



CRAFT

CENTER FOR RESEARCH TOWARD ADVANCING **FINANCIAL TECHNOLOGIES**

ANNUAL REPORT

JANUARY 1, 2022 - DECEMBER 31, 2022

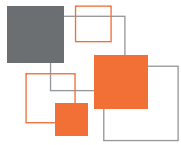
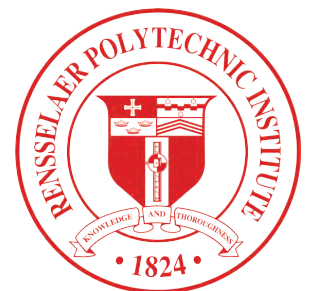
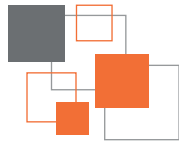


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A MESSAGE FROM THE DIRECTORS

The year of 2022 has been marked with excitement and opportunities for the Center for Research toward Advancing Financial Technologies. With the support of our industry members and the partnering universities, we launched the center on a solid footing. In spring, we formed the Industry Advisory Board (IAB) and worked with the IAB towards converging on funding seven projects to address the most challenging problems faced by the industry. At the same time, the center also established a set of processes and recruited additional staff at Stevens to support the center leadership.

As the global economy emerges from the shadows of the COVID pandemic, the fintech industry, while enjoying continued growth, faces challenges such as the crypto winter and ESG washing. Throughout 2022, CRAFT refined its strategic planning process to update its research map to better promote and align our commitment to our stakeholders. The center conducted surveys and workshops with our members to identify seven important vertical themes, which include explainable AI, decentralized finance and quantum computing, while keeping the related social concerns of fairness, accountability, responsibility, privacy and ethics in clear sight. This report provides additional details on the vertical themes and related research priorities.

In the second half of the year, CRAFT pursued several important fintech opportunities initiated by the state of New Jersey and the National Science Foundation. Leveraging the center's existing expertise and professional network, we worked with our members and other universities, industry start-ups, and state colleges to organize strong proposals to respond to these opportunities. With these prospects taking shape, we are excited that CRAFT is confidently and resolutely exerting its leadership in the fintech research and innovation space, even as a young enterprise. We eagerly look forward to more exciting work to follow in the coming years. Meanwhile, we reaffirm our commitment to our CRAFT members of continuing to enhance awareness and create solutions to realize a more diverse, equitable, and inclusive society using fintech research and innovations.

We are honored and excited to lead CRAFT activities and endeavors in collaboration with all of CRAFT's stakeholders. We wish to take this opportunity to thank all of our industry members for their commitment and dedication to take the center to new heights this past year and set it up for a rewarding and exciting journey forward.

Sincerely,

Steve Yang
Director

Aparna Gupta
Co-Director

George Calhoun
Managing Director

Jesse Lisnow
Operations Director



CRAFT OVERVIEW

The National Science Foundation awarded the first I/UCRC (Industry-University Cooperative Research Center) in fintech – The Center for Research toward Advancing Financial Technologies (CRAFT) – in a joint collaboration between Rensselaer Polytechnic Institute and Stevens Institute of Technology established on July 25th, 2021, and launched on Oct 28th, 2021.

CRAFT's leadership consists of Dr. Steve Yang (Center Director), Dr. Aparna Gupta (Co-Director), and Dr. George Calhoun (Managing Director). The Academic Leadership Team (ALT) of CRAFT consists of Dr. Steve Yang, Dr. Aparna Gupta, Dr. George Calhoun, Dr. Jeffrey Nickerson, Dr. K.P. Subbalakshmi, Dr. Koushik Kar, Dr. Darinka Dentcheva, Dr. Mohammed Zaki, Dr. Abby Kinchy, Dr. Andrei Kirilenko, and Dr. Maggie Chen.

The goal of the CRAFT center is to be a hub for fintech research and innovation. The Center strives to engage in research that helps its members create and assimilate fintech solutions effectively into their organizations. CRAFT's vision is to be an industry-university center devoted to research and workforce development in fintech with the aim of advancing the industry, the various related disciplines of research, and more broadly, make a beneficial impact on society.

