

RGC Ref. No.: UGC/FDS15/E01/17 <hr/> (please insert ref. above)

**RESEARCH GRANTS COUNCIL
COMPETITIVE RESEARCH FUNDING SCHEMES FOR
THE LOCAL SELF-FINANCING DEGREE SECTOR**

FACULTY DEVELOPMENT SCHEME (FDS)

Completion Report
(for completed projects only)

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

1. Project Title

Willingness to share construction safety knowledge via Web 2.0, mobile apps and IoT

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

Research Team	Name / Post	Unit / Department / Institution
Principal Investigator	Dr LI Rita Yi-Man, Associate Professor/Director/Director	Department of Economics and Finance / Sustainable Real Estate Research Centre / HKSYU Real Estate and Economics Research Lab, Hong Kong Shue Yan University
Co-Investigator(s)	Prof CHAU Kwong Wing, Chair Professor/Department Head/Director	Department of Real Estate and Construction / Ronald Coase Centre for Property Rights Research, the University of Hong Kong
Co-Investigator(s)	Prof HO Daniel Chi-wing Professor/Associate Dean	Faculty of Design Environment, THEi
Co-Investigator(s)	Dr LU Weishing, Associate Professor/Associate Dean	Department of Real Estate and Construction, the University of Hong Kong
Co-Investigator(s)	Dr POON Sun-wah, Adjunct Professor	Department of Real Estate and Construction, the University of Hong Kong

3. Project Duration

	Original	Revised	Date of RGC / Institution Approval <i>(must be quoted)</i>
Project Start Date	1 January 2018	N/A	N/A
Project Completion Date	31 March 2019	N/A	N/A
Duration <i>(in month)</i>	15 months	N/A	N/A
Deadline for Submission of Completion Report	31 March 2020	N/A	N/A

Part B: The Final Report

5. Project Objectives

5.1 Objectives as per original application:

1. study the psychological and informal institutional factors that affect the willingness to share construction safety knowledge, the link to behaviour and the requirements for successful knowledge-sharing initiatives in operational contexts via mobile apps, Web 2.0 and IoT;
2. study the interrelations between construction incidents, willingness and actual knowledge sharing via mobile apps, IoT and Web 2.0; and
3. construct algorithms to predict construction practitioners' willingness to share construction safety knowledge via mobile apps, IoT and Web 2.0.

5.2 Revised objectives

Date of approval from the RGC: N/A

Reasons for the change: N/A

- 1.
- 2.
3.

5.3 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)

To fulfil objective 1: to study the psychological and informal institution factors that affect the willingness to share construction safety knowledge and the link to behaviour, we firstly reviewed the literature on:

1. Psychological factors including Leader Membership Exchange theory, Perceived Organisation Support and Homan's theory
2. Institutional factors such as generation, migrants/ethnic minorities/locals that affect people's willingness to share knowledge via mobile apps, IoT and Web 2.0

A five-minute video about mobile apps, IoT and Web 2.0 and examples of its application on sites provided respondents with basic information on these technologies in English, Cantonese, Urdu and Mandarin. Interviews were conducted to study the current application of knowledge sharing in the construction industry. We analysed the results of the interviews via text mining. It assists us in investigating factors that motivate/prevent individuals to share construction safety knowledge. This also provides in-depth perspectives to ascertain why some workers are more willing to share knowledge via mobile apps, IoT and Web 2.0.

The abovementioned results were used to design questionnaires to send to practitioners, and construction practitioners from different trades are invited to complete the questionnaires. From these, we first studied the interrelationship between 1) psychological and institutional factors that can affect willingness, 2) actual safety knowledge sharing via the tools, and 3) construction incidents using structural equation modelling to fulfil objective 2, i.e. to study the interrelations between construction incidents, willingness and actual knowledge sharing via mobile apps, IoT and Web 2.0.

Significant factors were used to build algorithms to predict the willingness to share construction safety knowledge to fulfil objective 3, which will be fulfilled by constructing algorithms to predict construction practitioners' willingness to share construction safety knowledge via mobile apps, IoT and Web 2.0. The best predicting model identified, i.e. Multilayer Perceptron (MLP) Neural Network, was selected and published in (Li, Tang, & Chau, 2019).

