

**RESEARCH GRANTS COUNCIL
THEME-BASED RESEARCH SCHEME (TRS)**

Completion Report on Funded Project

Project start date: 1 Jan 2019
Project completion date: 31 Dec 2022

1. Project Title: Contributing to the Development of Hong Kong into a Global Fintech Hub

2. Names and Academic Affiliations of Project Team Members[#]

Project team member	Name / Post	Unit / Department / Institution	Average number of hours per week spent on this project in the <u>whole</u> project period
Project Coordinator (PC)	TAM Kar Yan / Chair Prof.	Information Systems, Business Statistics & Operations Management (ISOM) / HKUST	10
Co-Principal Investigator(s)	BHATTACHARYA Utpal / Chair Prof. ¹	Finance / HKUST	5
	CHAN K.C. / Adj. Prof.	Finance / HKUST	10
	CHAN Wai-sum / Dean ²	School of Decision Sciences / HSUHK	8
	CHEN Tai-Yuan / Prof. ³	Accounting / HKUST	8
	FONG Yuk-Fai / Prof. ⁴	Economics / HKUST	7
	HONG Weiyin / Asso. Prof. ⁵	ISOM / HKUST	8
	HUANG Allen / Prof. ⁶	Accounting / HKUST	5
	HUI Kai-Lung / Chair Prof.	ISOM / HKUST	10

	JAMES Lancelot / Chair Prof. ⁷	ISOM / HKUST	5
	LI Yingying / Chair Prof. ⁸	ISOM & Finance / HKUST	10
	LING Shiqing / Chair Prof. ⁹	Math / HKUST	5
	SO Mike Ka Pui / Prof. ¹⁰	ISOM / HKUST	8
	XU Yan / Prof. ¹¹	ISOM / HKUST	5
	YEUNG Dit-Yan / Chair Prof. ¹²	Computer Science & Engineering / HKUST	5
	YOU Haifeng / Prof. ¹³	Accounting / HKUST	10
	YU Philip L.H. / Prof. ¹⁴	Mathematics and Information Technology / HKEdU	5
	YUE Wei Thoo / Prof. ¹⁵	Information Systems / CityU	5
	ZHANG Chu / Chair Prof. ¹⁶	Finance / HKUST	10
	ZHANG Xiaoquan / Prof.	Decision Sciences & Managerial Economics / CUHK	10
	ZHENG Rong / Asso. Prof.	ISOM / HKUST	10
	ZHENG Xinghua / Prof. ¹⁷	ISOM / HKUST	10
Co-Investigator(s)	CHEN Yanzhen / Asst. Prof.	ISOM / HKUST	5
	YANG Yi / Asso. Prof. ¹⁸	ISOM / HKUST	5

Please highlight the approved changes in the project team composition and quote the date when the RGC granted approval of such changes. For changes in the project team composition, please submit a separate request, together with the justification and the curriculum vitae of the new member(s), to the RGC three months prior to the intended effective date of the change.

Note 1: The following changes in the affiliations and titles of existing project team members took place during the project period:

- ¹ Prof. BHATTACHARYA Utpal of HKUST was promoted from Professor to Chair Professor, w.e.f. 1 July 2020. An update of this change was submitted to RGC on 17 December 2020.
- ² Prof. CHAN Wai-sum changed affiliation from CUHK to HSUHK (non-UGC-funded institution) as Dean of the School of Decision Sciences, w.e.f. 1 August 2022. An update of this change was submitted to RGC on 23 February 2023.
- ³ Prof. CHEN Tai-Yuan of HKUST joined the project team as Co-PI. A change request was submitted to RGC on 17 December 2020 and approved on 15 January 2021.
- ⁴ Prof. FONG Yuk-fai changed affiliation from HKU to HKUST as Professor at the Department of Economics, w.e.f. 31 August 2023.
- ⁵ Prof. HONG Weiyin of HKUST joined the project team as Co-PI. A change request was submitted to RGC on 17 December 2020 and approved on 15 January 2021. Prof. HONG was promoted from Visiting Associate Professor to Associate Professor, w.e.f. 1 July 2021.
- ⁶ Prof. HUANG Allen of HKUST was promoted from Associate Professor to Professor, w.e.f. 1 July 2023.
- ⁷ Prof. JAMES Lancelot of HKUST was promoted from Professor to Chair Professor, w.e.f. 1 July 2018.
- ⁸ Prof. LI Yingying of HKUST was promoted from Associate Professor to Professor, w.e.f. 1

- July 2019, then promoted to Chair Professor of ISOM and Finance, w.e.f. 1 July 2023.
- 9 Prof. LING Shiqing of HKUST was promoted from Professor to Chair Professor w.e.f. 1 July 2021.
- 10 Prof. SO Mike Ka Pui of HKUST was promoted from Associate Professor to Professor, w.e.f. 1 July 2019. An update of this change was submitted to RGC on 17 December 2020.
- 11 Prof. XU Yan of HKUST was promoted from Associate Professor to Professor, w.e.f. 1 July 2019. An update of this change was submitted to RGC on 17 December 2020.
- 12 Prof. YEUNG Dit-Yan of HKUST was promoted from Professor to Chair Professor, w.e.f. 1 July 2020. An update of this change was submitted to RGC on 17 December 2020.
- 13 Prof. YOU Haifeng of HKUST was promoted from Associate Professor to Professor, w.e.f. 1 July 2021.
- 14 Prof. YU Philip changed affiliation from HKU to HKEdU as Professor at the Department of Mathematics and Information Technology, w.e.f. 1 September 2020. An update of this change was submitted to RGC on 17 December 2020.
- 15 Prof. YUE Wei Thoo of CityU was promoted from Associate Professor to Professor at the Department of Information Systems, w.e.f. 1 July 2020.
- 16 Prof. ZHANG Chu of HKUST was promoted from Professor to Chair Professor, w.e.f. 1 July 2021.
- 17 Prof. ZHENG Xinghua of HKUST was promoted from Associate Professor to Professor, w.e.f. 1 July 2021.
- 18 Prof. YANG Yi of HKUST was promoted from Assistant Professor to Associate Professor, w.e.f. 1 July 2023.

Note 2: Prof. PARLOUR Christine of University of California, Berkeley left the project team as Collaborator. A change request was submitted to RGC on 17 December 2020 and approved on 15 January 2021.

3. Project Objectives

Summary of objectives addressed/achieved:

Objectives*	Percentage achieved	Remarks**
1. To assess the impacts of emerging fintech technologies on the delivery of financial services and the landscape of Hong Kong's finance industry.	1. 100%	1. See Section 6.1.
2. To study the ecosystem of fintech innovations in Hong Kong and offer policy recommendations to maintain and strengthen the creation of financial innovations that leverage technological advances.	2. 100%	2. See Section 6.1.

* Please highlight the approved changes in objectives and quote the date when the RGC granted approval of such changes.

** Please provide reasons for significantly slower rate of progress than originally planned.

6. Research Highlights and Outputs

6.1 What are the most exciting research accomplishments of the project?

(Please list five or more of the team's best research accomplishments, such as journal and conference papers, software codes, research infrastructure, etc. For each item, please clearly justify how it has achieved international excellence (e.g. best paper award, invited presentation, citations, product licensed to industry, etc.))

The team made notable research accomplishments, including a number of published papers in high-impact journals, conference papers, and development of innovative fintech application models and prototypes such as the financial language analysis applications FinBERT and FinSent (Task 5) and the Emerging Jobs and Skills Portal (Task 8) which are accessible to the public and well received by companies and individual users. Furthermore, the team engaged actively with industry leaders, professional bodies, regulators and the government to drive various collaborative initiatives on fintech promotion, talent development and public education that helped to align our research endeavours with the industry's perspectives and needs. The following report of accomplishments is organised by our eight research tasks, followed by additional outputs beyond the individual tasks.