CRAFT is dedicated to supporting new research that is collectively endorsed by experts in computer science, mathematics, finance, economics, business management, law and regulation, risk analytics, behavioral and social sciences. Working closely with the CRAFT IAB members, the Center developed a formal process and roadmap to facilitate collaboration across different disciplines in the center's multiple sites. Furthermore, the roadmap for the next 5-10 years has identified seven vertical areas such as Explainable AI, Natural Language Process (NLP), Crypto Assets, DeFi, Green Finance, Quantum Computing, and Cybersecurity. At the same time, across all seven technology areas, the Center promotes social values such as fairness, accountability, responsibility, privacy and ethics. The center's multidisciplinary research projects aim to assimilate the following values:

CRAFT'S VALUES

-  Fairness and accessibility, to establish trust and capitalize on the opportunities with emerging technologies
-  Accountability and social responsibility, with the goal of democratizing finance
-  Sustainability, climate impact and green finance
-  Cooperation with financial regulation, which will greatly benefit interdisciplinary investigation



Fairness



Accountability



Responsibility



Sustainability



Cooperation

CRAFT VERTICALS



Artificial Intelligence



Natural Language Processing



Crypto Assets



DeFi



Quantum Finance



Green Finance



Cybersecurity



SIGNIFICANT RESULTS



Partnered with **15** Industry Leaders

4Thought Tech, Altonomy, Elevance (formerly Anthem), Bank of America Corporate, Bank of America Securities Trading, Capgemini, Charles Schwab, CME, Goldman Sachs, Government Blockchain Association, IBM, SWIFT, The Vanguard Group, UBS, Wells Fargo



Partnered with **60** Faculty Members

Across multiple disciplinary areas such as quantitative finance/financial engineering, finance, business analytics, information systems, computer science, physics, psychology, economics.



Hosted **2** Workshops

Quantum Computing in Finance Workshop with Elena Yndurain, May 2022
Central Bank Digital Currency (CBDC) Workshop, Sep 2022

Upcoming: Workforce Development Workshop, Feb 2023



Hosted **2** Industry Advisory Board Meetings

March 2022 at Rensselaer
November 2022 at Stevens



Funded **7** Industry-Inspired Research Projects



FUNDED 7 PROJECTS

Funded at Full-Level \$100,000

Fast Quantum Methods for Financial Risk Management

PI: Zhenyu Cui (Stevens)

Risky Business? Deep Dive into DeFi

PI: Kristin P. Bennett (RPI)

High-dimensional Portfolio Design and Optimization

PI: Lydia Manikonda (RPI)

Risk Mitigation in Cross-Platform Decentralized Finance

PI: Oshani Seneviratne (RPI)

Predictive Learning from Long Financial Documents

PI: Mohammed Zaki (RPI)

Funded at Pilot-Level \$30,000

Causal Inference for Fairness and Explainability in Financial Decisions

PI: Jia Xu (Stevens)

Explainable Machine Learning for Credit Risk Analytics

PI: Brian Clark (RPI)



“Technology has become a key driver of human progress. It is important to marry these two concepts: using the power of technology to improve human life.”

-- Nariman Farvardin, President, Stevens Institute of Technology



SIGNIFICANT RESULTS

CRAFT has so far successfully recruited 15 industry partners. In addition, the Center has interfaced with a number of federal financial regulators who participated in our center meetings (Securities and Exchange Commission, Commodity and Futures Trading Commission, Office of Currency Control, Federal Reserve Systems, Treasury).

The Center funded 7 Industry Advisory Board (IAB)-recommended projects, established engagement channels between industry and project PIs, held two center-wide Industry Advisory Board meetings, two industry-inspired workshops, and continues to recruit new industry and academic partnerships. CRAFT is also working closely on two major initiatives - the NJEDA Fintech Innovation Center and the NSF Regional Innovation Engines (NSF Engines) Program.

CRAFT is presently in working group discussions with the NJEDA to establish a state level Fintech Innovation Center with the primary aim of serving as an incubator for early stage fintech companies. The CRAFT team submitted a proposal to the NJEDA in response to their RFI to build a Fintech Innovation Center with a focus on startup incubation, workforce development, and regional economic improvement. The team received very favorable feedback and is actively planning the center with NJ State and corporate partners.

CRAFT also submitted a NSF Engines Type-1 Proposal seeking to develop an NSF Regional Fintech Innovation Engine (initial grant award is \$1 million for first two years). This new NSF program was created under the Chips and Science Act passed into law in August 2022. If progressed to a "Type 2" grant, this initiative has the potential to receive up to \$160 million in funding for 10 years. We built a team of 25 organizations including Stevens Institute of Technology, Princeton University, Columbia University, Rensselaer Polytechnic Institute, University of Connecticut, and Rutgers Law School along with state colleges, incumbent industry members, venture funds, fintech start-ups along with government agencies from NJ-NY-CT.



