

Extended Open innovation model for the Development of Innovation and Technology Industry in the Greater Bay Area : The Case of Shenzhen and Hong Kong

YVONNE WONG LAI FONG (STUDENT ID: 1922252)

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- ▶ Industry Background
- ▶ The Problem
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- ▶ Literature Review
- ▶ Proposed Model & Hypotheses
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- ▶ Preliminary observation & Expected Findings
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Introduction:

My past researches on Open innovation

- ▶ Innovated by HK Research Project in 2008
- ▶ Future Digital and Technology Strategy Roadmap studies in 2013
- ▶ Presentation paper: The Shenzhen-Hong Kong Collaboration in Start-up Incubation – Qianhai E-hub in CIV 2017 Forum
- ▶ Presentation paper – “GBA innovative talent policies” in GBA talents Forum 2019



Industry Background: The GBA Outline Development Plan

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Industry Background:

Closer partnership with industry in PRD

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International Science, Technology and Innovation Hub

→ “GZ-SZ-HK-MO Innovation & Technology Corridor”



Building an
Open
Community for
Coordinated
Innovation in
the Region

Developing
Quality
Innovation &
Technology
Carriers and
Platforms

Enhancing
the
Environment
for
Innovation in
the Region

Industry Background: GBA as International Center of Innovative Technology

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- The Government and the Chinese Academy of Sciences (CAS) signed a MOU in Nov 2018 that CAS will establish an affiliated institution in HK to facilitating its GZ Institutes of Biomedicine & Health and Institute of Automation to establish their presence in the 2 research clusters for launching R&D work.
- Six Hong Kong universities have set up 72 scientific research institutions in Shenzhen, jointly participating in Guangzhou-Shenzhen-Hong Kong-Macao Science and Technology Innovation Corridor.
- They are the State Key Laboratory of Quality Research in Chinese Medicine; the State Key Laboratory of Analog and Mixed-Signal VLSI; the State Key Laboratory of Internet of Things for Smart City; and the State Key Laboratory of Lunar and Planetary Sciences in Macau.

The Problem:

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To **enrich** the discussion in the open innovation model, I wish to study the role of **entrepreneurial financial institutions** in facilitating open innovation among **university-industry-research institutes** in terms of **capital and value transfer**.

Research objectives:

- ▶ To **enrich the discussion in open innovation**
- ▶ To encourage more open innovation in the innovation & technology industry
- ▶ To provide a better framework for policy drivers in the formulation of future innovation policies for the innovation and technology industry in the Greater Bay Area and provide incentives for entrepreneurial financing intuitions.

Literature Review

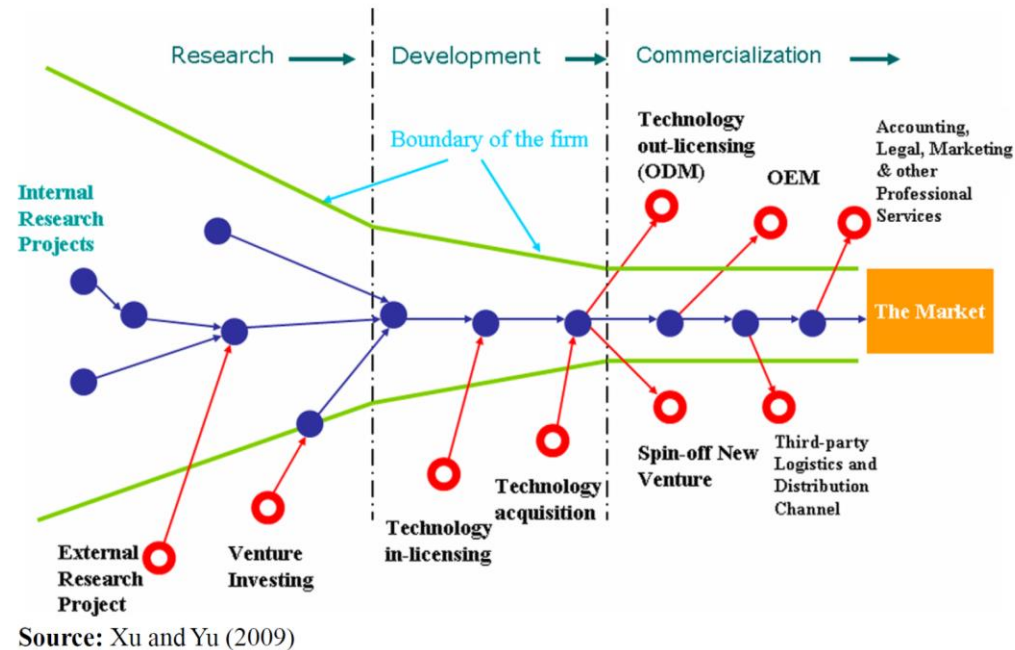
- ▶ Open vs closed innovation (Chesbrough 2003) ((Mika Kautonen et al. 2014). (Kari Laine & Mirka Leino & Petteri Pulkkinen 2015)
- ▶ Extended Open innovation model (Xu, Y. & Yu, C.C. 2013)
- ▶ University-industry-government relationship, PPP, triple helix, quadruple-helix, valley of death etc.
- ▶ Regional integration ,regionalisation of PRD, GBA, cities cluster etc.
- ▶ Discussion of Financial institutions / investors for start-ups
- ▶ Discussion of social capital, interorganizational relationship etc.
- ▶ The Sheffield Model (Advanced Manufacturing Research Centre)