I. Research Accomplishments by Task:

Task 1: The Economic Implications of Blockchain Technology

- We are preparing a paper “**Permissioned Blockchains, Transaction Fee, and Strategic Validators: An Economic Analysis**” for journal submission. This paper discusses the findings of our study that examines orderers' economic incentives in a permissioned blockchain. Key findings include:
 - Through comparing and contrasting the benefits and outcomes of incorporating transaction fees in a permissioned blockchain vis-a-vis the first-come, first-served (FCFS) mechanism, we found that the transaction fee mechanism can enhance social welfare over the FCFS mechanism in a wide range of settings, especially when only a fraction of users choose to pay transaction fees because of their need to settle time-sensitive transactions. We showed that strategic orderers may have incentives to reduce service capacity in an FCFS system.
 - We then compared the merits of two transaction fee allocation mechanisms: Equal allocation and effort-based allocation. Our numerical simulation shows that there is an intriguing tradeoff between social welfare and orderers' profits. Equal allocation enhances orderers' profits but decreases social welfare, while effort-based allocation enhances social welfare at the sacrifice of orderers' profits. Given that orderers, collectively, are often also the founders or core members of a permissioned blockchain, this discrepancy between profit and social welfare performance calls for closer scrutiny.
 - Related managerial and policy implications are also set out in the paper. Findings of the study were delivered at the **International Conference on Industrial Engineering and Industrial Management in 2021 (IEIM 2021)**.
- We have submitted a paper “**Experimenting on Transaction Fee Artifacts in Permissioned Blockchains for Payment Networks: Unification of Design and Social Sciences**”, which is currently under review at *MIS Quarterly*. This paper documents findings of the experiment on validators' behaviors using a functioning permissioned blockchain we built. We introduced and experimented with an economic incentive artifact for transaction fees in permissioned blockchains in the context of payment networks. Our design draws on game-theoretic models and theories of information disclosure to understand validators' resource contribution decisions. The artifact design was then refined and tested with a series of behavioural experiments. The pilot study shows that the experimental results are inconsistent with the model's predictions, implying room for

improving our model-based artifact design. Hence, the team has proposed to study how to improve our model with empirical evidence to refine our design. This study has the potential to advance the understanding of how validators interact with economic incentives in permissioned blockchains. In terms of methodology, we extended the repertoire for design science researchers by demonstrating the interaction of economic modeling, behavioural sciences and design science. Furthermore, fintech practitioners can apply the resulting artifact to improve their blockchain-based payment systems.

- We believe that the study can offer insights into the impacts of blockchain technology on firm performance and help to validate the general findings based on the developed models. Considering the significant potential and widespread interest in blockchain technology, the outcomes of Task 1 can assist both researchers and practitioners in deciding the suitability of blockchain as a foundational technology for fintech applications, which also contributes to a broader understanding and assessment of blockchain's potential in the fintech industry.

Task 2: The Effectiveness of Cybersecurity Protection Schemes for Financial Institutions

- We conducted a thorough evaluation of the effectiveness of cybersecurity protection schemes for financial institutions (FIs), which encompassed an analysis on the implementation status of Cyber Resilience Assessment Framework (C-RAF) measures among FIs and their state of security as measured by the number of security incidents and attacks they experience, as well as an empirical assessment of the impact of C-RAF adoption on security in the industry.
- To raise awareness about the importance of addressing cybersecurity gaps, the team published a report “**Cybersecurity for Financial Industry: An Analysis of the Cyber Resilience Assessment Framework**” in February 2022. This report summarizes key insights from the detailed assessment and analysis of the C-RAF measures, and provides additional views on how these measures can expose the state of security development of FIs. A copy of the report can be found at <https://bm.hkust.edu.hk/en-us/media-resources/overview/publications/reports/issue:8/>.
- Between January 2019 and June 2021, we compiled a detailed list of C-RAF measures, surveyed 22 authorised institutions (AIs) and collected public data on participating banks for a comprehensive assessment using different models of analysis to study the effectiveness of the C-RAF and the banks’ cybersecurity performance relative to industry peers.
- Through the survey, we assessed the two processes of the C-RAF – Inherent Risk Assessment (IRA) and Maturity Assessment (MA). In the IRA process, AIs performed self-assessment under five domains to reflect their cybersecurity threat level, which is mapped to their expected maturity level of cyber resilience. In the MA process, they assessed cybersecurity controls under seven domains to determine their maturity level.
- The report serves to bridge the understanding of the effectiveness of the security measures undertaken by FIs under the C-RAF and to assess the impact of C-RAF adoption on security in the industry. It also provides useful insights for regulators to evaluate whether their policies and regulations are effective in achieving security outcomes and worthy of the investment.

Task 3: Integrating Individual Investors’ Risk Preferences into Robo-advising

- We published a paper “**Robo-Advising Risk Profiling through Content Analysis for Sustainable Development in the Hong Kong Financial Market**” that summarizes the results of our research, where we compiled a list of client profiling questions based on existing instruments and literature, sorted the questions into subgroups to reflect investors’ behaviours, objectives and risk tolerance in robo-advising, and collected comments from financial practitioners on profiling questions.
- A focus of this task was to develop statistical models to learn potential clients’ latent traits or attitudes. Based on the background statistical tools developed in this project, a new

statistical model was developed. Details are summarised in a working paper “**A Semi-parametric Multidimensional and Longitudinal Item Response Model with Mixed Data Type**” on eliciting clients’ risk profiles and investment behaviours through statistical modelling. We conducted simulations on the statistical models using the client profiling questions to apply the model to real data. The paper was presented at the **6th International Conference on Econometrics and Statistics in August 2023 (EcoSta 2023)** to obtain feedback from local and overseas scholars for improving the models.

- The assessment of the statistical model on the effectiveness of attitude scores is being done for robo-advising. Preliminary results are expected to be available in a few months, after which we will document the experience from the assessment for possible adoption and implementation by the financial industry.
- Prof. Mike So (Co-PI and leader of Task 3) represented HKUST to serve as co-chair of the organisation committee and hosted the **4th International Conference on Econometrics and Statistics in June 2021 (EcoSta 2021)** (enclosed in Appendix A1). This is an annual academic conference sponsored by the journal *Econometrics and Statistics (EcoSta)* and its supplement, the *Annals of Computational and Financial Econometrics*, and the *Computational Statistics & Data Analysis*. At the conference, Prof. Philip Yu (Co-PI and member of Task 3) presented the paper “**Sparse Vector Error Correction Models with Application to Cointegration-based Trading**”, which is one of the publication outputs of this project.

Task 4: Robo-advising and the Trading Behaviour of Individual Investors

- Despite the challenges in obtaining field data for empirical analysis at the early stage of the project, we were able to collaborate with China CITIC International Bank in Hong Kong to gain access to relevant data. This data allowed us to analyse and examine the difference in investment behaviours between adopters and non-adopters. In addition, we developed a robo-advising system based on a novel risk estimation model developed by Prof. Y.Y. Li (Co-PI) (Ao, Li, Zheng, 2019, available at <https://doi.org/10.1093/rfs/hhy105>), which allows investors to state their risk preferences and recommends a portfolio of Hong Kong stocks that matches their risk preferences. The system enabled the study of the relationship between trading behaviour, risk preference and model-based portfolio recommendation, and provided a basis for more rigorous analysis.
- We published two papers, “**Protecting Against Threats to Information Security: An Attitudinal Ambivalence Perspective**” in *Journal of Management Information Systems* in 2021, and “**Augmenting Fake Content Detection in Online Platforms: A Domain Adaptive Transfer Learning via Adversarial Training Approach**” in *Production and Operations Management* in 2023.
- The paper “Protecting against Threats to Information Security: An Attitudinal Ambivalence Perspective” explores the relationship between motivation and behaviour in the context of information security, specifically focusing on the Protection Motivation Theory (PMT). The paper offers a perspective of incorporating attitudinal ambivalence, which arises from the intrapersonal and interpersonal appraisal processes, into PMT. From a practical standpoint, the paper provides insights into designing effective fear appeals to avoid triggering attitudinal ambivalence and thus encouraging adoption of security protection behaviour.
- The paper “Augmenting Fake Content Detection in Online Platforms: A Domain Adaptive Transfer Learning via Adversarial Training Approach” sheds light on the platform operation in managing online content and resources when applying machine learning for fake content detection. We also outline a modular architecture that can be adopted in developing content screening tools relevant to a number of fintech applications.

