A STUDY OF OPEN INNOVATION IN SMALL AND MEDIUM ENTERPRISES IN HONG KONG

BY

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SUBMITTED IN A PARTIAL FULFILMENT FOR THE AWARD OF THE DEGREE

OF DOCTOR OF BUSINESS ADMINISTRATION (DBA)

UNIVERSITY OF WALES TRINITY SAINT DAVID

2024

ABSTRACT

The concept of open innovation (OI) has gained significant attention in recent years as a means to accelerate innovation, reduce costs, and enhance competitiveness, particularly for small and medium-sized enterprises (SMEs). However, the adoption and implementation of OI practices among SMEs in Hong Kong remain understudied and underdeveloped. This thesis aims to investigate the OI ecosystem of SMEs in Hong Kong by identifying key players and their roles, analysing SMEs' participation in OI activities, examining the factors that encourage SMEs to engage in OI, and providing recommendations for establishing a support mesh to facilitate their participation.

An explanatory sequential design was employed, combining both quantitative and qualitative methods. The quantitative part of the study comprised survey responses from 144 people working separately in 144 SMEs in Hong Kong, while the qualitative part involved 21 interviews with 19 participants. The findings revealed that Hong Kong SMEs have strong relationships with customers and suppliers, indicating the importance of these partnerships in driving innovation. However, there is room for improvement in relationships with large enterprises, government organisations, industry consultants, and other stakeholders. The relationships between SMEs and OI partners are associated with their motives for participating in OI, particularly in technology acquisition, cost reduction, knowledge transfer, and performance improvement (financial and non-financial). The study found that more SMEs participate in inbound rather than outbound OI, and as a consequence, they are naturally less involved in technology spin-off and technology out-licensing but are more inclined to adopt rather than create new technologies.

The study uncovered the roles of previously overlooked OI players, such as financial institutions, agencies, and media, thereby enriching the existing literature on OI ecosystems. Incubators/accelerators provide physical spaces, resources, and networking opportunities to support SMEs in scaling up their operations, while facilitators facilitate collaborations between SMEs, industries, and government departments. Financial institutions provide funding support and guidance to evaluate market prospects, manage risks, and promote and package enterprises. The study also identified media's crucial role in enhancing visibility and awareness, fostering collaboration and networking, advocating for supportive policies, building a sense of community, and disseminating knowledge.

Broadening sales and marketing channels and cost reduction are the primary motivations for Hong Kong SMEs to engage in OI. Additionally, technology acquisition, talent acquisition, and improving corporate performance are also significant drivers. The research revealed that gaps in not participating in OI activities in Hong Kong include difficulties in finding suitable partners, accessing talents, and securing capital. To further enhance the OI atmosphere in Hong Kong, efforts should be made to address these obstacles and develop targeted strategies to enhance OI adoption and collaboration among SMEs in the region.

The findings of this study not only deepen our understanding of the OI mechanism in the OI ecosystem but also carry practical implications for policymakers, industry stakeholders, and SMEs themselves to devise targeted strategies for enhancing OI adoption among SMEs in Hong Kong.

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed: Wong Lai Fong Yvonne

Date: 12-03-2024

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used the extent and nature of the corrections is clearly marked in a footnote(s). Other sources are acknowledged by giving explicit references. A list of references is appended.

Signed: Wong Lai Fong Yvonne

Date: 12-03-2024

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for deposit in the University's digital repository.

Signed: Wong Lai Fong Yvonne

Date: 12-03-2024

DEDICATION

To my parents, my husband Jasper, my children Sharon and Kayton NG and my mentors

ACKNOWLEDGEMENTS

First of all, I wish to thank my Director of Studies, Dr. Alice Te, for her patience, guidance, and motivation throughout my research. Her unfailing support and encouragement helped me pass through all the challenges. Her prompt feedback was an important driver for me to move forward in the past few years. I have learnt a lot from Dr. Te in compiling a doctoral thesis. I would like to express my deepest gratitude to my supervisor, Professor Peter Fong; his profound knowledge of strategic management gave me many directions and directions on my research. It paved the way for me to work according to my plan.