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Xu & Yu (2008, 2009, 2013) Extended Open Innovation Model

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The study of Xu & Yu has described the role of each entity in the model. However, they did not study the detailed relationship of the entrepreneurial financial associations with the innovation & technology enterprises (firms) and research institutes through the support of capital and values

Xu, Y. & Yu, C.C. (2013), "Strengths and weaknesses of Hong Kong's technology and innovation industry with reference to the extended open innovation model", *Journal of Science and Technology Policy in China*, vol. 4, no. 3, pp. 180-194.

Yun & Liu (2019) Quadruple-Helix Model

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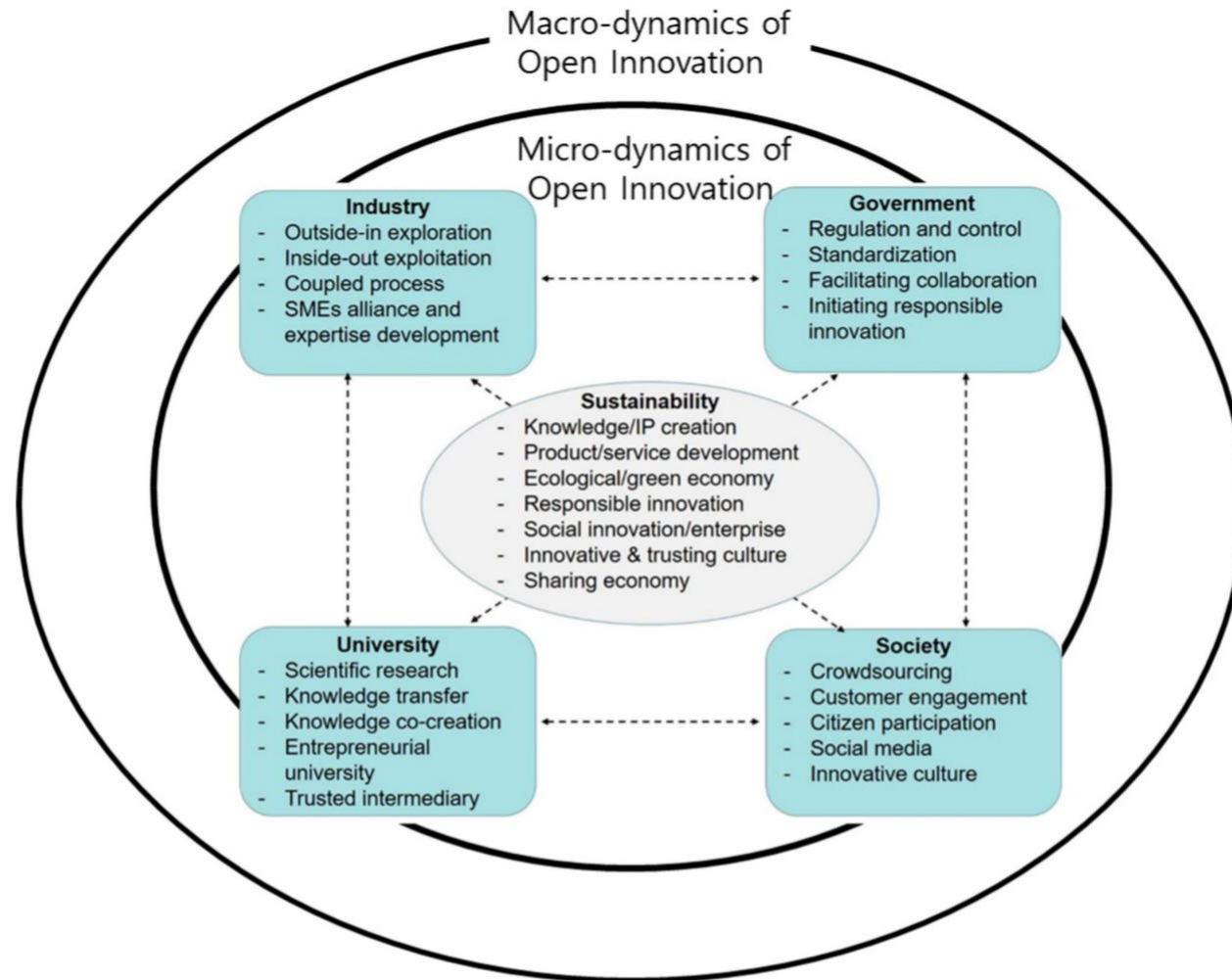
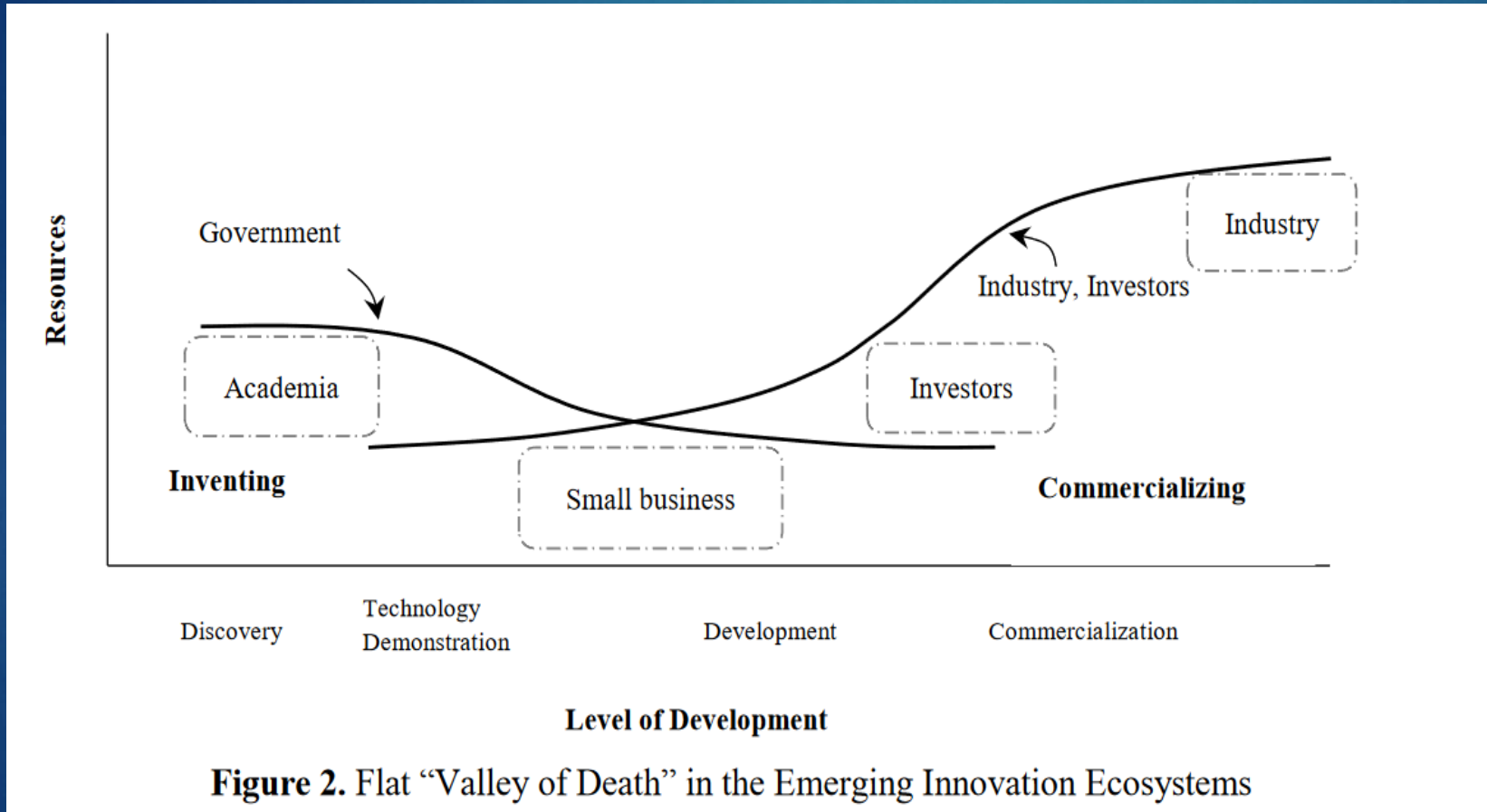


Figure 4. The roles of the quadruple-helix model for open innovation micro- and macro-dynamics.