Task 5: The Effectiveness of Artificial Intelligence Techniques in the Multimodal Content Analysis of Public Disclosures

- Task 5 focused on advancing the understanding of the information content in qualitative

corporate disclosure by applying deep learning methods to the analysis. A significant output delivered by the team is the deep learning-based language model, **FinBERT**, which is a language model for natural language processing (NLP) in financial applications. The model extends Google's BERT by pre-training it with financial information with a corpora size of 4.9B tokens. Initial benchmarking results indicate FinBERT outperforms BERT in analysing financial texts. The FinBERT model is accessible online. Individuals and companies can make use of it for financial text analysis to predict outcomes such as stock returns, stock volatility and corporate fraud. The software can be downloaded for free via the HKUST Business School website or directly at: https://ust.az1.qualtrics.com/jfe/form/SV_9LXsU66wTPpyCmF.

- Building on the foundation of FinBERT, we developed a fintech application **FinSent** for sentiment analysis based on financial texts. The application was first trained on financial communication corpus of US-listed firms and was expanded to encompass HKEX-listed firms in 2022. It provides investors with a new perspective to analyse listed companies beyond financial information. We are continuously enhancing FinSent to maximise its usefulness to the industry. It can be accessed for free at <https://cbsa.hkust.edu.hk/FinSent/hkg-listed>. Relevant communication materials of the application can be found in Appendices A2 and A3.
- We published a paper "**FinBERT: A Large Language Model for Extracting Information from Financial Text**" in *Contemporary Accounting Research* in 2023 to introduce and comprehensively evaluate FinBERT's performance and application. The paper also discusses the project's implications for academic researchers, investment professionals and financial market regulators.
- We also produced a paper "**The Effects of Sentiment Evolution in Financial Texts: A Word Embedding Approach**", which has been accepted for publication in *Journal of Management Information Systems*. The paper documents findings of the study examining the evolutionary effects of sentiment words in financial text and their implications for various business outcomes. The paper documents findings of the study to examine the evolutionary effects of sentiment words in financial text and their implications for various business outcomes. In the study, we proposed an algorithm called Word List Vector for Sentiment (WOLVES) that leverages both a human-defined list of sentiment words and the word embedding approach to quantify text sentiment over time. WOLVES was then applied to investigate the evolutionary effects of the most popular list of financial words, i.e., words in the Loughran and McDonald (LM) dictionary, that appeared in annual reports, conference calls and financial news. It was found that LM negative words become less negative over time in annual reports compared to conference calls and financial news, while LM positive words remain qualitatively unchanged. This finding reconciles with existing evidence that negative words are more subject to managers' strategic communication. We also provided practical implications of WOLVES by correlating the sentiment evolution of LM negative words in annual reports with market reaction, earnings performance and accounting fraud.

Task 6: Developing a Real-Time Systemic Risk Monitoring System Using Advanced High-Frequency and High-Dimensional Analytics Techniques

- This task aimed to quantify market risk through statistical modelling and develop a real-time systemic risk monitoring system using the measures developed. We contributed working papers and conference presentations across the key areas of risk analysis, cross-sectional volatility modelling, financial networks and asset allocation. A number of these papers produced were published or accepted by top journals including the *Journal of Econometrics* and the *Journal of the American Statistical Association*. Our papers, namely "**Fundamental Analysis via Machine Learning**" and "**Statistical Learning for Personalized Wealth Management**", have been widely presented to the global research community at multiple international conferences in the fields of fintech and financial econometrics by members of Task 6.

- We also produced the paper “**Stock co-jump networks**”, which was accepted and will be published in the *Journal of Econometrics*. A Degree-Corrected Block Model with Dependent Multivariate Poisson edges (DCBM-DMP) was proposed to study stock co-jump dependence. To estimate the community structure, we extended the SCORE algorithm in Jin (2015) and developed a Spectral Clustering On Ratios-of-Eigenvectors for networks with Dependent Multivariate Poisson edges (SCOREDMP) algorithm. We demonstrated that SCORE-DMP enjoys strong consistency in community detection. Empirically, using high-frequency data of S&P 500 constituents, we constructed two co-jump networks according to whether the market jumps and found that they exhibit different community features than GICS. It was shown that the co-jump networks are useful in predicting stock returns.

Task 7: Sustaining Financial Innovations in Hong Kong

- We dedicated efforts to study and bridge the gaps between the development of fintech and the regulatory and policy frameworks in the financial sector, which led to the paper “**Fintech Lending, Financial Inclusion, and Policy Implications**”. The paper highlights the dynamics between banks, informal lenders and fintech lenders in shaping financial inclusion outcomes. Findings of the study were presented at six international conferences between 2019 and 2022 despite the challenges brought about by the COVID-19 pandemic.
- Building on the outputs and as a continuation of this research project, we will expand our study to investigate the direct competition between banks and big techs, as well as how open banking affects financial inclusion.
- In addition, we published the industry report “**The Adoption of Virtual Banks and Insurers**” in October 2020 (reported and submitted in the 3rd Progress Report), which features findings from a large-scale survey conducted between May and July 2020 that involved over 2,200 respondents from the Hong Kong population. Findings and insights from this research were also shared by Prof. Kar Yan Tam (PC) in an article in the Hong Kong Economic Times (HKET). A copy of the article is provided in Appendix A4.
- We also published an industry report “**Hong Kong Towards A Leading Global Fintech Hub – Best Practices and Recommendations through Examining Other World Hubs**” in March 2022. The report documents findings and policy recommendations based on an in-depth research study on the ways forward for Hong Kong’s development into a leading global fintech hub. This was a first-of-its-kind comprehensive study taking references from the experience of seven fintech hubs in the world – namely London, New York, San Francisco, Shanghai, Singapore, Tokyo and Zurich. Drawing insights from the study and inputs from diverse industry stakeholders, we outlined 10 opportunities that Hong Kong should leverage to enhance its fintech capabilities, and provided key observations and policy recommendations spanning strategy setting, innovation and talent building for Hong Kong to achieve the status of a leading global fintech hub. A copy of the report is available at <https://bm.hkust.edu.hk/en-us/media-resources/overview/publications/reports/issue:9/>.

Following the launch of the report, we held an industry seminar “**Hong Kong’s Way Forward to Becoming a Leading Global Fintech Hub: An Industry Dialogue**” in June 2022 to yield further insights from representatives from the government and regulator, including the Hong Kong Monetary Authority (HKMA), InvestHK and the Financial Services Development Council (FSDC) and facilitated further discussions on the topic among stakeholders of the Hong Kong fintech ecosystem. Findings of our study were presented to the Coordination Group on Implementation of Fintech Initiatives (CGFin), which was chaired by the Secretary for Financial Services and the Treasury of HKSAR on 23 May 2022, the Fintech Cross-Agency Coordination Group (CACG) led by the HKMA on 27 June 2022, and industry participants at the “Hong Kong Towards a Leading Global Fintech Hub” seminar on 8 June 2022. The agendas of the meetings with the coordination groups and details of the industry seminar are enclosed in Appendices A5, A6 and A7.

