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| RGC Ref. No.:<br>UGC/IIDS14/P01/17<br><hr/> (please insert ref. above) |
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**RESEARCH GRANTS COUNCIL  
COMPETITIVE RESEARCH FUNDING SCHEMES FOR  
THE LOCAL SELF-FINANCING DEGREE SECTOR**

**INTER-INSTITUTIONAL DEVELOPMENT SCHEME (IIDS)**

**Completion Report**  
(for completed projects only)

|   |
|---|
| <p><b><u>Submission Deadlines:</u></b></p> <ol style="list-style-type: none"> <li>1. The unspent balance, if applicable, and auditor's report: within <b>six</b> months of the approved project completion date.</li> <li>2. Completion report: within <b>12</b> months of the approved project completion date.</li> </ol> |
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**Part A: The Project and Investigator(s)**

**1. Project Title**

Recent Developments in Business Analytics and New Research Directions

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**2. Investigator(s) and Academic Department(s) / Unit(s) Involved**

| Research Team          | Name / Post                           | Unit / Department / Institution   |
|------------------------|---------------------------------------|---|
| Principal Investigator | CHU Man Ying /<br>Assistant Professor | Department of Mathematics and Statistics / The Hang Seng University of Hong Kong  |
| Co-Investigator        | LAM Shu Yan /<br>Assistant Professor  | Department of Mathematics and Statistics / The Hang Seng University of Hong Kong  |
| Co-Investigator        | LIU Tin Shing /<br>Lecturer           | Discipline of Business & General Management / School of Professional Education and Executive Development (SPEED)                      |
| Co-Investigator        | CHU Chun Fai /<br>Assistant Professor | Mathematics & Statistics Team / The Open University of Hong Kong  |
| Co-Investigator        | SO Ka Pui /<br>Associate Professor    | Department of Information Systems, Business Statistics and Operations Management / The Hong Kong University of Science and Technology |

### 3. Project Duration

|   | <b>Original</b> | <b>Revised</b> | <b>Date of RGC /<br/>Institution Approval<br/>(must be quoted)</b> |
|---|-----------------|----------------|--|
| Project Start Date                              | 01/12/2018      | /              |  |
| Project Completion Date                         | 31/12/2018      | /              |  |
| Duration ( <i>in month</i> )                    | 12              | /              |  |
| Deadline for Submission<br>of Completion Report | 31/12/2019      | /              |  |

## **Part B: The Final Report**

### 5. Collaboration with Other Self-Financing Degree-Awarding Institutions

|  | <b>Name of Institution(s)</b>         | <b>% of Participation</b> | <b>Distinctive <u>Element(s)</u> of the Institution in Responsible Project</b> |
|--|---------------------------------------|---------------------------|--|
| <b>Applying Institution</b>                    | The Hang Seng University of Hong Kong | 80%                       | To manage, organize, and promote the project and workshops.                    |
| <b>Collaborating Institution(s) (If any) #</b> | SPEED                                 | 10%                       | To co-organize and promote the project and workshops                           |
|  | The Open University of Hong Kong      | 10%                       | To co-organize and promote the project and workshops                           |
|  |                                       |                           |  |
| <b>Total:</b>                                  |                                       | <b>100%</b>               |  |

# If no other eligible local self-financing degree-awarding institutions are involved, please input "N/A" in this table.

### 6. Project Objectives

#### 6.1 Objectives as per original application

1. To establish research and academic links between local self-financing degree-awarding institutions (LSDIs) and other local and overseas institutions.
2. To provide a knowledge-exchange platform for academic and other researchers in Hong Kong, especially those in LSDIs, that will allow them to learn about research trends in business analytics from active scholars in the subject area.
3. To discover future research opportunities and explore techniques in analytics research.
4. To develop research collaboration opportunities among researchers in Hong Kong, particularly those in LSDIs, and overseas.
5. To expose students to business analytics trends in various areas such as finance and economics, risk management, information management.
6. To enhance students' research capabilities and interest in statistics.
7. To provide a framework for students in LSDIs to understand advanced analytical techniques.
8. To provide opportunities for local students to meet scholars from overseas.

#### 6.2 Revised objectives

Date of approval from the RGC: /

Reasons for the change:

1.

2.

3. ....

### 6.3 Realisation of the objectives

*(Maximum 1 page; please state how and to what extent the project objectives have been achieved; give reasons for under-achievements and outline attempts to overcome problems, if any)*

The project objectives have been fully achieved. We provided a knowledge-exchange platform for participants to learn and explore research ideas and opportunities.