Thank you for the support and assistance from the Hong Kong Management Association staff and the University of Wales Trinity Saint David faculty members. Special thanks to the encouragement from my mentor, Prof Witman Hung, and his assistance in lining up some of the key respondents for my fieldwork. I would also like to express my deepest gratitude to all the respondents who participated in my research. Without your valuable input, I am unable to complete my doctoral thesis finally.

Thank you for the support from my family, including my husband Jasper, my children Sharon, and Kayton. Thank you very much for your kind understanding and supporting me to complete this research.

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List of Abbreviations

AMRC	Advanced Manufacturing Research Centre
CITB	Commerce, Industry and Technology Bureau
CPC	Communist Party of China
CTB	Communications and Technology Branch
D-Biz	Distance Business
DDIY	Digital DIY
DTSPP	Digital Transformation Support Pilot Programme
ESS	Enterprise Support Scheme
FYP	Five-Year Plan
GBA	the Guangdong-Hong Kong-Macao Greater Bay Area
GERD	Gross domestic expenditure on R&D
HKPC	Hong Kong Productivity Council
HKSAR	Hong Kong Special Administrative Region
HKSTP	The Hong Kong Science and Technology Parks Corporation
I&T	Innovation and technology
IP	intellectual property
IPR	intellectual property rights
ITB	Innovation and Technology Bureau
ITF	The Innovation and Technology Fund
ITIB	The Innovation, Technology and Industry Bureau
KTO	technology transfer office
NITTP	New Industrialisation and Technology Training Programme
OEM	original equipment manufacturing
OGCIO	Office of the Government Chief Information Officer
OI	Open innovation
PSTS	Public Sector Trial Scheme
R&D	Research and development
RAISe+	Research, Academic and Industry Sectors One-plus Scheme
RBT	Resource-based theories

RGC	Research Grants Council
SERAP	Small Entrepreneur Research Assistance Programme
SMEs	Small and medium-sized enterprises
TPLSP	Third Party Logistics Service Providers Pilot Programme
TVP	Technology Voucher Programme
UGC	University Grants Committee
UICP	University-Industry Collaboration Programme
VoD	Valley of Death

CHAPTER I
INTRODUCTION

1.1 A Brief History of Open Innovation

Innovation is a popular topic in the field of management research. The relationship between innovation and company growth or long-term performance is widely proven in different studies. According to Nesta (2013)'s research on high-growth firms, companies that innovate grow almost twice as fast as those that do not. Innovation can occur within a company or through cooperation among organizations. In recent years, the importance of open innovation has attracted more attention.

The term 'Open Innovation' (OI) was made a popular research topic since different OI research was done by the Berkeley Professor Henry Chesbrough in 2003 (Chesbrough, 2003). In the 1980s and 1990s, many global pharmaceutical companies began to look externally for product innovation. Today, organisations across industries embrace OI and attribute part of their success to OI strategies.

OI can be defined as innovating with partners by sharing the risks and rewards (Chesbrough, 2003). It requires reciprocity and cannot be reduced to simply implementing a customer suggestion box or making new demands on suppliers. It involves establishing long-term relationships with external stakeholders, such as customers, suppliers, research institutions, and even competitors, to co-create and co-develop innovative solutions. This collaborative mindset encourages the exchange of ideas, expertise, and resources, leading to the generation of novel concepts, products, and services (Lopes & de Carvalho, 2018). Furthermore, open innovation recognizes that valuable knowledge and ideas can originate from anywhere, not just within the boundaries of the organization. By actively seeking external inputs, organizations can tap into a wider pool of diverse perspectives and expertise, enhancing their ability to identify emerging trends, solve complex problems, and seize new market opportunities (Brunswicker & Vanhaverbeke, 2015).

While it is difficult to quantify the benefits of OI, this approach has been taken in some industries. A Big Innovation Centre study (GSK, 2013) found that as of 2013, Unilever and GlaxoSmithKline have OI elements in over 50% of their research and development (R&D) projects. Research by Accenture also suggests that OI is related to reduced time-to-market for new products and increased recognition of innovations from large organisations (Reid, 2014).