Task 8: Fintech Core Competencies and Manpower Development

- The research team has conducted various industry-wide studies on fintech talent development, and our research effort was also extended to encompass other fintech sub-sectors that are identified as areas of focus in Hong Kong, namely regulatory technology (regtech) and insurance technology (insurtech). Several reports were published as a result of the project, including:
 - **“Fintech Talent Development, Competency, and Manpower Study”** in June 2020 (reported in the 3rd Progress Report), accessible at <https://bm.hkust.edu.hk/en-us/media-resources/overview/publications/reports/issue:2/>
 - **“Fintech Manpower Development in Asia-Pacific Financial Centers with A Focus on Artificial Intelligence and Big Data Professionals”** in December 2021, accessible at <https://bm.hkust.edu.hk/en-us/media-resources/overview/publications/reports/issue:6/>
 - The duo reports **“Regtech Development in Hong Kong: Talent as a Fuel for Growth”** and **“Regtech Development in Hong Kong: Challenges and Recommendations”** in January 2023, which are accessible at <https://bm.hkust.edu.hk/en-us/media-resources/overview/publications/reports/issue:12/> and <https://bm.hkust.edu.hk/en-us/media-resources/overview/publications/reports/issue:11/> respectively.
- “Fintech Talent Development, Competency, and Manpower Study” discusses 10 observations about the industry and 10 recommendations related to talent development, as well as 13 core competencies for fintech professionals that are relevant to Hong Kong’s unique context. The industry-wide study involved the collaboration and participation of 80 fintech organizations. A press conference, webinars for industry participants and the public, and an online sharing session for students and alumni were held in connection with the launch of the report (Appendix A8).
- “Fintech Manpower Development in Asia-Pacific Financial Centers with A Focus on Artificial Intelligence and Big Data Professionals” provides an in-depth analysis of the AI and big data talent landscape across six financial centres in Asia-Pacific, namely Hong Kong, Singapore, Shanghai, Shenzhen, Tokyo and Sydney. In light of the findings of the study, we included additional observations and outlined six policy recommendations for Hong Kong to leverage its human capital and support the city’s status as a global financial centre and Asia’s world city. Some insights from the corresponding research were shared at the panel “AI and Big Data Adoption in APAC: A Talent Development Perspective” at Hong Kong FinTech Week 2021. Details of the panel session are enclosed in Appendix A9.
- The PC is PI of another project entitled “The Development of Fintech, Insurtech, and Regtech Manpower to Sustain Hong Kong as a Leading Global Financial Center” (S2020.A7.008.20S) funded by PICO which shares the objective of developing talent for the financial industry. It started in May 2021. There are synergies between the two projects and each is complementary to the other to ensure the best utilization of resources to achieve a broader goal beyond each project individually. One common goal is Regtech talent development. Based on four focused group studies conducted in July 2022, two reports “Talent as a Fuel for Growth” and “Challenges and Recommendations” under the theme of “Regtech Development in Hong Kong” identify the barriers hindering regtech growth in Hong Kong, examine the manpower situation and talent gaps in the regtech talent landscape, and provide recommendations for enhancing the regtech capability of Hong Kong. In connection with the reports, an industry seminar **“Regtech Industry Dialogue: Talent as the Fuel for Growth”** was held in February 2023 to provide a platform for industry stakeholders to share thoughts on potential solutions to the talent shortage. Details of the industry seminar are provided in Appendices A10.
- Leveraging on the additional resources provided in the PICO project to build on top of the findings of Task 8 from 2019 to 2022, we developed the **Emerging Jobs and Skills Portal** and launched it for public use in July 2023 (Appendix A11). Using AI/ML technologies to analyse job market data of the emerging sectors, the Portal features employment trends and statistics of six emerging sectors, including AI and ML, big data analysis, ESG, fintech,

insurtech and regtech, and may be expanded to cover more sectors in the future. The Portal allows job seekers and employers to easily understand the job market trends, key responsibilities, and skills requirements of jobs available in these dynamic sectors, and facilitates interested individuals to enter the fields. The Portal can be accessed at <https://jobsskillsportal.hkust.edu.hk/>. The Portal has been well received by relevant stakeholders. Testimonials from the regulators and industry associations are enclosed in Appendix A12.

- Through our comprehensive industry manpower studies, development of a practical job portal and various talent development activities, Task 8 was able to establish a solid foundation for building a sustainable fintech talent capacity for Hong Kong.

Please refer to sections 6.4(a) and 6.4(b) for details of the journal papers and conference papers mentioned above.

II. Research and Industry/Policy Engagement beyond the Eight Tasks:

The fintech industry has been undergoing rapid development since the inception of the project in 2019. New fintech innovations were launched, novel practices adopted, and policy agenda changed during the project period, creating many opportunities for research with industry impacts. The project team decided not to miss these impactful research opportunities. While we must deliver what we stated in our original proposal, we have exerted extra efforts to cater for these opportunities as highlighted in this section.

In line with our project objective of producing research most useful and relevant to the industry, we have extended our research work beyond the eight original tasks. In addition to academic outputs, we placed great importance on translating our research deliverables into outcomes that would benefit the local fintech industry. We worked closely with the local fintech community and regulators, which resulted in a range of collaborative research and engagement initiatives. These helped Hong Kong to develop its capabilities for the adoption and implementation of fintech on a wider scale.

1. Research on Central Bank Digital Currency (CBDC)

- As CBDC is gaining priority in the policy agenda of the Hong Kong Monetary Authority, the project has forged a **joint research partnership with HSBC** to investigate Hong Kong's readiness for the potential launch of e-HKD. To support Hong Kong's plan in exploring the potential issuance of a retail CBDC, a survey research "**Public Perception of e-HKD**" led by Prof. TAM Kar Yan (PC) was conducted from August to September 2022 and gathered 6,681 responses from the Hong Kong population. The results provided insights into the public's perceptions and views regarding digital currency and e-HKD, including personal data privacy and willingness of adoption. A corresponding findings report was published in December 2022. Findings were shared with relevant government units, regulatory bodies, as well as the public through the media and news outlets. A copy of the report and the relevant press release are provided in Appendix B1.
- Following the HKMA's announcement of the e-HKD Pilot Programme in May 2023, we organised the "**Fintech Industry Dialogue: Retail CBDC in Hong Kong**" in June 2023 to gather the industry's views on e-HKD, with the participation from HKMA and 60 C-level representatives from financial institutions, fintech and regtech companies and retailers. Details of the seminar are provided in Appendix B2.
- Furthermore, a one-week "**Hypothetical e-HKD**" **campus pilot** in collaboration with HSBC was launched in September 2023 as part of the HKMA's e-HKD Pilot Programme. The pilot leveraged a platform designed with distributed ledger technology to simulate the payment infrastructure necessary for programmable money and instant settlement in different retail settings. We engaged around 200 HKUST students and staff to test eligible purchase transactions at participating merchants on campus using the Hypothetical e-HKD

tokens in a digital wallet. Results and feedback collected from the pilot will serve as a foundation for future experimentation and research on the subject. Details and the relevant news clipping are provided in Appendix B3.

- Given our active engagement and participation in CBDC research projects, two project team members, Profs. TAM Kar Yan (PC) and Allen HUANG (Co-PI), joined the **HKMA's CBDC Expert Group** in October 2023. This allows the team to make contributions relevant to HKMA's research work on CBDC beyond the project's original scope and to exchange knowledge with other members of academia more easily. In addition, HKUST signed a **Memorandum of Understanding (MoU) with the HKMA** on 20 October 2023, which further strengthens the government-industry-academia collaboration in CBDC research. Relevant press releases are enclosed in Appendix B4.

2. Research on Virtual Assets and DeFi

- In response to the government's policy stance on developing the virtual assets (VAs) sector in Hong Kong, we conducted a two-phase survey "**Public Perception of Virtual Assets**" to gauge public attitudes and views in Hong Kong on topics related to VA investment, including investment experience and intentions, and regulatory safeguards. Over 5,700 responses were collected between April and May 2023. Following the recent alleged financial fraud incident involving a cryptocurrency platform, the second phase of the survey was launched in September 2023, gathering more than 2,200 responses from the public. Results show that about 84% of the respondents are aware of virtual assets, but only about 27% currently hold or have previously held them. It is also shown that 41% of Hong Kong people prefer not to hold VAs, up by 12 percentage points from the first-phase survey. An article was published on HKET to share findings from the study. A media briefing was held on 17 October 2023. The relevant press release and news clipping are included in Appendix B5. An industry report will be published to furnish regulators and the industry with the updated insights of the sector.
- The forthcoming article "**Auditing Decentralized Finance**", coauthored by Prof. Allen HUANG (Co-PI), has been accepted for publication in the *British Account Review*. The paper provides the first empirical evidence on DeFi audit services that check and verify the smart contracts underlying DeFi protocols. The paper is available at <https://ssrn.com/abstract=4613529>. Details are provided in Section 6.4(a).