RESEARCH

The CRAFT IAB recommended 7 projects for research funding. Following bylaw procedures, the ALT (Academic Leadership Team) decided to fund 7 projects, all of which started on June 1, 2022. Five projects were selected for the \$100K full-funding level (1 year) and two projects were selected for the \$30K pilot-funding level (6 months) for a total of \$560K. During this funding process, the Center established a collaborative research interest discovery procedure, securing it as a formal operation to follow. The Center also created a collaborative culture between the IAB, ALT, and project PIs; establishing a budget and scope revision process for project teams prior to project kickoff. All full and associate CRAFT industry partners have full access to CRAFT's research outcomes – including publications, intellectual property rights, and deployable technologies – on a non-exclusive, royalty-free basis. IP terms and conditions are standardized according to the NSF's well-established template, which simplifies this often-tricky aspect of industry funding for academic research.



"Unique partnerships between universities, government, & industry will be crucial to advancing technologies to meet the challenges we have ahead of us."

-- Martin Schmidt, President, Rensselaer Polytechnic Institute



WORKSHOPS

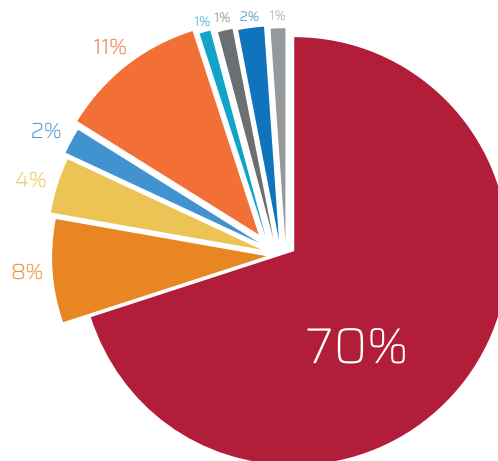
In May 2022 CRAFT launched a Quantum Computing in Finance Workshop with Elena Yndurain, a technology strategist specialized in launching emerging technologies into the market, linking R&D to business applicability. The workshop was an overview and discussion of what quantum computing is, the current state of the art, and what are the potential use cases for the finance industry. During the 2-session workshop the following concepts were presented - quantum computing overview/concepts, providers, ecosystem, technology stack, development environment, preparing for quantum, where are we today, quantum computing general applicability, use cases examples, finance use cases, corporate examples, prioritizing use cases, and selecting a use case. A survey was also distributed after the workshop so the Center could further develop workshop formatting to suit industry needs.

In September 2022, CRAFT hosted its second workshop on Central Bank Digital Currency (CBDC) at the Stevens Institute of Technology. The workshop was an overview and discussion of the CBDC System Governance and Policies, Infrastructure Design and Interoperability, and Liquidity and Systemic Risk. The 2-session workshop included both industry and faculty presentations. Session 1 included CBDC System Governance and Policies with use cases and development. SWIFT, Government Blockchain Association, IBM, and Capgemini all presented. Session 2 was dedicated to Infrastructure Design, Interoperability, Liquidity, and Systemic Risk. Dr. Yeganeh Hayeri, a faculty of the School of Systems and Enterprises at Stevens Institute of Technology, presented System Governance and Policies, Oshani Seneviratne, Associate Director of the Tetherless World Constellation at Rensselaer Polytechnic Institute and an Assistant Professor in Computer Science, presented Infrastructure Design and Interoperability, and Dr. Zachary Feinstein, an Assistant Professor at Stevens Institute of Technology School of Business, presented Liquidity and Systemic Risk.



EXPENSE REPORT (PAID BY STEVENS)

- Salaries - \$182,891
- Professional Services - \$20,858
- Data & Audio - \$9,212
- Printing & Copy Services - \$4,479
- Meetings & Workshops - \$27,875
- Equipment Purchases - \$3,598
- Materials & Supplies - \$2,718
- Travel - \$4,862
- Maintenance & Repairs - \$2,578
- Software Licenses - \$237
- Bank Fees - \$750
- Subscriptions & Publications - \$394