5.4 Summary of objectives addressed to date

Objectives <i>(as per 5.1/5.2 above)</i>	Addressed <i>(please tick)</i>	Percentage Achieved <i>(please estimate)</i>
1. study the psychological and informal institutional factors that affect the willingness to share construction safety knowledge, the link to behaviour and the requirements for successful knowledge-sharing initiatives in operational contexts via mobile apps, Web 2.0 and IoT;	✓	100%
2. study the interrelations between construction incidents, willingness and actual knowledge sharing via mobile apps, IoT and Web 2.0; and	✓	100%
3. construct algorithms to predict construction practitioners' willingness to share construction safety knowledge via mobile apps, IoT and Web 2.0.	✓	100%

6. Research Outcome

6.1 Major findings and research outcome

(Maximum 1 page; please make reference to Part C where necessary)

Objective one: study the psychological and informal institutional factors that affect the willingness to share construction safety knowledge, the link to behaviour and the requirements for successful knowledge-sharing initiatives in operational contexts via mobile apps, Web 2.0 and IoT

PLS-SEM and MLP revealed that practitioners who share construction safety knowledge are not driven by safety-related reasons such as safety awareness enhancement but perceived organisation support from their companies. Employees who agree that their organisation cared about their employees' well-being were the strongest predictors in influencing people's decision to use tools for knowledge sharing. Moreover, many respondents claimed that factors such as monetary rewards have little impact on motivating people to use tools for knowledge sharing. With regard to institutional factors that affect safety issue, quite a number of them suggested, "many people, especially the older generations, do not know how to use mobile apps and are worried that workers are hit by vehicles when they use apps."

Objective two: study the interrelations between construction incidents, willingness and actual knowledge sharing via mobile apps, IoT and Web 2.0

The PLS-SEM model shows that willingness to use IoT, Web 2.0 and mobile apps to share construction safety knowledge positively influences knowledge sharing behaviour. While more willing to share construction safety knowledge via mobile apps and Web 2.0 has led to lower accident rates, willingness to share safety knowledge through IoT does not imply a reduction in construction accidents.

Objective three: construct algorithms to predict construction practitioners' willingness to share construction safety knowledge via mobile apps, IoT and Web 2.0

The predictive algorithms for willingness and actual knowledge-sharing behaviour illustrated the effect of various factors on predicting the desire to share the knowledge via Web 2.0, mobile apps and IoT. It was found that employees who agreed that their organisation cared about employees' well-being were the strongest predictors influencing people's decisions regarding the use of tools for knowledge sharing, which was particularly true for IoT. Willingness to share knowledge using these tools was an essential factor promoting actual usage.

6.2 Potential for further development of the research and the proposed course of action *(Maximum half a page)*

We are now expanding the scope of the research to cover more overseas countries to investigate the impact of informal institutions on people's willingness, actual knowledge sharing behaviour. In this regard, we will send the questionnaires to overseas countries via mass LinkedIn and mass emails.

We will also experiment the data with other prediction model based on the data we have collected. That can be compared with the results we have obtained from this project, and then studied with the AutoML model that we have applied to other existing projects.

As there are many industries that can apply IoT, Web 2.0 and mobile apps to share the occupation safety knowledge, we can expand the research to other industries.

7. Layman's Summary

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

Most studies introducing new technologies have not investigated the psychological factors affecting the willingness to use them or conducted empirical studies to explore whether willingness and actual construction safety knowledge-sharing behaviour are associated with fewer construction incidents. We conducted interviews and surveys to study the willingness and actual behaviour to share construction knowledge via social software Web 2.0, IoT and mobile apps. Then, the Square-Structural Equation Model for willingness and actual knowledge-sharing behaviour, as well as the Multilayer Perceptron (MLP) Neural Network were used to illustrate the effect of various factors on predicting the willingness to share knowledge via Web 2.0, mobile apps and IoT. We found that practitioners use IoT for knowledge sharing, mainly because they do not want to fall behind the curve. PLS-SEM and MLP revealed that practitioners who share construction safety knowledge are not driven by safety-related reasons such as safety awareness enhancement, but perceived organisational support from their companies. Employees who agree that their organisation cared about their employees' well-being were the strongest predictor in influencing people's decision to use tools for knowledge sharing. Moreover, many respondents claimed that factors such as monetary rewards have little impact on motivating people to use tools for knowledge sharing.