3. Industry Research and "Industry Dialogue" Event Series

Throughout the project period, we conducted various industry research studies to provide insights and practical recommendations to policymakers, regulators and practitioners of the fintech industry. In addition to the published reports already mentioned above, we organised a series of "Industry Dialogue" events as a platform to facilitate ideas and knowledge exchange among policymakers, financial regulators and industry experts and practitioners in Hong Kong. The events allowed all stakeholders to collectively formulate practical action plans to strengthen Hong Kong's fintech sector. Through these events, we played an important role as a trusted party in facilitating healthy communication within the fintech community. The seminars held under the "Industry Dialogue" series include:

- o "Hong Kong's Way Forward to Becoming a Leading Global Fintech Hub: An Industry Dialogue" (June 2022)
- o "Regtech Industry Dialogue: Talent as the Fuel for Growth" (February 2023)
- o "Fintech Industry Dialogue: Retail CBDC in Hong Kong" (June 2023)

4. Collaboration with Joint Financial Intelligence Unit (JFIU) of the Police Force

With the team's experience from the collaboration with a bank on anti-money laundering (AML), we collaborated with the Joint Financial Intelligence Unit (JFIU) of the Police Force to facilitate the processing of increasing volumes of Suspicious Transaction Report using AI/ML technology. Research findings from this collaboration offer guidelines for the

implementation of a large-scale AML digital infrastructure of JFIU. A seminar on AML was held in collaboration with JFIU in November 2021, attracting the participation of about 100 students. Supplementary information about the seminar is provided in Appendix B6.

5. Bridging the Knowledge Gap

- Since project inception, we have collaborated with a number of key players in the local fintech ecosystem to deliver a range of knowledge sharing activities in various formats. With close to 50 seminars and talks conducted for students, researchers, industry practitioners and the public throughout the project, we have worked extensively with stakeholders across financial, investment and e-commerce sectors, as well as regulators, government agencies, professional bodies, fintech companies and startups. Some examples of our collaborators include Ant Group, Deloitte, the Hong Kong Monetary Authority (HKMA), Hong Kong Institute of Bankers (HKIB), Institute of Financial Technologists of Asia (IFTA), InvestHK, HSBC, Tencent, J.P. Morgan, AQUUMON, livi bank and MoonLab. From “mini lectures” and sharing sessions to career talks, our activities covered a wide range of topics and for audiences with different levels of fintech knowledge. A list of these activities along with supplementary information that has not been submitted before is provided in Appendix C.
- We have organised several fintech symposiums and conferences in collaboration with top journals and professional organizations for academics and researchers to facilitate academic exchange on fintech research. For example, we co-organised the **Applying AI in Business Symposium 2020** and the **RMBI Symposium 2021: Risk Management in the Changing World** with Risk Management and Business Intelligence (RMBI) Program of HKUST in May 2020 and March 2021 respectively, the **4th International Conference on Econometrics and Statistics (EcoSta 2021)** with the Working Group on CMStatistics and CFENetwork, which was sponsored by the journal *Econometrics and Statistics (EcoSta)* and its supplement, the *Annals of Computational and Financial Econometrics*, and the *Computational Statistics & Data Analysis* in June 2021, and the **2021 FinTech Symposium** with National Natural Science Foundation of China and Beijing-Hong Kong Academic Exchange Centre in December 2021. Details are provided in Appendix C.

6. Fintech Promotion and Public Education

At the early stage of the project, we observed a lack of public understanding of fintech, which was a barrier to fintech adoption in Hong Kong. According to our own research, market adoption and consumer feedback are important components for implementing fintech solutions for the continuous growth in the financial services industry.⁵ Therefore, throughout the project period, we included the general public as one of the target audiences when disseminating our findings. We also created a few campaigns that were tailored to the public:

- o We produced and published two Chinese-language books to promote fintech to the public and encourage fintech adoption. “**FINTECH – Reshaping the Future of Finance Services**” (「金融科技重塑金融未來」), with contributions from several Co-PIs, was published in October 2020. “**Welcoming the New Fintech Era: Hong Kong Fintech Applications and Ways Forward**” (「迎接金融新時代 — 香港金融科技實踐與前瞻」), which features over 30 influential fintech icons of the Hong Kong fintech community, was published in November 2021. In addition to these books, all of our fintech-themed reports produced in relation to this project are made available to the public for free. The full list of these publications and supplementary info of those not provided in previous reports or previous sections of this report are enclosed in Appendices D1 - D3.

⁵ *Hong Kong Towards A Leading Global Fintech Hub: Best Practices and Recommendations Through Examining Other World Hubs*, HKUST Business School.

- We created the “**HKUST Fintechstic**” program in 2020 as a satellite event of the Fintech Education Series of the Hong Kong FinTech Week. Four editions were successfully delivered with the most recent one concluded in November 2023. The program comprised three core elements, one of which was an online interactive trivia for the public to learn about different fintech concepts through games. So far, Fintechstic has reached over 6,800 public participants. The program represents a noteworthy achievement of our team in offering fintech education to the public.

7. **Talent Development and Capacity Building**

As an extension of Task 8, we implemented a series of talent development initiatives to nurture students into future fintech professionals. Through our industry engagement efforts, we were able to collaborate with different organizations to provide a variety of learning opportunities to students and young graduates. We were able to observe an increase in student interest in fintech activities over the past five years. Below are some notable examples of our work in talent development:

- **Student competitions, workshops and seminars**
 - The previously mentioned “**HKUST Fintechstic**” is dedicated to a different fintech theme each year for students to learn the latest trends through seminars/workshops and competitions, as well as providing an opportunity for students to network with industry experts. The program is open to all university students in Hong Kong. So far, Fintechstic had recorded more than 1,600 webinar attendance and about 600 student participants for the competitions.
 - In terms of student competitions, we also hosted **Bizkathon@HKUST** – the first virtual banking hackathon in Hong Kong, **Blockchain Business Model Challenge** – a first-of-its-kind case competition on blockchain, **Cyber Defenders Challenge** – a practical cybersecurity training and competition based on real-life cyberthreats faced by financial institutions, and more. A record and supplementary information of competitions and workshops organised under the project are provided in Appendix E.
- **Internship opportunities and hands-on training for students**
 - We had partnered with different fintech companies to organize several **Fintech Mentorship Programs**, where students can work on real-life fintech projects under the guidance of industry professionals. A list of the Fintech Mentorship Programs and supplementary information are provided in Appendices F1 - F6.
 - Internship is another way of providing students with hands-on experience in the fintech work setting. With the support from Livi Bank, we were able to create the **liVi bank recruitment campaign** which offered exclusive internship opportunities to HKUST students in 2022 (Appendix F7). The program allowed students to explore the roles of digital marketing, customer relationship management operations and customer engagement in the fintech world.
 - Furthermore, in February 2023, we supported HKUST’s World Bachelor Business Program in organising the **HKUST-WBB x MIT Node Fintech Academy**, where 42 HKUST students from over 10 degree programs participated in a series of learning sessions, a company visit, and a two-day industrial challenge to devise insurance technology solutions for use in digital innovations and the metaverse (Appendix F8).
- **Training for advanced-level students, working professionals and industry practitioners**
 - In a joint effort with the China Banking Association, Shenzhen University and the China Construction Bank, we established an industry-recognised **Fintech Professional Qualification** for enhancing the professionalism of fintech practitioners in China. The first and second cohorts of the program were launched in September 2019 and 2020 respectively and together benefited over 650 fintech practitioners.