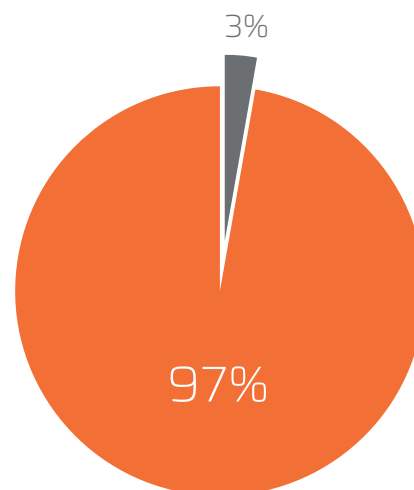


TOTAL EXPENSES: \$260,452



REVENUE FROM MEMBERSHIP FEES

- Membership Indirect Costs - \$15,000
- 7 Funded Awards - \$560,000



TOTAL REVENUE: \$575,000



"NSF's commitment signals the federal government's recognition of the importance of technology in the financial industry, and corporate involvement will be crucial to the success of CRAFT."

-- Jianmin Qu, Provost and Senior Vice President
for Academic Affairs, Stevens Institute of Technology



INFRASTRUCTURE

Stevens, as the lead site, received additional financial support from the university to hire additional staff to support CRAFT's operations and outreach. These additional hires include a full-time operations director, a part-time finance manager, a part-time communications staff, and a part-time Chief Research Officer for outreach. These additions have all been successfully completed in 2022.

CRAFT has also received physical space for operations at Stevens which include conference rooms and office spaces for faculty and staff. The number of affiliated faculty of the Center has grown from the initial 28 during the planning phase to nearly 60 across science, technology, and social science disciplines at both Stevens and RPI.



"We're not just looking at specific technologies like AI, blockchain or quantum computing. We want to address related issues: ethics, law regulation, governance and policy issues so that we have a holistic approach in product development and service innovation. All fintech innovations should provide better accountability, privacy and social responsibility."

--Steve Yang, CRAFT Director



ACCOMPLISHMENTS AND MILESTONES



CRAFT has launched its first year of operations with 15 Members (13 Full or Associate, 2 Affiliate), including industry leaders representing many different segments of the financial services industry including banking, insurance, retail brokerage, a financial exchange, asset management, and others.



Between Stevens and RPI, CRAFT has secured nearly 60 affiliated faculty members across multiple disciplinary areas such as quantitative finance/financial engineering, finance, business analytics, information systems, computer science, physics, psychology, economics, systems, etc.



The first cycle of research project proposals attracted dozens of submissions from both university sites, resulting in approximately 15 proposals that were presented at the first IAB meeting of CRAFT held in March 2022 at the Rensselaer Polytechnic Institute campus.



CRAFT launched the first Industry Advisory Board Meeting (IAB) Spring Meeting at Rensselaer Polytechnic Institute. Day 1 consisted of presentations made by Center leadership, RPI and Stevens leadership, and prospective academic partner the University of Memphis. Keynote addresses by Capgemini and IBM were also presented. An NSF presentation on the I/UCRC Model by former NSF Program Director & Evaluator Behrooz Shirazi (now Mohan Kumar) is presented. A panel discussion on FinTech Challenges and Opportunities in Insurance with panelists from Anthem, Capgemini, and others was included. 15 project proposals were presented on Explainable AI and Fairness, Novel Data Paradigms for Financial Decisions, and Frontiers in Risk Challenges. Day 2 opened with networking, followed by IAB administrative matters, and feedback and voting from industry participants. IAB members completed 2 rounds of project voting, and their results were issued to the ALT. From the proposals that were presented, 7 were selected for first year funding by the IAB (5 Full, 2 Pilot).



CRAFT created engagement and collaborative channels between IAB members and project PIs through Slack and bi-weekly/monthly zoom meetings. These strategic channels are an opportunity not only for IAB members to be updated on project progress, but allows them to further guide, advise, and steer projects as they unfold.



CRAFT has been using the IAB semi-annual meetings to provide fintech training and development to industry participants, government staff, and students at all levels. More than 200 industry professionals and 40 students participated in the open meetings for the spring and fall IAB meetings. For all the funded projects, there is at least one Ph.D. student involved in the research. These students will be trained as experts in specific areas.



"Our students get relevant, compelling research projects to work on. And, of course, industry members get strong talent."

--Aparna Gupta, CRAFT Co-Director



CRAFT launched its official website at stevens.edu/craft. The website contains essential overview information about the mission and vision of the Center, includes a I/UCRC overview with FAQs, provides leadership information and all the affiliated faculty profiles, details how to become a member, lists current academic and IAB members, provides current project summary information, news and events related to the center, fintech overviews, and includes a portal for new research proposals.