Specifically,

1. We invited both local and overseas speakers to share their view points on the analytic trends. In addition, we sent email invitations to potential academics in all universities and LSDIs to attend the workshops. We also sought their helps to invite their postgraduate and undergraduate students to attend the workshops. To further invite participants, we requested some related associations to invite their members to join the workshops. What's more, we co-organized with SEED (Statistics machinELearning Datascience), which is jointly organized by researchers from National University of Singapore, Zuse Institute Berlin, The Institute of Statistical Mathematics, Academia Sinica, University College London, Seoul National University and the Hong Kong University of Science and Technology, to live broadcast three of our workshops to their members.
2. We exposed not only academics, but also students to business analytics trends via the five workshops in different areas, including financial/economic analytics, risk analytics, social media analytics, and machine learning and big data analytics.
3. We included a research sharing and consultation session in each workshop. Topics in the research sharing and consultation session included generating research ideas, tips for journal publication, and trends in analytics. Students can further enhance their research capabilities and interest in statistics not only from the talks, but also from the research sharing and consultation sessions. We also invited experienced industry practitioners to deliver talks for us to better understand the industry needs on analytics.
4. We had 16 speakers in total, seven from Hong Kong and nine from overseas. Participants had time to ask questions when the speakers delivered their talks or meet them before/after the workshop or during the break to discover research opportunities and further explore analytics research.
5. We created some research collaboration among the PI, Co-Is, participants and speakers on business analytics.

## 6.4 Summary of objectives addressed to date

| <b>Objectives</b>   | <b>Addressed</b><br><i>(please tick)</i> | <b>Percentage Achieved</b><br><i>(please estimate)</i> |
|---|--|--|
| 1. To establish research and academic links between local self-financing degree-awarding institutions (LSDIs) and other local and overseas institutions.  | ✓  | 100%   |
| 2. To provide a knowledge-exchange platform for academic and other researchers in Hong Kong, especially those in LSDIs, that will allow them to learn about research trends in business analytics from active scholars in the subject area. | ✓  | 100%   |
| 3. To discover future research opportunities and explore techniques in analytics research.  | ✓  | 100%   |
| 4. To develop research collaboration opportunities among researchers in Hong Kong, particularly those in LSDIs, and overseas.   | ✓  | 100%   |
| 5. To expose students to business analytics trends in various areas such as finance and economics, risk management, information management.   | ✓  | 100%   |
| 6. To enhance students' research capabilities and interest in statistics.   | ✓  | 100%   |
| 7. To provide a framework for students in LSDIs to understand advanced analytical techniques.   | ✓  | 100%   |
| 8. To provide opportunities for local students to meet scholars from overseas.  | ✓  | 100%   |

## 6.5 Project progress

| <b>Original Implementation Schedule</b>             | <b>Revised Implementation Schedule</b><br><b>(Date of RGC's Approval)</b> | <b>Updated Progress</b>         |
|---|---|---------------------------------|
| Workshop on Financial/Economic Analytics (I)        | /   | Completed on March 8, 2018.     |
| Workshop on Financial/Economic Analytics (II)       | /   | Completed on March 9, 2018.     |
| Workshop on Machine Learning and Big Data Analytics | /   | Completed on September 6, 2018. |
| Workshop on Risk Analytics                          | /   | Completed on October 4, 2018.   |
| Workshop on Social Media Analytics                  | /   | Completed on November 29, 2018. |

## 6.6 Speaker(s)

| <b>Title / Name</b><br>(Surname in Capital Letters) | <b>Post / Institution</b>  | <b>Title / Topic of Presentation / Course</b>  | <b>Previous Research Links with Hong Kong Institutions</b><br>(Nature and Date (Month / Year)) |
|---|--|--|--|
| Prof. Cathy W. S. CHEN                              | Distinguished Professor / Feng Chia University                           | On Hysteretic Vector Autoregressive Model with Applications  |  |
| Prof. Sangyeol LEE                                  | Professor / Seoul National University                                    | On the CUSUM Test for Parameter Change in Time Series Models   |  |
| Prof. Kosuke OYA                                    | Professor / Osaka University   | Estimation of Implied Risk-aversion for Nikkei 225 on Tokyo Stock Exchange with Variance Spread        |  |
| Prof. Manabu ASAI                                   | Professor / Soka University  | Realized Stochastic Volatility Models with Generalized Gegenbauer Long Memory                          |  |
| Prof. Yasuhiro OMORI                                | Professor / University of Tokyo  | Realized Stochastic Volatility Models with Skewed t Distribution                                       |  |
| Prof. Toshiaki WATANABE                             | Professor / Hitotsubashi University                                      | Predictability of Excess Bond Premium and Variance Risk Premium for Business Cycles and Recession Risk |  |
| Prof. Chor-yiu SIN                                  | Professor / National Tsing Hua University                                | Order Selection for High-dimensional Non-stationary Time Series Under Various Sparsity Conditions      |  |
| Prof. Tomohiro ANDO                                 | Associate Professor / The University of Melbourne                        | Quantile Co-Movement in Financial Markets  |  |
| Mr. David WONG                                      | Chief System Analyst / Fledge Algorithm Trading Co. Ltd.                 | How Retail Traders Approach Risk   |  |
| Prof. Mike SO                                       | Associate Professor / The Hong Kong University of Science and Technology | Risk Analytics Research: How Important It Is in the Information Age                                    | HKUST  |
| Prof. Ying CHEN                                     | Associate Professor / National University of Singapore                   | Topic Sentiment Asset Pricing with DNN Supervised Learning   |  |
| Prof. Philip YU                                     | Associate Professor / The University of Hong Kong                        | Detecting Comments Showing Risk for Suicide in Social Media  | HKU  |