Valley of Death

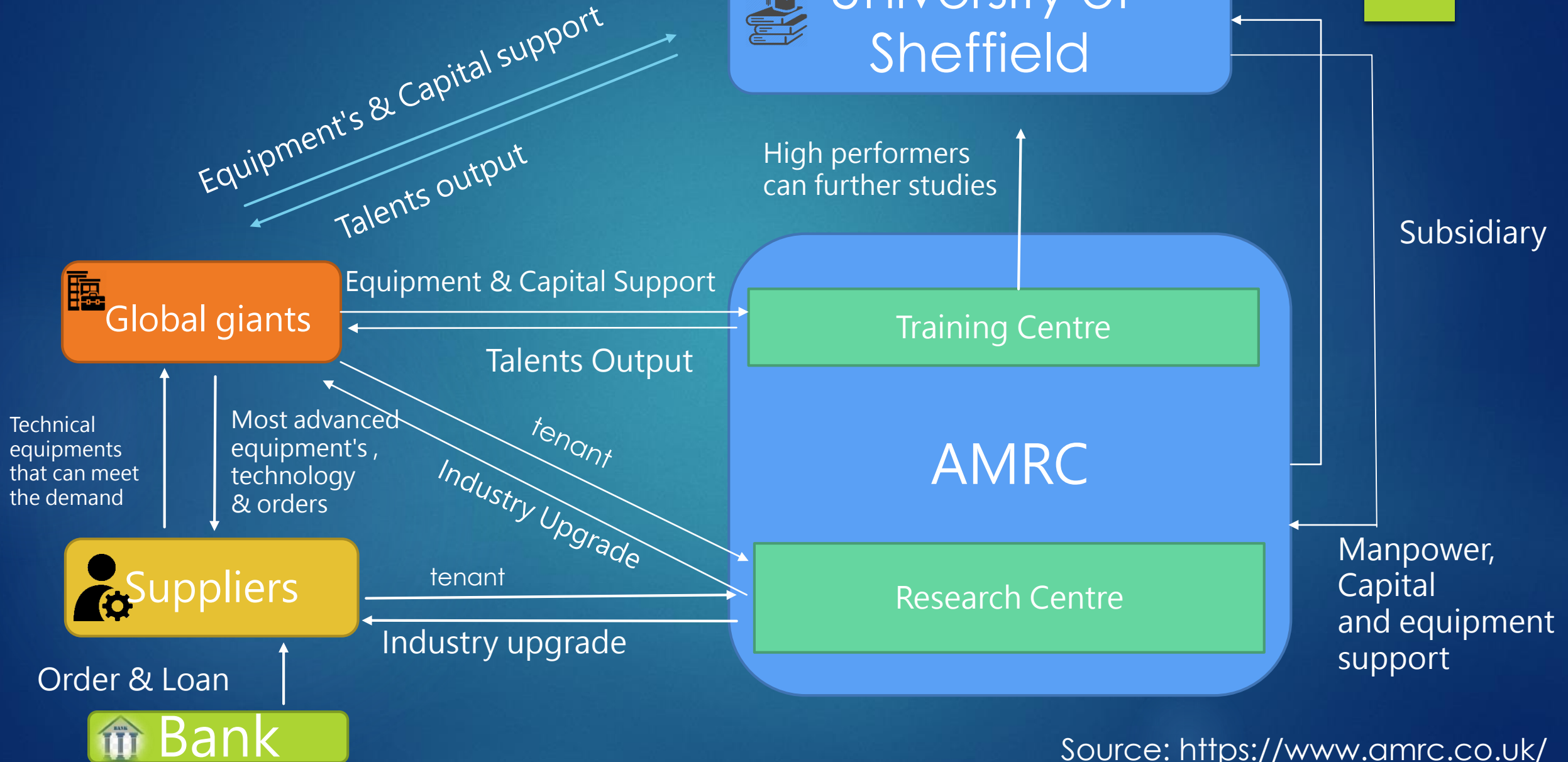
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- ▶ Gap in the commercialization of universities' basic research
- ▶ Observation: Technology transfer ratio of <10% in GBA