- We represented HKUST as the strategic partner of the **Cyberport Financial Practitioners FinTech Training Programme** which commenced in March 2020. Prof. TAM Kar Yan (PC and Task Leader of Task 8) is the Chairman of the Advisory Group of the Program. Following the successful rollout in 2020, the second edition took place in 2022 and engaged over 2,600 finance practitioners and 91 financial institutions.
- Led by Prof. HUI Kai-Lung (Co-PI), we partnered with the Hong Kong Institute of Bankers (HKIB) to offer the **ECF-Fintech (Professional Level) Program**. With the objective of building a strong foundation for the development of fintech talent locally and in the GBA, the first module of the program was launched in November 2022.
- To strengthen the academia-industry collaboration on fintech talent development, we worked with Microsoft Hong Kong to launch **Hong Kong's first MBA elective** in early 2020, featuring **an Artificial Intelligence (AI) curriculum**. The course is offered to students from the HKUST MBA and MSc programs.
- We also facilitated the signing of an MOU between HKUST and Ant Group, which enabled over 100 selected master's degree students to undergo fintech education in Ant Group's global fintech training program **10x1000 Tech for Inclusion**.

Supplementary information of the training programs above that have not been submitted before are enclosed in Appendices F9 - F11.

-
- 6.2 What was the added value of the TRS funding, rather than standard project grant funding?
(For example, could this work have been achieved with other funding scheme, such as the General Research Fund or Collaborative Research Fund? If not, why?)

The TRS focuses on academic research efforts that are highly significant for Hong Kong's long-term development. The scheme encourages collaborations between academia, government and industry, fostering innovation beyond scholarly capacity. This enables academic researchers to produce a wider variety of outputs that are more relevant to industry needs. The scheme also stimulates ideas from not just the academic researchers but also the industry. Both parties are motivated to find the common ground where practical solutions can be devised to contribute to the healthy growth and development of Hong Kong. This interdisciplinary approach and cross-sector engagement (academia, regulators, industry, and government) throughout the project period is able to deliver values to a broad spectrum of stakeholders which are difficult to accomplish by GRF and CRF. Furthermore, the additional outputs beyond the original deliverables as reported in Section 6 helps to flexibly cater for the continuous development of the industry which is the guiding principle of TRS.

- 6.3 If the project has not met its original objectives, why?

N/A. The project has been successfully completed and the proposed objectives met.

-
- 6.4 (a) Please provide details of each peer-reviewed journal publication arising directly from this project by completing the table at **Annex** (one for each publication).

See the Annex for the completed tables. The consolidated list of publication outputs of the project and a copy of each of the publications that have not yet been submitted in previous progress reports are provided in Appendix G.

- (b) Please provide details of recognised international conference(s) in which paper(s) related to this project was/were delivered by completing the following table:

(Please attach a copy of each conference abstract)

The list of conferences and the relevant paper abstract and programs are provided in Appendix H.

- (c) RGC funding should have been acknowledged in all publication(s)/conference papers listed in (a) and (b) above. If no acknowledgement has been made in any of the publications/ papers, please indicate and provide explanations.

RGC funding has been acknowledged in all publications/ conference papers listed in (a) and (b) above, except for the following:

- The publisher did not ask for acknowledgement information for “FinTech as a Game Changer: Overview of Research Frontiers” by Terrence Hendershott, Michael Zhang, Leon Zhao, and Eric Zheng published in *Information Systems Research*, 31(1): 1-17. We have recognised the generous support from RGC in the working paper version, a copy of which is provided in Appendix G.
- The paper “High-dimensional Minimum Variance Portfolio Estimation Based on High-frequency Data” by Tony Cai, Jianchang Hu, Yingying Li and Xinghua Zheng was first submitted in January 2018, which was before the start date of the project. The revision and continuous refinement of this paper was supported by the grant after January 2019 which led to its publication.

6.5 To what extent this project has strengthened inter-institutional collaborations and other partnerships?

This project was a collaborative effort involving a team of faculty members across disciplines from several local universities, namely HKUST, HKU, CUHK, HKEdU and CityU, and thus the project has enabled a frequent and extensive exchange of expertise and knowledge among local institutions. In addition, the project has fostered greater collaborations among academic institutions in Hong Kong, mainland China and overseas on the topic of fintech. For example, Task 3 has provided academic exchange opportunities between HKUST, HKEdU and University of Amsterdam. The Task 4 team has engaged Singapore Management University (SMU) in their research, which has resulted in the publication of a paper. These collaborations have enriched the project’s global perspective on fintech development and have brought valuable impacts to our research.

In addition to collaborations with academic institutions, the project has established a strong network with industry stakeholders including regulators, fintech companies, startups and financial institutions to develop knowledge sharing activities and talent building programs for students and industry professionals, as well as industry-relevant research initiatives as listed in Section 6.1. These have facilitated the exchange of knowledge, expertise and insights between academics and industry players, allowing us to convert research insights into practical outcomes which benefit the fintech ecosystem of Hong Kong. The diversity of stakeholder groups and the large number of participants in our activities organized during the project period reflect the breadth and depth of our inter-institutional collaborations and partnerships.

6.6 Research students trained (registration/awards):

A total of 18 research postgraduate students majoring in Information Systems, Business Statistics, Operations Management, Accounting, and Management and Strategy from HKUST,

HKU, CUHK and CityU were engaged and trained in the project. The list of research students is enclosed in Appendix I.

6.7 Specific products (e.g. software or netware, instruments or equipment developed):

1. **FinBERT**, a pre-trained BERT model for financial communications, was developed under Task 5. The paper “FinBERT: A Large Language Model for Extracting Information from Financial Text” was published in 2022 in *Contemporary Accounting Research*. The model is available for free download on Github (<https://github.com/yya518/FinBERT>).
 2. **FinSent**, a fintech application built on the foundation of FinBERT for sentiment analysis based on financial texts, was developed under Task 5. The portal can be accessed for free at <https://cbsa.hkust.edu.hk/FinSent/hkg-listed>.
 3. **Emerging Jobs and Skills Portal**, developed under Task 8, is an online portal that features job market trends and statistics, and skills requirements for jobs in six emerging sectors, including fintech and a few of its sub-sectors. The portal can be accessed for free at <https://jobskillsportal.hkust.edu.hk/>
-

6.8 Other education activities and/or training programmes developed:

Apart from the education, mentorship and talent development programs developed in the project as mentioned in Section 6.1, the new research findings from various research tasks, which were highly relevant to industry, were used as teaching materials for postgraduate programs offered by the HKUST Business School. For example, some of the research findings from Task 1 were taught in the EMBA class to explain to students the pros and cons of a permissioned and an unpermissioned blockchain system. The concept of cybersecurity risk and maturity assessment relevant to the C-RAF study under Task 2 was discussed as an exemplary case in the EMBA class. A course entitled “Equity Investment with Machine Learning”, for both undergraduate and postgraduate students, was developed and delivered by project team members. We also worked with the HKUST Thompson Center for Business Case Studies to develop case studies with fintech companies. We completed two cases during the project period:

- **The Neat Account: Fintech Innovation in Hong Kong (Part III)**
- **Privé Technologies: Digitalization of Asset Management Services in Hong Kong**

Copies of these cases were provided in the previous progress report. These cases are useful teaching materials and are distributed worldwide.

6.9 Please highlight any deliverables indicated in the project implementation timetable endorsed by the RGC which have not been covered or achieved as per sections 6.1 to 6.8 above, and explain/ elaborate.

N/A

Project Management

6.10 Please elaborate how the PC has played his/her role in coordinating and managing the project.

The PC consistently demonstrated strong leadership and effectively managed the project, providing continuous guidance to the team. With a hands-on approach, the PC diligently monitored the progress of research activities through a combination of in-person and online

meetings, as well as regular email communications with Co-PIs and Co-Is. This proactive approach ensured a comprehensive understanding of the project's status and enabled efficient management of required resources and staffing needs across the eight research tasks.

In addition to overseeing project logistics, the PC effectively leveraged the team's expertise and made direct contributions to the research process. Recognising the importance of real-life relevance, the PC guided the team in strengthening the practical application of the research, enabling us to incorporate technologies into our outputs for industry use. This gave rise to a number of practical applications employing some of the emerging technologies, such as AI/ML, which are widely tested and used by the industry and government bodies. Through fostering collaborations and communications among the industry, academia and government, as well as facilitating connections between project team members and key industry and policy representatives, the PC and the team successfully aligned project activities with the intended objectives and outcomes and, most importantly, addressed the needs of the industry. As an example, the PC and his team led several industry-wide studies, engaging industry practitioners and regulators in addressing the challenges faced by different fintech sub-sectors, including regtech and insurtech.