|                  |  |   |       |
|------------------|--|---|-------|
| Mr. Albus TANG   | Regional Data Analyst / Young & Rubicam, WPP   | When Social Listening Meets Marketing & Communication |       |
| Mr. Tak CHU      | Founder / Big Data Architect Ltd.              | The Challenges of Big Data Integration                |       |
| Dr. Dennis LEUNG | Director of Presales / SAS Hong Kong           | Advancing with Artificial Intelligence                |       |
| Prof. Hong YAN   | Chair Professor / City University of Hong Kong | Co-clustering Analysis of Multidimensional Big Data   | CityU |

6.7 Please provide details of the activities organized, including the theme / objectives of the activities, targeted participants, attendance, analysis of participants, e.g. country of origin, research background, etc., evaluation forms of the activities and a summary of the participants' evaluation. Photos of the activities are preferred.)

- *The proposal suggested including five research workshops held on non-consecutive days, which will be open to all institutions and the public.*
- *Each workshop would have a main theme and consist of around three talks. At least 15 speakers would be invited.*
- *Two workshops will focus on financial/economic analytics, one on risk analytics, one on social media analytics, and one on machine learning and big data analytics.*

With the support of Research Grant council and team's effort, we have successfully carried out the project and met all the performance indicators. We organized two workshops on financial/economic analytics on 8/3/2018 and 9/3/2018 (one with four speakers, another with three), a workshop on machine learning and big data analytics on 6/9/2018 (three speakers), a workshop on risk analytics on 4/10/2018 (three speakers), and a workshop on social media analytics on 29/11/2018 (four speakers). We opened the workshops to all institutions and the public.

According to our records, there were around 411 participants in total without counting the overseas participants via the live broadcast of the three workshops through SEED. Majority of the participants were students and academics in universities/LSDIs in Hong Kong. Some were industrial practitioners (e.g., in Census and Statistics Department). More details of the workshop are shown in the table below:

|                            | <b>Workshop</b>                               | <b>Speakers</b>  | <b>No of registered participants</b> |
|----------------------------|---|--|--------------------------------------|
| 8 <sup>th</sup> March 2018 | Workshop on Financial/Economic Analytics (I)  | <ul style="list-style-type: none"> <li>• Prof. Cathy W.S. CHEN</li> <li>• Prof. Sangyeol LEE</li> <li>• Prof. Kosuke OYA</li> <li>• Prof. Manabu ASAI</li> </ul> | 75                                   |
| 9 <sup>th</sup> March 2018 | Workshop on Financial/Economic Analytics (II) | <ul style="list-style-type: none"> <li>• Prof. Yasuhiro OMORI</li> <li>• Prof. Toshiaki WATANABE</li> <li>• Prof Chor-yin Sin</li> </ul>                         | 52                                   |

|                                |   |  |     |
|--------------------------------|---|--|-----|
| 6 <sup>th</sup> September 2018 | Workshop on Machine Learning and Big Data Analytics | <ul style="list-style-type: none"> <li>• Prof. Hong YAN</li> <li>• Mr. Tak CHU</li> <li>• Dr. Dennis LEUNG</li> </ul>      | 122 |
| 4 <sup>th</sup> October 2018   | Workshop on Risk Analytics                          | <ul style="list-style-type: none"> <li>• Prof. Tomohiro ANDO</li> <li>• Mr. David Wong</li> <li>• Prof. Mike SO</li> </ul> | 90  |
| 29 <sup>th</sup> November 2018 | Workshop on Social Media Analytics                  | <ul style="list-style-type: none"> <li>• Prof. Ying CHEN</li> <li>• Prof. Philip YU</li> <li>• Mr. Albus TANG</li> </ul>   | 72  |

Some photos taken in the workshop are shown below:













We would like to thank the Research Grant Council for supporting this project. Through the discussion with speakers and practitioners in the workshops, we identified some research problems to study and a paper has been produced and under revision by a journal in economics field and a speaker wrote two articles about the workshop he attended in a magazine. In addition, we collaborated with SEED to live broadcast three of our workshops to some overseas universities and partners, making our workshops not only local events but also international activities. These are unexpected outcomes of the project.