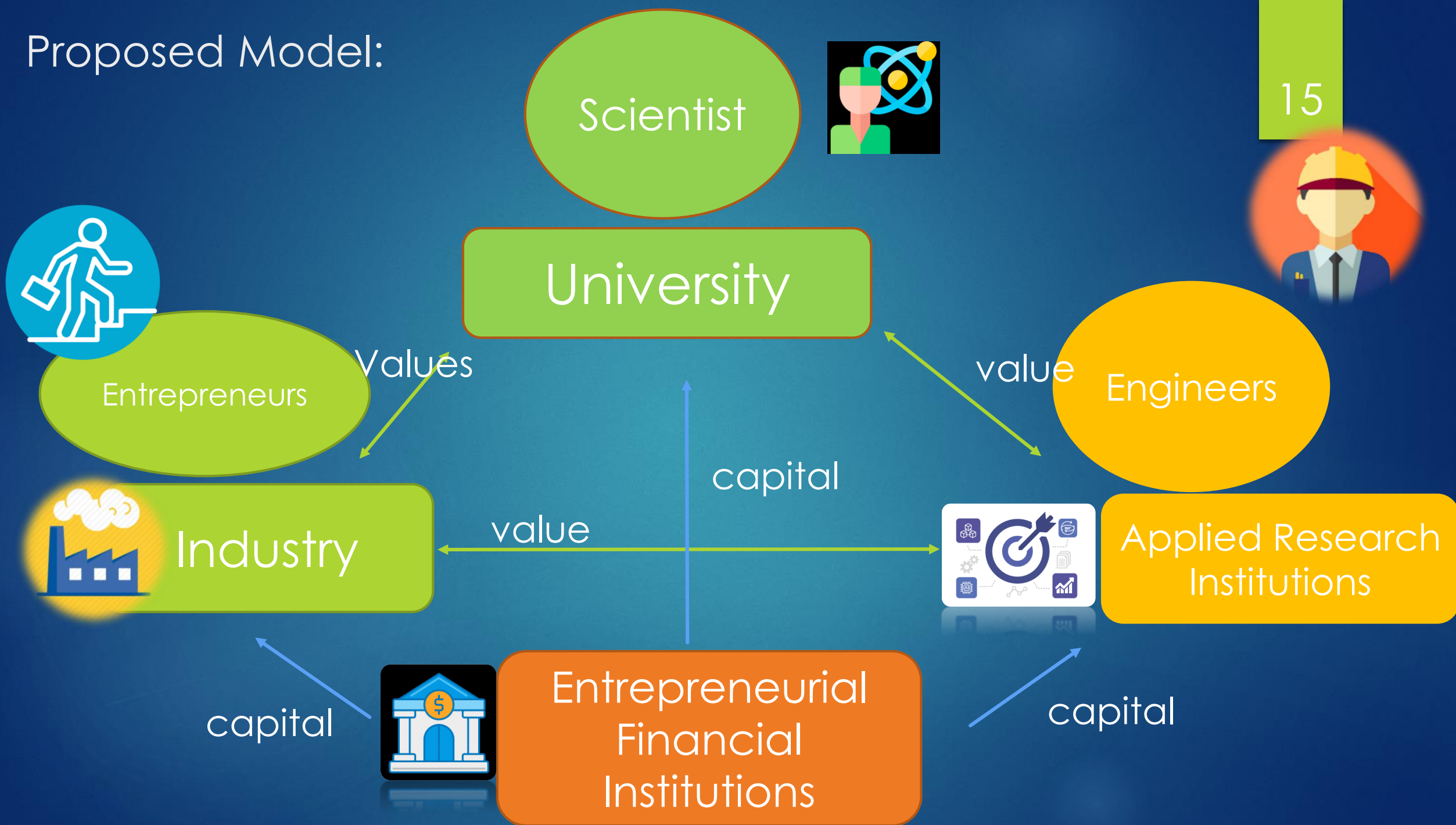


Advanced Manufacturing Research Centre (AMRC) Model

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Proposed Model:



Hypotheses:

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- ▶ Entrepreneurial financial institutions can facilitate the university-industry cooperation in research and development of innovation and technology industry through capital support.
- ▶ Entrepreneurial financial institutions can facilitate the applied research institute-industry cooperation in research and development of innovation and technology industry.
- ▶ University and innovation and technology industry can provide values with each other.
- ▶ University and applied research institute can provide values with each other.
- ▶ Innovation and technology industry and applied research institute can provide values with each other.