Overall, the PC's effective leadership and active involvement in the project led to the project's fruitful completion and meaningful outcomes.

7. Awards and Recognition

- 7.1 Have any research grants been awarded that are directly attributable to the results obtained from this project?

Our effort and adaptation to evolving industry development, technology landscape, and policy agenda of government and regulators have led to a new theme-based proposal submission on Regtech in 2022. The proposal *Strengthening Hong Kong as a Global Financial Center by Enhancing the Overall Regtech Capacity of the Industry and Facilitating the Regulation and Infrastructure Design of CBDC and Digital Assets in Hong Kong, Theme-based Research Scheme 2023/24, T35-607/23-N* is granted one-year funding from RGC in 2023 to generate initial results to prepare for resubmission for full proposal. There is a strong connection between the current one TRS and the new grant with the latter built on the solid foundation established by the former.

- 7.2 Have any project team members participated as invited speakers in or organisers of international conferences as a result of this project?

Yes, the conferences are documented in Section 6.4(b) of this report.

The following items are in addition to Section 6.4(b):

- HKUST, represented by Prof. Mike So (Co-PI) as the conference host and co-chair, co-organised the **4th International Conference on Econometrics and Statistics (EcoSta 2021)** in June 2021. Details of the conference can be found at the conference website: <http://www.cmstatistics.org/EcoSta2021/index.php>.
- In 2019, Prof. HUI Kai-Lung (Co-PI) was invited to deliver a keynote speech at the **9th International Conference on Internet Technologies and Society**. Although the invitation was not a direct result of this project, insights from the C-RAF study under Task 2 were shared at the conference.

- Prof. Allen Huang (Co-PI) delivered a presentation on “Blockchain Use Cases in Financial Markets” at the **public seminar "Blockchain Changing the Course of Human History"**, which was organised by Blockchain.News with the support from the project team. The seminar was a sub-event of the Hong Kong FinTech Week 2019. In the same year, Prof. Allen Huang also gave a talk on “Informativeness of corporate filing sentiments: new evidence from a contextual deep learning approach” at the **Workshop on AI Powered Sentiment Analysis – NLP, Data Science and Others**, organised by the National University of Singapore (NUS). Details of the relevant presentations have been provided in previous progress reports.
 - Several Co-PIs and researchers in their group shared research findings and insights at the Hong Kong FinTech Week (HKFTW):
 - o Prof. TAM Kar Yan (PC), panelist, “AI and Big Data Adoption in APAC: A Talent Development Perspective”, HKFTW 2021
 - o Prof. HUI Kai-Lung (Co-PI), panelist, “Sustainability & Roadmap in Nurturing & Developing FinTech Talents in HK & Beyond”, HKFTW 2021
 - o Prof. HONG Weiyin (Co-PI), panelist, “AI, Big Data & FinTech: How to Stay Ahead in the Banking Industry”, HKFTW 2021
 - o Prof. Jean WANG, panelist, “Digitalization of the Customer Experience”, HKFTW 2023
-

7.3 Have any project team members taken leadership positions in editorial boards, scientific and professional organisations?

Prof. BHATTACHARYA Utpal

- Executive Editor of *Financial Management* (until October 2022)

Prof. FONG Yuk-Fai

- Associate Editor of *International Journal of Industrial Organization* (until January 2022)
- Editor of *The B.E. Journal of Theoretical Economics* (until July 2022)

Prof. HONG Weiyin

- Editorial Board Member of *AIS Transactions on Human-Computer Interaction*
- Associate Editor of *MIS Quarterly*

Prof. HUANG Allen

- Member, *CBDC Expert Group of the HKMA*

Prof. HUI Kai-Lung

- Editorial Board Member of *Journal of Management Information Systems (JMIS)*
- Department Editor of *Business and Information Systems Engineering (BISE)*
- Advisory Board Member of *Electronic Commerce Research and Applications (ECRA) and Information and Media (I&M)*

Prof. SO Mike Ka Pui

- Associate Editor, *Bayesian Analysis*
- Associate Editor, *Econometrics and Statistics*
- Associate Editor, *Asia-Pacific Financial Markets*
- Associate Editor, *Statistics and Probability Letters* (until August 2021)

Prof. TAM Kar Yan

- Editorial Board Member of *Journal of Management Information Systems (JMIS)*
- Editorial Board Member of *International Journal of Electronic Commerce (IJECE)*
- Senior Editor Board Member of *AIS Transactions on Human-Computer Interaction*
- Advisory Board Member of *Journal of Electronic Commerce Research (JECR)*
- Member, *Board of EFMD*
- Member, *AACSB Board of Directors*
- Chairman, *Hong Kong Committee for Pacific Economic Cooperation*
- Member, *CBDC Expert Group of the HKMA*
- Member, *The Exchange Fund Advisory Committee of the HKMA*
- Member, *Council of Advisers for Applied Research, Hong Kong Academy of Finance*
- Member, *Policy Research Committee, Financial Services Development Council*
- Member, *Banking Review Tribunal of the HKSAR*
- Member, *Anti-Money Laundering and Counter-Terrorist Financing Review Tribunal of the HKSAR*
- Member, *Digital Advisory Panel, The Hong Kong Retail Management Association*

Prof. YUE Wei Thoo

- Senior Editor of *Production and Operations Management*

Prof. ZHENG Rong

- Associate Editor of *Business & Information Systems Engineering*

Prof. ZHENG Xinghua

- Associate Editor of *Statistica Sinica*

7.4 Any documentary proof of the application of technologies arising directly from this project?

Fintech applications and tools based on emerging technologies were developed in this project. They included the financial language analysis model FinBERT (<https://huggingface.co/yiyanghkust/finbert-tone>) and the portal FinSent (<https://cbsa.hkust.edu.hk/FinSent/>) from Task 5, and the [Emerging Jobs and Skills Portal](#) from Task 8. These applications have received positive feedback and recognition from the industry. The documentary proofs, including fact sheets, download statistics, testimonials provided by key industry representatives and relevant media reports, are provided in Appendix J.

7.5 Other awards and recognitions as a result of this project (please specify):

N/A

8. Impacts

8.1 What are the current and expected impacts of the project on the long-term development of Hong Kong (social or economic development, e.g. patent, technology transfer, collaboration with external organisations, etc.)?

The project has contributed to building a sustainable fintech capacity and ecosystem for Hong Kong through our efforts in talent development, policy engagement and fostering collaborations with other academic researchers, regulators and industry stakeholders.

The industry-wide manpower studies (Task 8) allowed us to gain insights into the fintech talent landscape in Hong Kong and other regions. Ultimately, it led to accessible reports that shed light on the core competencies required in fintech professionals, talent supply projections and strategies to address the severe talent shortages. Moreover, we developed multiple initiatives to nurture future fintech talents and enhance fintech education, including talks and seminars, competitions, workshops and mentorship programs for students, as well as professional qualification programs for industry professionals. Over a period of four years, we have seen students who started with minimal knowledge of fintech to working in the fintech industry upon their graduation. Our research outputs, including the dedicated jobs and skills portal featuring fintech-related jobs, allowed us to bridge students to job opportunities in the fintech sector. These efforts strengthened our collaborations with industry partners, government bodies and overseas academic institutions on talent development, and have successfully driven more industry initiatives in building a sustainable talent pipeline for fintech, which we expect will have a positive impact on strengthening Hong Kong's fintech talent pool and enhancing its talent capacity in the long run.

Throughout the project period, we were able to build an extensive network and gradually strengthened our relationships with stakeholders including regulators, fintech companies, startups and financial institutions. This inspired us to act as a bridge between policymakers and industry practitioners. As a facilitator, we were able to conduct more insightful research that led to practical policy recommendations. Our establishment of a solid communication and collaboration platform to connect academia, regulators and industry is a major contribution of the project towards the development of the finance industry of Hong Kong. The industry reports and publications arising from the project delivered up-to-date insights on fintech to different stakeholders and were highly welcomed by the policymakers and industry practitioners. These reports provide an academic perspective on the market and are solid references for the fintech community.