## 7. Research-Related Outcome

### 7.1 Potential for development into research proposal and the proposed course of action (Maximum half a page)

Speakers provided us valuable insights on the various applications of business analytics which can be further developed into research proposals.

### 7.2 Research collaboration achieved (Please give details on the achievement and its relevant impact)

We are happy that the project has created research collaboration among the PI, Co-Is, participants and speakers on business analytics. In addition, some new research ideas generated from the workshops can be further investigated.

Two examples are:

- a) The PI got a research idea from the talks in Workshops on Financial/Economic Analytics. She sought further advice from a speaker and then developed a paper with her research collaborators. The paper is now under 1<sup>st</sup> revision by *Emerging Markets Review*.

- b) A Co-I invited the PI and a speaker in the Workshop on Machine Learning and Big Data Analytics to collaborate in a big data related research paper after the workshop. The paper has recently been accepted by *Pattern Recognition* on Dec 8, 2019.

It is especially important for colleagues in LSDIs to extend their research network with academics in other local and overseas institutions.

- 7.3 Any new development and/or challenging research topic(s) has / have been identified and any new initiative(s) for future research has / have been inspired.

Various application areas in business analytics.

## 8. The Layman's Summary

(Describe *in layman's language* the nature, significance and value of the research activities, in no more than 200 words)

The aims of the project are to foster research and academic collaboration among tertiary institutions, to inspire faculty members and other participants in developing ideas and research areas in the field of business analytics research, and to provide students with advanced business analytics knowledge by bringing together a wide range of knowledge in the areas of applied statistics, information management, and modelling.

To encourage the exchange of research ideas and foster research collaboration, the project invited renowned researchers and experts in Hong Kong and from all over the world to share their insights in four hot areas in business analytics. It included five research workshops held on non-consecutive days, which were open to all institutions and the public. Each workshop had a main theme and consisted of at least three talks. Two workshops focused on financial/economic analytics, one on risk analytics, one on social media analytics, and one on machine learning and big data analytics.

To further facilitate research idea exchange and collaboration, each workshop included a consultation session during which participants could seek research advice from the speakers.

**Part C: Research Output****9. Recognized Conference(s) Paper(s) Related To This Project Was / Were Delivered (As Applicable)***(Please attach a copy of each conference abstract)*

| Month /<br>Year /<br>Place | Title | Conference Name | Submitted to<br>RGC<br><i>(indicate the year<br/>ending of the<br/>relevant progress<br/>report)</i> | Attached<br>to this<br>Report<br><i>(Yes or No)</i> | Acknowledged<br>the Support of<br>RGC<br><i>(Yes or No)</i> |
|----------------------------|-------|-----------------|--|---|---|
| /                          |       |                 |  |   |   |
|                            |       |                 |  |   |   |
|                            |       |                 |  |   |   |
|                            |       |                 |  |   |   |

**10. Research Personnel Trained (As Applicable)**

| Name | Capacity |
|------|----------|
| /    |          |

**11. Other Impact (As Applicable)***(e.g. prizes, collaboration with other research institutions, technology transfer, etc.)*

Collaboration with other research team: SEED

Knowledge transfer via magazine articles

**12. Statistics on Research Outputs**

| No. of outputs<br>arising directly<br>from this<br>project | Peer-reviewed<br>Journal<br>Publications   | Conference<br>Papers | Scholarly<br>Books,<br>Monographs<br>and<br>Chapters | Patents<br>Awarded | Other Research<br>Outputs<br>(please specify) |     |
|--|--|----------------------|--|--------------------|---|-----|
|  |  |                      |  |                    | Type  | No. |
|  | 1 (under 1 <sup>st</sup><br>revision by<br><i>Emerging<br/>Markets<br/>Review</i> ,<br>abstract<br>attached) | /                    | /  | /                  | Articles in<br>magazine                       | 2   |

**13. Public Access Of Completion Report**

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

| <b>Information that Cannot Be Provided for Public Access</b> | <b>Reasons</b> |
|--|----------------|
| /  |                |