Methodology – Qualitative Research + Snowball Sampling

- ▶ Qualitative research : an invitation letter / email will be sent to targeted respondents to invite them to join an 1-1.5 hour one-one interview / 2 hour focus group interview (for innovation & technology companies)
- ▶ Respondents / Interviewees include:
 - ▶ University in HK and Shenzhen (esp. 1. Knowledge Transfer department 2. Centre of entrepreneurship) (N= 4)
 - ▶ Applied Research institutes in HK and in Shenzhen e.g. ASTRI, High-education research institute in Shenzhen (N=4)
 - ▶ Innovation and Technology companies in Hong Kong & Shenzhen (N=20)
 - ▶ Entrepreneurial financial institutions in Hong Kong and Shenzhen e.g. angel investors, bank, venture capitalists etc. (N=6)

Interviewees are found via my personal network or referral by purpose (Purposive Snowball sampling)

Operationalization & Measure of variables

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- ▶ Open innovation is measured by existence & types research & development activities, IP licensing , recruitment / training of talent, technology disclosure, commercialisation of research projects, advices of commercial projects, advices on academic projects, technology spin-off etc. ; frequency of the each type of activities in the past 3 years (e.g. 0, 1-5 times, 6-10 times, 11-15 times, 16-20 times, 20 times +)
- ▶ Capital is measured by the amount of funding support , % of shares purchased, loan, no. of times of getting funded / invested in the past 3 years etc.
- ▶ Values are measured by industry know-how & extent of exchange (by Likert scale); personal network, interorganizational network, R&D related knowledge etc. brought to the counter-part ; frequency of exchange with counter-part the past 3 years
- ▶ Definitions:
 - ▶ Entrepreneurial financial institutions: venture capitalists, angel investors, start up incubators/ accelerators etc.
 - ▶ University: tertiary institutions in Hong Kong and in Shenzhen (in particular the knowledge transfer centre / centre for entrepreneurship)
 - ▶ Applied Research Institutes: University related research institutes or government related research institutes e.g. ASTRI (HK) , Shenzhen Institutes of Advanced Technology

Data Collection:

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- ▶ Primary data collection:
 - ▶ 1. Questionnaire for individual interviews (industry, university, applied research institutes, entrepreneurial association) and focus group (for industry players)
 - ▶ 2. Informal talks to compensate data cannot be collected through individual interviews or focus group
 - ▶ 3. Probing methods will be used in the individual interview
- ▶ Secondary data collection:
 - ▶ Industry reports, university reports, government statistics etc.

Data Analyses :

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- ▶ Tabulation of related data e.g. GERD, commercialisation of patents, no. of university graduates employed etc.
- ▶ General descriptions of the research findings
- ▶ Cross-case analysis (comparison of commonalities & differences) & Cross tabulation for comparison:
 - ▶ Group 1: innovation & technology enterprises got the support from financial institutions successfully
 - ▶ Group 2: innovation & technology enterprises failed to get the support from financial institutions
 - ▶ Group 3: innovation & technology enterprises without getting the support from financial institution intentionally (control group)
 - ▶ The Feedback of respondents from university, research institute, entrepreneurial financial institutions can help to verify the cross-case analysis

Cross-case comparison Matrix

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Group 1: I&T enterprises got the support from financial institutions successfully	Group 2: I&T enterprises failed to get the support from financial institutions	Group 3: I&T enterprises without support from financial institution intentionally (control group)
1A – Shenzhen Enterprises with U/ RI in mainland	2A – Shenzhen Enterprises with U/ RI in mainland	3A – Shenzhen Enterprises with U/ RI in mainland
1B – Shenzhen Enterprises with U/ RI in HK	2B – Shenzhen Enterprises with U/ RI in HK	3B – Shenzhen Enterprises with U/ RI in HK
1C – Shenzhen Enterprises without any U / RI cooperation	2C – Shenzhen Enterprises without any U / RI cooperation	3C – Shenzhen Enterprises without any U / RI cooperation
1D – HK Enterprises with U/ RI in mainland	2D – HK Enterprises with U/ RI in mainland	3D – HK Enterprises with U/ RI in mainland
1E – HK Enterprises with U/ RI in mainland	2E – HK Enterprises with U/ RI in mainland	3E – HK Enterprises with U/ RI in mainland
1F – HK Enterprises without any U / RI cooperation	2F – HK Enterprises without any U / RI cooperation	3F – HK Enterprises without any U / RI cooperation

Working Time Frame

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Formulation of Research Framework, Secondary data research	1 month
Prepare sample questionnaire	1 month
Trial Run	2 weeks
Revise the questionnaire	2 weeks
Focus Group and Interviews	3 months
Data Analysis	3 months
Writing Research Report	3 months