CRAFT organized two industry-inspired Fintech workshops (Quantum Computing, CBDC Standardization) which included participation from specialized consultants, Stevens/RPI faculty, and Industry members.



The second cycle of project proposals attracted 13 newly proposed research projects. After a review by the ALT, 8 proposals were chosen to present at the Fall 2022 Industry Advisory Board Meeting based on industry interest, academic merit, and possibility of commercialization. ALT findings are shared with all proposal PIs so they may revise their proposals for future funding opportunities.



CRAFT launched its second bi-annual Industry Advisory Board Meeting at the Stevens Institute of Technology. Day 1 of the conference includes presentations from Center and Academic Leadership, prospective academic presentations by the University of Memphis and the University of Florida, keynote addresses by prospective industry partners NJEDA and PGIM, a presentation by the Center's NSF Program Director, and 8 newly submitted research project proposals. Overviews of 7 current research projects as well as presentations on Workforce Development, Access to Talent, and the IUCRC mission are also presented. Day 2 consisted of an ALT/IAB session, presentations by the 7 PIs of our currently funded projects, an NSF/IAB closed session, and an IAB/ALT final report.



LOOKING AHEAD

In February 2023, CRAFT will be hosting a Workforce Development Workshop at Stevens. Threading a common industry theme, the Center will be actively focusing on building workforce development initiatives and access to talent pipelines, with the first such iterations occurring as this proposed industry panel discussion. Though still in the process of finalization, the workshop will be a 2-part industry/HR discussion on the state of the industry and a “fireside chat” led by students from Stevens and RPI. We aim to gather enough information from this session to curate a specialized job fair based on industry and HR needs, which will not only serve to stimulate student engagement in the Center, but also begin the process of building CRAFT resume books. Included in the workshop will be presentations of Stevens Hanlon Financial Systems Center and a presentation by SSMIF (Student Managed Investment Fund). CRAFT’s 3rd bi-annual Industry Advisory Board Meeting will take place on March 30 & 31, 2023 at Rensselaer Polytechnic Institute. The Industry Advisory Board will be reviewing and voting on a new set of research projects that will begin on June 1, 2023.



“Just as the financial exchanges have been transformed by automation in the last 20 years, new technologies will reshape the banking and insurance sectors. The mission of CRAFT is to help our industry members prepare and stay ahead of this trend, and allow for a smoother transition to new business models and infrastructures.”

--George Calhoun, CRAFT Managing Director



CRAFT GROWTH OBJECTIVES

To accomplish the Center's long-term growth objectives, the CRAFT team have defined specific plans according to these broad objectives.

A Conduct high-quality, high-impact research to meet shared needs of industry constituencies



Base all research funding on industry need and the ability of commercialization.



Work with venture investment firms to develop start-up incubation programs.

B Enhance workforce development and access to talent pipelines to drive industry and student engagement



Continue to provide industry-inspired workshops, work with HR representatives from IAB members to drive actionable recruitment efforts, provide opportunities for active student engagement and showcasing.



Continue to enhance the student Sandbox program which is designed to solicit, support, and develop student team-initiated project ideas to serve the academic and industry needs for greater coherence in fintech innovations.

C Continue to actively recruit new partners in industry and academia



Add new industry partners to the consortium to strengthen the research and talent needs while additional partners in academia will add to the diversity of affiliated faculty and available research projects for funding.



The two specific sectors we are targeting during the next period are the insurance and consulting industry.



Encourage diversity equity and inclusion (DEI) throughout all CRAFT activities.

D Assert thought leadership in fintech research and innovation



Continue to use workshops, social media, and other public forums to disseminate new knowledge in fintech, and advocate social and economic impact.



Engage local and federal financial regulators (SEC, Federal Reserve, CFTC, Treasury) to communicate challenging issues raised by the center members.

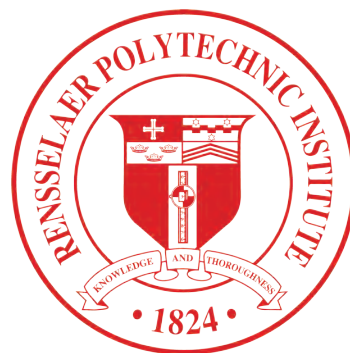


CRAFT

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School of Business



stevens.edu/craft