On the policy front, our research (Task 7) focused on the following key questions:

- How can policymakers promote fintech innovation and entry while ensuring financial stability and addressing privacy concerns?
- How can policymakers facilitate win-win outcomes that benefit traditional financial institutions, fintech entrants, as well as consumers and investors?
- What is Hong Kong's comparative advantage and how can it position itself to reap the most benefit from fintech development?

To address these questions, we published an industry report based on a comprehensive study on the experiences of seven fintech hubs in the world, providing a long-term roadmap with key opportunities, observations and policy recommendations on strategy setting, innovation and talent building for Hong Kong to build the required capacities and develop into a leading global fintech hub.

In addition to the above, the project also demonstrated significant impacts through engagement in joint research projects with the regulators, a law enforcement agency, banks and financial institutions, and tech firms and startups. For example, we assisted the JFIU of the Police Force in enhancing the efficiency in processing increasing volumes of suspicious transaction reports. Our joint research collaboration with the JFIU on AML is expected to contribute towards enhancing the police force's AML capabilities and strengthening its financial regulatory framework. In addition, our joint research study on retail CBDC with HSBC, which is a part of the e-HKD Pilot Programme of the HKMA, will have an impact on Hong Kong's final decision

on whether e-HKD will be implemented.

Overall, this project and its many outputs, have expedited the adoption and implementation of fintech applications in Hong Kong in multiple ways. We expect the project's impact will be long-lasting and will directly or indirectly contribute to the social and financial development of Hong Kong.

8.2 Others (please specify):

N/A

9. Sustainability of the Project

9.1 Whether there are new ideas evolved directly from this project?

Yes. This project has explored the usage and effectiveness of using emerging technologies such as AI and blockchain in financial applications. Some innovative applications and experimental models have been developed leveraging these technologies. For example, the financial language analysis portal has been instrumental in enhancing our understanding of the economic implications and impacts of these emerging technologies on the industry. In addition, this project has shed light on several burgeoning topics within the financial industry, for instance CBDC, where the project team has engaged in various ongoing collaborative initiatives with the industry and the government to explore the feasibility and potential of implementing retail CBDC in Hong Kong.

Furthermore, in our study on sustaining financial innovations in Hong Kong (Task 7), we have focused on examining how the emergence of fintech affects the competition between banks and informal lenders, and the dynamics between banks, informal lenders, and fintech lenders in financial inclusion. As a new idea building on our project outputs, we will expand our study to investigate the direct competition between banks and big techs and how open banking affects financial inclusion. We aim to gain insights into the evolving dynamics of the financial industry and how greater financial inclusion can be achieved for a more inclusive and accessible financial ecosystem.

9.2 Whether there are new projects evolved directly from this project?

During the project, the team has devoted efforts to research related to regtech, for example the survey research on public perceptions of e-HKD and virtual assets, the study on cybersecurity and the Cyber Resilience Assessment Framework (C-RAF) for the financial industry, the industry-wide manpower study on the regtech sector in Hong Kong, as well as the joint research project with the JFIU of the Police Force regarding the implementation of a large-scale AML digital infrastructure. The valuable insights and outputs from these initiatives have garnered recognition and support from industry and policy stakeholders. As a testament to the quality and impact of our work, HKUST was awarded a new theme-based research project entitled “Strengthening Hong Kong as a Global Financial Center by Enhancing the Overall Regtech Capacity of the Industry and Facilitating the Regulation and Infrastructure Design of CBDC and Digital Assets in Hong Kong” by the RGC. Our research efforts and outputs generated from this project have established a solid foundation for the new project starting in January 2024. We are excited to build upon our existing work and contribute to the enhancement of Hong Kong's regtech capacity, which is an important endeavour to support the growth and innovation of the financial industry as well as to further establish Hong Kong as a leading global fintech

hub.

9.3 Whether there are new collaborations developed directly from this project?

As discussed in previous sections, as a direct result of this project, we have started various collaborative initiatives with many key stakeholders from the financial and fintech industry. One noteworthy example is our collaboration with HSBC. This collaboration includes joint research on CBDC, quantum computing, fraud detection and privacy enhancing technologies, and educational activities such as industry seminars and student competitions. Other notable examples of new collaborations developed from this project include the establishment of a strategic partnership with the Hong Kong Monetary Authority (HKMA) on fintech talent development to implement educational initiatives such as the Industry Project Masters Network (IPMN).

9.4 Please give details on how much money and from which sources has been obtained/requested for the specific purpose of continuing the work started under this project.

Based on the outcomes related to regtech which arose directly from this project, we proposed a new theme-based research project “Strengthening Hong Kong as a global Financial Center by Enhancing the Overall Regtech Capacity of the Industry and Facilitating the Regulation and Infrastructure Design of CBDC and Digital Assets in Hong Kong.” The proposal has been awarded a one-year exploratory funding of HK\$5.624M by the Research Grants Council.

10. Statistics on Research Outputs

(Please ensure the statistics in this section are consistent with the information presented in other sections of this report.)

	Peer-reviewed journal publications	Conference papers	Scholarly, books, monographs and chapters	Patents awarded	Other research outputs (please specify)	
No. of outputs arising directly from this research project	41	19 (delivered in 31 international conferences)	12	0	Type	No.
					Technology models/ applications	3

11. Public Access of Completion Report

(PCs of projects funded in 2010/11 academic year or onwards are required to release the completion reports to the public through the RGC website. Completion reports containing information such as abstracts in non-technical terms, objectives, research output including the list of conference papers / publications / journals and research findings and contact information of PCs should be open to public access.)

Please specify the information, if any, that cannot be provided for public access and give the reasons.

Information that cannot be provided for public access	Reasons
N/A	N/A

12. The Layman's Summary

(describe in layman's language the abstracts and research impact of the project.)

This research project aimed at strengthening Hong Kong's position as an international financial centre by exploring how emerging financial technologies (fintech) could enhance the delivery of financial services. Over a period of four years, the research team comprising experts in finance, information systems, business statistics, operations management, computer sciences and engineering, mathematics, economics and accounting across universities in Hong Kong examined various aspects of fintech. We addressed key research questions including how technologies such as blockchain, AI and analytics could shape the financial industry, and how fintech affects individual investors, financial institutions and the manpower needs of the industry.

The eight research tasks undertaken by the project team included investigating the economic implications of blockchain technology, assessing cybersecurity protection schemes for financial institutions, integrating individual investors' risk preferences into robo-advising, analysing the impact of robo-advising on investors' trading behaviour, evaluating the effectiveness of AI techniques in analysing public disclosures, developing a real-time systemic risk monitoring system using advanced analytics techniques, sustaining financial innovations in Hong Kong, and gaining a systematic understanding of the required fintech core competencies and manpower development. The project generated valuable insights into the potential benefits, risks and challenges associated with fintech. It also provided guidance for Hong Kong to develop into a global fintech hub through driving innovation in the financial sector, promoting financial inclusion, enhancing cybersecurity measures and the relevant regulatory framework, as well as nurturing talent for the financial industry.

Key findings and policy recommendations generated from the project were documented in academic journal publications and industry reports. They were shared with industry, government and public stakeholders through conferences, seminars, meetings, press releases and column articles in newspapers. Through collaborations with industry partners and harnessing the diverse expertise of our project team, we successfully translated our research efforts into practical outputs and policy recommendations that prioritise industry needs to achieve the ultimate goal of fostering greater fintech adoption and facilitating capacity building within the industry. Publications and practical applications developed by this project for the industry and the public can be found at: <https://bm.hkust.edu.hk/en-us/the-school/introduction/fintech-research-project>.

In summary, this project contributed to a comprehensive understanding of the development of fintech in Hong Kong and established a roadmap for Hong Kong to optimise policies, regulations and strategies needed to thrive as a top global fintech hub.