration while they earn an MBA or MS in Management or Management of Technology. MIT Sloan Fellows spend one year dedicated to the goals and challenges of their organizations. With day-to-day tasks off their radar, they spend long hours working closely with peers—from 30+ countries and as many industries—to develop a set of com-

petitive strategies and pragmatic solutions. At the same time, they build the necessary skills for executing those strategies, skills grounded in the three pillars of the program's rigorous executive development curriculum: innovation, leadership, and global perspective.

The *MIT Sloan Neuroeconomics Lab* is a multidisciplinary research center studying problems at the intersection of economics, management, and cognitive neuroscience. The lab's projects are stimulated by economic theory and decision analysis, which provide an ideal standard, as beautiful conceptually as it is flawed empirically. The group studies behavior that appears anomalous in light of the rational model, focusing especially on financial, medical and consumption choices. Methods include functional MRI, lab experiments, game theory, Bayesian modeling and machine learning.

The *Department of Economics* faculty is equally committed to graduate and undergraduate education and is at the forefront of both theoretical and applied economics. Its faculty has made pioneering contributions from theory to macroeconomics, to finance, to industrial organization, to international trade. The department's scholars have received numerous awards, including four Nobel Prizes (Peter Diamond, the late Paul Samuelson, Robert Solow, and the late Franco Modigliani), and many are Fellows of the National Academy of Sciences, the American Academy of Arts and Sciences, and the Econometric Society. Many faculty members have served in various elected offices of the American Economic Association and the Econometric Society. Student dissertation topics span a wide range of issues in microeconomics and macroeconomics, and include economic theory, data analysis, and econometric methodology.

The *Sloan School of Management* is one of the world's leading business schools — conducting cutting-edge research and providing management education to top students from more than 60 countries. The mission of the MIT Sloan School of Management is to develop principled, innovative leaders who improve the world and to generate ideas that advance management practice. MIT Sloan offers undergraduate, master's, PhD, executive education and non-degree programs together with special seminars, conferences, and programs for alumni. MIT Sloan includes 200 professors and lecturers; approximately 1,300 students; and 10 degree and non-degree programs for undergraduates through experienced executives. MIT Sloan has 120,000 alumni in 90 countries; more than 650 companies have been founded by MIT Sloan alumni.

## ENTREPRENEURSHIP, VENTURE CAPITAL

The *Martin Trust Center for MIT Entrepreneurship* provides the expertise, support, and connections MIT students need to

become effective entrepreneurs. The Center serves all MIT students, across all schools, across all disciplines. MIT students and alumni use their entrepreneurship skills to found hundreds of companies each year, many using cutting-edge technologies developed in MIT labs or elsewhere. The Center team educates and develops leaders of successful ventures by offering best-in-class educational courses and executive programs powered by MIT's leading-edge technology and business research.

The *MIT Enterprise Forum* is a global organization of dedicated professionals with local chapters, affiliated with MIT through MIT Technology Review, and is open to all participants of the entrepreneurial ecosystem. The Forum informs, connects, and coaches technology entrepreneurs—enabling them to rapidly transform ideas into world-changing companies.

Student Group:  The *MIT $100K Entrepreneurship Competition* has been bringing together students and researchers from across MIT and Greater Boston to launch their talent, ideas, and technology into leading companies for 25 years. The competition is run as a series of distinct, increasingly intensive contests from September to May: Pitch, Accelerate, and Launch. Each contest focuses on developing specific founding skills, and for each semi-finalist contender the MIT $100K brings together a network of resources, including mentorship from venture capitalists, serial entrepreneurs, corporate executives, and attorneys; media exposure; prototyping funds; business plan feedback; and discounted services.

Student Group:  The *MIT Venture Capital & Private Equity Club (VCPE)* delivers relationships, visibility, and tailor-made initiatives to its partners looking to build and maintain their valuable connections to MIT's innovation ecosystem. VCPE has a proven track record of developing new projects, identifying and matching talent, and successfully helping drive MIT-generated technology towards commercialization.

## FINANCE, FINANCIAL ENGINEERING

The *Finance Research Practicum* is a key element of MIT Sloan's Master of Finance Program, and is open to other graduate-level students who have completed the prerequisites. In this graduate-level finance course, students work in teams on substantive projects proposed by external sponsors. The goal is to provide students with a meaningful opportunity to work with leading industry practitioners on important topical finance problems, while helping them to bridge the gap between theory and practice, and introducing them to the broader financial community. The course is full-time during the month of January, and includes some preparation and follow-up before and after the full-time experience.

The *Laboratory for Financial Engineering (LFE)* is a partnership between academia and industry designed to support and promote quantitative research in financial engineering and computational finance. The principal focus of the LFE is the quantitative analysis of financial markets using mathematical, statistical, and computational models. LFE research projects are grouped into five areas: foundations of financial behavior and adaptive markets, risk management and systemic risk, healthcare finance, big data and financial technology, and hedge funds and asset-market dynamics.