Preliminary Observations:

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Status of Innovation Performance of Hong Kong and Shenzhen										
	Hong Kong					Shenzhen				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Demographic and Socioeconomic [#]										
GDP per capita (nominal) (current USD)	40315.29	42431.89	43734.25	46220.50	48717.29	21147.55	22348.24	23681.63	25904.78	26815.91
Human Capital in R&D [#]										
Total R&D Personnel (FTE)	29169	30110	31282	32355	33576	164103	172608	198556	239606	301839
Total R&D personnel per '000 labour force	9.3	9.7	9.6	10.1	10.4	6.33	6.23	6.62	7.07	8.51
Gross Domestic Expenditure on R&D (GERD) [#]										
GERD as a percentage of GDP	0.74	0.76	0.79	0.8	0.86	3.89	4.07	4.20	4.34	4.80
GERD - performed by higher education %	51.60	52.27	52.10	50.93	50.44	1.18	0.84	0.66	0.91	0.39
GERD - performed by business enterprise %	44.46	43.75	43.26	44.23	44.87	93.92	94.08	94.34	92.61	93.75
GERD - performed by government %	3.93	3.97	4.64	4.84	4.69	4.61	4.86	4.84	6.23	5.77
Education*										
Government expenditure per tertiary student as % of GDP per capita (%)	24.59	23.32	24.33	23.05	24.20	13.00	10.05	13.02	13.74	14.39
Government expenditure on education as % of GDP (%)	3.57	3.26	3.29	3.31	3.32	2.00	1.60	2.07	2.26	2.41
Science & Technology Outcomes*										
High-technology exports (% of manufactured exports)	11.41	12.32	13.50	61.56	64.65	55.34	60.45	54.80	48.80	54.13
Patent applications, residents	192	239	233	324	314	82254	105481	145294	177103	228608

References: 1 CNY = 0.141458 USD

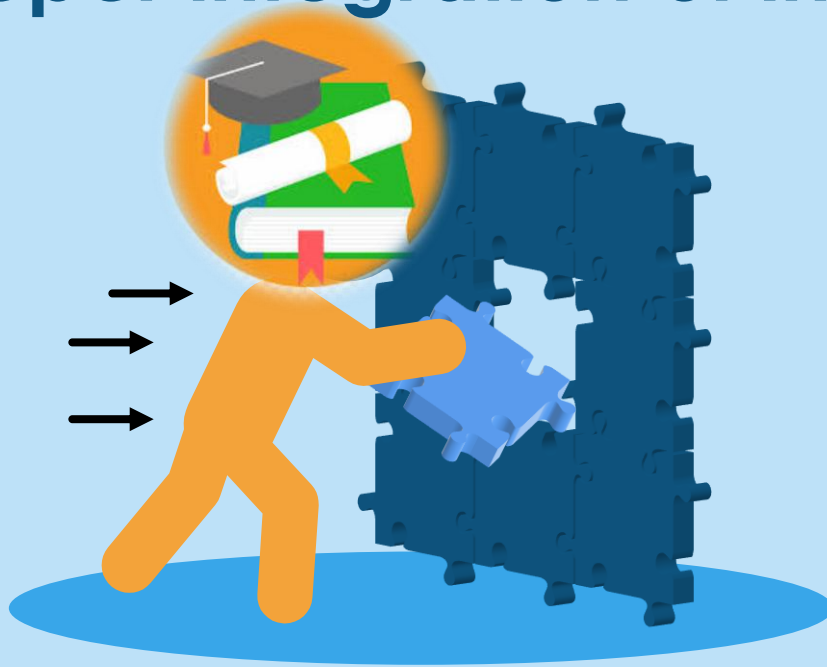
UIS Statistics (<http://data.uis.unesco.org>)

[#] data were obtained and calculated from <http://data.uis.unesco.org> and Shenzhen Statistical Yearbook 2019

^{*} data were obtained and calculated from <http://data.worldbank.org> and Shenzhen Statistical Yearbook 2019