Part C: Research Output**8. Peer-Reviewed Journal Publication(s) Arising Directly From This Research Project**

(Please attach a copy of the publication and/or the letter of acceptance if not yet submitted in the previous progress report(s). All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

The Latest Status of Publications				Author(s) <i>(denote the corresponding author with an asterisk*)</i>	Title and Journal / Book <i>(with the volume, pages and other necessary publishing details specified)</i>	Submitted to RGC <i>(indicate the year ending of the relevant progress report)</i>	Attached to this Report <i>(Yes or No)</i>	Acknowledged the Support of RGC <i>(Yes or No)</i>	Accessible from the Institutional Repository <i>(Yes or No)</i>
Year of Publication	Year of Acceptance <i>(For paper accepted but not yet published)</i>	Under Review	Under Preparation <i>(optional)</i>						
2019	2019			Li, Rita Yi Man; Tang, B.; Chau, Kwong Wing	Sustainable construction safety knowledge sharing: A partial least square-structural equation modelling and a feedforward neural network approach, Sustainability, 11(20), 5831 [Attachment 1], SSCI IF 2.592	N/A (first submitted)	Yes	Yes	Yes
2020, forthcoming	2019			Derek Asante Abankwa, Rita Yi Man Li, Steve Rowlinson and Yadi Li	Exploring individual adaptability as a prerequisite for adjusting to technological changes in construction, Advances in Science, Technology & Innovation, Springer, forthcoming [Attachment 2]	N/A (first submitted)	Yes	Yes	Yes
2019	2018			Li, Rita Yi Man*	Construction safety informatics, Springer, Singapore, pp.1-142 [Attachment 3]	2018	Yes	Yes	Yes

The Latest Status of Publications				Author(s) (denote the corresponding author with an asterisk*)	Title and Journal / Book (with the volume, pages and other necessary publishing details specified)	Submitted to RGC (indicate the year ending of the relevant progress report)	Attached to this Report (Yes or No)	Acknowledged the Support of RGC (Yes or No)	Accessible from the Institutional Repository (Yes or No)
Year of Publication	Year of Acceptance (For paper accepted but not yet published)	Under Review	Under Preparation (optional)						
2019	2018			Li, Rita Yi Man* and Li, Herru Ching Yu	Causes of construction accidents and safety knowledge sharing among Generation Y, Handbook of Mobile Teaching and Learning, Springer, Berlin [Attachment 4]	2018	Yes	Yes	Yes
2019	2018			Li, Rita Yi Man, Chau, Kwong Wing; Ho, Daniel Chi Wing, Lu, Weisheng; Muhammad Shoaib; Meng, Li	Construction hazard awareness and construction safety knowledge sharing epistemology, ICE Publishing and Cambridge Centre for Smart Infrastructure and Construction [Attachment 5]	N/A (first submitted)	Yes	Yes	Yes
2018	2018			Li, Rita Yi Man*, Kwong Wing Chau, Daniel Chi Wing Ho, Weisheng Lu, Mandy Wai Yee Lam, Tat Ho Leung	Construction safety knowledge sharing by Internet of Things, Web 2.0 and mobile apps: psychological and new institutional economics conceptual analysis, IOP Conference Series: Materials	2018	Yes	Yes	Yes

The Latest Status of Publications				Author(s) (denote the corresponding author with an asterisk*)	Title and Journal / Book (with the volume, pages and other necessary publishing details specified)	Submitted to RGC (indicate the year ending of the relevant progress report)	Attached to this Report (Yes or No)	Acknowledged the Support of RGC (Yes or No)	Accessible from the Institutional Repository (Yes or No)
Year of Publication	Year of Acceptance (For paper accepted but not yet published)	Under Review	Under Preparation (optional)						
					Science and Engineering, Volume 365, pp. 1-7 [Attachment 6]				