The *Operations Research Center (ORC)* education and research draws upon ideas from engineering, management, mathematics, and psychology to apply scientific methods to decision-making. ORC faculty contribute to a wide range of application domains such as financial engineering services; flexible manufacturing systems; air traffic control; transportation systems; public services, such as urban emergency systems; safety and risk analysis in air transportation; and more.

## GLOBAL DEVELOPMENT, LOCAL INNOVATION SYSTEMS

The *Abdul Latif Jameel Poverty Action Lab (J-PAL)* serves as a focal point for development and poverty research based on randomized trials. The objective is to improve the effectiveness of poverty programs by providing policy makers with clear scientific results that help shape successful policies to combat poverty. J-PAL works with NGOs, international organizations, and others to evaluate programs and disseminate the results of high quality research. The researchers work on issues as diverse as boosting girls' attendance at school, improving the output of farmers in sub-Saharan Africa, racial bias in employment in the US, and the role of women political leaders in India.

The *Abdul Latif Jameel Poverty Action Lab North America (J-PAL North America)* was launched at MIT in 2013 to improve social programs in the region by ensuring that policy is based on scientific evidence. Academic affiliates collaborate with governments at the city, state, and national levels as well as a variety of social organizations to conduct randomized evaluations. J-PAL North America disseminates results from these studies and works to build organizational research capacities.

The *Global Entrepreneurship Lab (G-Lab)* is an interdisciplinary project-based learning course at the Sloan School. G-Lab focuses on developing markets in up to 15 countries with emerging economies throughout the world. The course focuses on measuring and understanding what kinds of entrepreneurship thrive in different countries, and it develops analytical diagnostic frameworks that can be used to better understand

any situation. This includes applying macroeconomic, financial, and microeconomic tools – as well as thinking about the role of politics, culture, and other noneconomic variables.

The *Industrial Performance Center (IPC)* studies innovation, productivity and competitiveness in the US and around the world. The IPC specializes in bringing together teams of researchers in engineering, science, management and the social sciences to carry out innovative, applied research on industrial growth and transformation, national and regional economic growth and competitiveness, and innovation performance. The IPC research program is organized around the following broad themes:  energy; globalization; innovation; and production.

The *Legatum Center for Development and Entrepreneurship* at MIT was founded on the belief that economic progress and good governance in low-income countries emerge from entrepreneurship and innovations that empower ordinary citizens. The Center works to accelerate social and economic progress across the developing world through innovation-driven entrepreneurship (IDE). The Center runs a highly competitive fellowship program for MIT graduate students who intend to launch enterprises in low-income countries, and offers seed grants and research assistantships for students.

The *School Effectiveness and Inequality Initiative (SEII)* is a research program based in the MIT Department of Economics. SEII focuses on the economics of education, poverty, and the connections between human capital and the American income distribution.  SEII's diverse projects explore topics ranging from the effectiveness of charter and pilot schools to the impact of rising Chinese import competition on America's regional labor markets.

## REAL ESTATE

The *Center for Real Estate (CRE)* research investigates the real estate transaction from initial concept to market reality, providing breakthrough knowledge to help organizations capitalize on today's dynamic markets and technologies. Uniting industry leaders with MIT's distinguished researchers and students, CRE's selective industry partnership program advances the art and science of international real estate, and bridges the gap between theory and practice. CRE is home to the first-ever one year Master of Science in Real Estate Development (MSRED) degree, as well as an integrated suite of professional development courses.

The *Samuel Tak Lee MIT Real Estate Entrepreneurship Lab (STL Lab)* aims to educate future entrepreneurs and thought leaders in the real estate sector to undertake socially responsible investment and development. The STL Lab's mission is to create a new generation of socially responsible entrepreneurs

and academics within the field of urban development and real estate who, regardless of their social and financial background, understand and embrace individual initiative. Through socially responsible real estate entrepreneurship, these individuals will help society achieve high private and social returns on land and housing investment.

## SOCIAL NETWORKS, COLLECTIVE INTELLIGENCE, MOBILITY

The MIT *Center for Collective Intelligence (CCI)* conducts research on how people and computers can be connected so that—collectively—they act more intelligently than any person, group, or computer has ever done before. CCI brings together faculty from across MIT to conduct research. Projects range from Combining Human and Machine Intelligence for Making Predictions, to the Climate CoLab, to the Deliberatorium, to Nonlinear Negotiation.

The *Human Dynamics Group* pioneered the idea of a society enabled by big data. The group has developed technologies such as reality mining, which uses mobile phone data to extract patterns that predict future human behavior, a 'nervous system' framework for dramatically more efficient transportation, health, energy, and financial systems, the New Deal on Data policies which are now enshrined in the US Consumer Privacy Bill of Rights, and a Trust Network communication architecture that ensures that this new data driven society is secure and fair.

The *MIT Mobile Experience Lab* seeks to radically reinvent and creatively design connections between people, information and places. Using cutting-edge information and mobile technology, the lab seeks to improve people's lives through the careful design of meaningful experiences. The lab's multidisciplinary team researches and designs new technologies, carefully considering their impact on societies, spaces and communities. Project examples:  Financial tools for the unbanked; the everyday branch—smart learning hub.