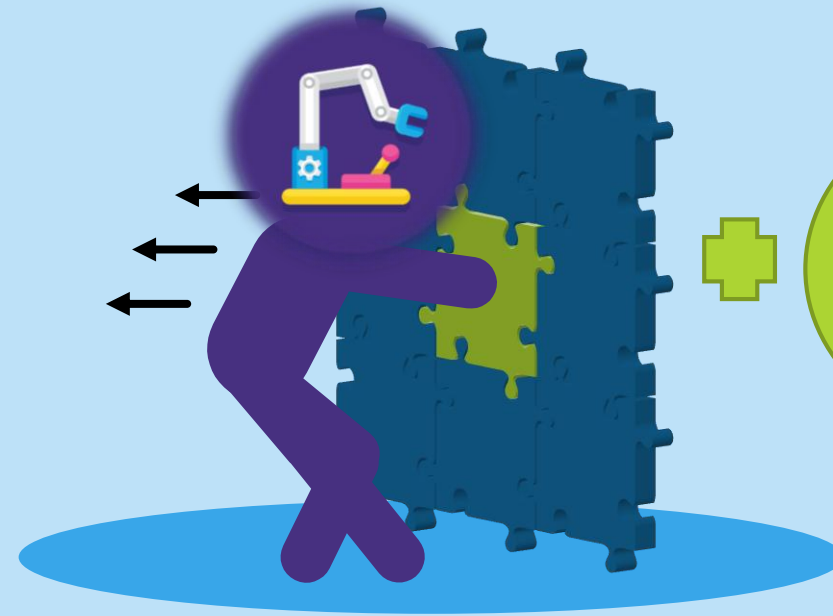
1. GERD by SZ is mainly by business enterprises (room for cooperation with university)
2. GERD by HK is mainly by Govt & higher education (room to cooperate with industry)

Deeper integration of industries, academia & research



Technology Transfer

Technology transfer model – push from academia & research to industries



Industry commissioned research

High-tend industry development should be "pulled" by industry, academia and research should serve the industry's needs

Advanced research for state development and better human beings

Limitations:

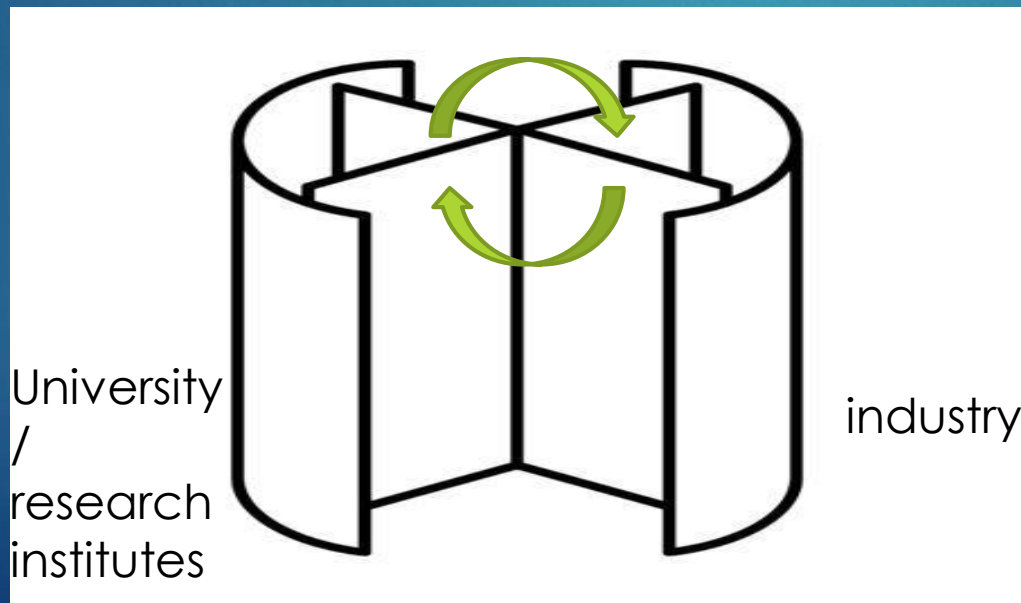
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- ▶ Open innovation is a dynamic process. Involved parties with vested interest in the open innovation model may have concern in knowledge transfer and talents transfer due to loss of control. Mutual trust and relationship needs time to build.
- ▶ Latent variables not studied e.g. industry / trade association, government, public in the quadruple helix model
- ▶ Only limit the scope of work to Shenzhen & Hong Kong instead of whole GBA
- ▶ Respondents are just selected by convenience sampling. It may have selection bias and the selective sample may not be representative,

Research recommendations:

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- ▶ 1. To establish SVB banks or similar organizations in Shenzhen / Hong Kong to facilitate development of regional innovation systems in GBA
- ▶ 2. Setting up a “revolving door” between university / research institutes and industry
 - ▶ professors are encouraged to do business with research students / research engineers
 - ▶ industry professionals are encouraged to teach in university to share their knowledge and participate in curriculum design





**THANK
YOU**

Research Topic:

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Yvonne Wong Lai Fong (Student ID: 1922252)