9. Recognized International Conference(s) In Which Paper(s) Related To This Research Project Was / Were Delivered

(Please attach a copy of each conference abstract)

Month / Year / Place	Title	Conference Name	Submitted to RGC (indicate the year ending of the relevant progress report)	Attached to this Report (Yes or No)	Acknowledged the Support of RGC (Yes or No)	Accessible from the Institutional Repository (Yes or No)
April/2018/ Hong Kong	Building an algorithm to predict construction practitioners' willingness to share construction safety knowledge: a machine learning approach	International Conference on E-Business, Information Management and Computer Science, Hong Kong, 14-15 April 2018 [Keynote, Attachment 7]	2018	Yes	Yes	Yes
April/2018/ Hong Kong	Ergonomics, hazard awareness and construction safety: a mixed research approach	International Conference on Economics, Finance and Statistics, Hong Kong, 14-15 April 2018 [Keynote, Attachment 8]	2018	Yes	Yes	Yes
September/ 2018/ Qingdao	Construction safety knowledge sharing in the knowledge economy: an evidence-based practice approach	The 5th Annual Global Congress of Knowledge Economy-2018, Qingdao, 7-9 September 2018 [invited paper, Attachment 9]	2018	Yes	Yes	Yes

Month / Year / Place	Title	Conference Name	Submitted to RGC <i>(indicate the year ending of the relevant progress report)</i>	Attached to this Report <i>(Yes or No)</i>	Acknowledged the Support of RGC <i>(Yes or No)</i>	Accessible from the Institutional Repository <i>(Yes or No)</i>
Oct/2018/ Hanoi	New Era of Manufacturing and Construction safety– Industry 4.0 In Hong Kong, Vietnam and Europe	Industry 4.0 : Opportunities and Challenges for Europe and experiences for Vietnam, October 26th, 2018 in Hanoi - Vietnam by the Institute for European Studies [invited paper, Attachment 10]	2018	Yes	Yes	Yes
Nov/2018 / Pune	Refurbishment work safety knowledge sharing via IoT, AIoT and Intelligent MR in smart cities	91 International Research Awards in Engineering, Science & Management, Pune, 2-3 November 2018 [Keynote, Attachment 11]	2018	Yes	Yes	Yes
July/2019 / Washington	Brain regions involved in construction knowledge sharing, hazard identification and decision making: a conceptual analysis	10 th International Conference on Applied Human Factors and Ergonomics, Washington D.C. USA, July 24-28, 2019 [Attachment 12]	2018	Yes	Yes	Yes
June/2019 / Hong Kong	Knowledge sharing and hazard awareness in the construction industry: a global perspective	CIB World Building Congress, Hong Kong, 17-21 June 2019 [Attachment 13]	2018	Yes	Yes	Yes
April/2019/Hong Kong	Willingness to share construction safety knowledge via Web 2.0, mobile apps and IoT	RGC Visit Poster Presentation [Attachment 14]	N/A (first submitted)	Yes	Yes	Yes

10. Whether Research Experience And New Knowledge Has Been Transferred / Has Contributed To Teaching And Learning

(Please elaborate)

The journal article, book and book chapters are shared to students of ECON 100 Introduction to Economics, ECON 244 Managerial Economics, ECON346 Research Methodology, ECON 446 Honours Project, FIN445 Regulations and Management of Financial Management and FIN446 Property Valuation, Funding and Investment. The students were involved in the data collection process, such as surveys, interviews and literature review etc.

11. Student(s) Trained

(Please attach a copy of the title page of the thesis)

Name	Degree Registered for	Date of Registration	Date of Thesis Submission / Graduation
N/A			

12. Other Impact

(e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, teaching enhancement, etc.)

We have collaborated with other institutions, such as University of South Australia and National University of Science and Technology I received the Women Researcher Award from International Organisation of Scientific Research and Development.

13. Statistics on Research Outputs

No. of outputs arising directly from this research project	Peer-reviewed Journal Publications	Conference Papers	Scholarly Books, Monographs and Chapters	Patents Awarded	Other Research Outputs (please specify)	
					Type	No.
	1	7	Book: 1 Book chapters: 4	N/A	Poster	1

14. Public Access Of Completion Report

(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	