OI is not limited to R&D or innovation professionals. Its success relies on people management professionals and requires support from HR to incorporate OI into an organisation's culture (Lopes & de Carvalho, 2018). OI can have a profound effect on the skills required by managers and leaders, career paths, and performance measures (Rahimli, 2021).

1.2 An Overview of Open Innovation Research

OI has been a popular topic in academic literature. A number of literature reviews have specifically focused on this phenomenon. Significant attention has also been given to different aspects of OI, such as adoption, commercialisation, risks, impact, and sustainability. One study by De Coninck et al. (2021) focused on determinants of OI adoption in public organisations and identified the factors that can influence its implementation. Resource-based determinants have three dimensions: tangible assets, intangible assets, and capabilities. Tangible assets can generally be grouped into two categories: technological resources and financial resources. Intangible assets include determinants such as public managers and leaders, organisational structure, organisational culture, professional identity, and strategic alignment. The capabilities identified in the literature include exploring, codifying, transferring innovation needs, managing external innovators' involvement, acting as meta-governor, and agile development methodology. Uncertainty-related determinants include intermediaries; inter-actor trust; and standardised processes across public organisations. Institutional determinants include coercive pressures (e.g. political entities and legislation framework), normative pressures (e.g. social environment), and mimetic pressures (e.g. comparable public organisations). Helm et al. (2019) critically examined the timing and frequency of outbound OI commercialisation of technologies and addressed various challenges and propositions in this respect.

Madanaguli et al. (2023) investigated the uncertainties and risks associated with OI and highlighted the need for identifying and understanding these risks. They present a systematic review of risks to uncover pertinent typologies, unexplored horizons, and other related issues, including data-related risks, people-related risks, firm-level risks, outcome risks, and other risks. Oduro et al. (2021) conducted a meta-analytic review of the impact of OI on firm performance, synthesising the findings of many previous studies into a comprehensive analysis. They concluded that there is a positive relationship between OI and firm performance. The study discovered that the diverse outcomes could be attributed to various contextual factors, such as sectors, firm sizes, culture, industry intensity, and study regions, as well as measurement moderators, including data type and study measure. Romera et al. (2022) conducted a comprehensive systematic literature review from entrepreneurship to OI, highlighting the evolution of OI research and proposing future research directions.

1.3 Open Innovation in Mainland China

OI has been rapidly embraced by Chinese firms, both large and small, as they seek to enhance their innovative capabilities and efficiency. A range of studies has investigated different dimensions of OI in China, including its application in Shenzhen, the role of internal absorptive capacity and external knowledge sources, the impact of partner heterogeneity, the effectiveness of industry-university-research cooperation, and the barriers to OI.

Fernandez et al. (2016) examined the evolution of the OI paradigm from outsourcing to open-sourcing in Shenzhen, China. The study showed that OI is a crucial component of the innovation ecosystem in Shenzhen, which has become a hub for innovators and entrepreneurs in China. F. Huang et al. (2015) investigated the applicability of OI to Chinese firms and found that external knowledge sources and internal absorptive capacity play a crucial role in the success of OI initiatives in both large and small firms.

S. Huang et al. (2018) explored how OI performance is affected by partner heterogeneity in China. The study showed that diversity of external partners positively influences innovation outcomes, indicating that OI can open new opportunities for firms to collaborate and create economic value. Lu et al. (2021) investigated the impact of OI strategies on innovation performance of SMEs in China and found that there is a positive relationship between the scope and intensity of OI and innovation performance among small and medium-sized enterprises (SMEs). Additionally, the study highlighted that the ability of SMEs to effectively utilise external knowledge, i.e. realised absorptive capacity, plays a mediating role in enhancing the impact of OI on innovation performance. Furthermore, factors such as potential absorptive capacity and institutional support from the government can moderate the connection between the breadth of OI and innovation performance.

Ortiz et al. (2019) used a case study of Xiaomi to examine how open innovation ecology can be constructed on the internet. The study showed how institutional logic can be used to promote open innovation, and thereby create a sustainable competitive advantage. Savitskaya et al. (2010) examined the barriers to OI in China, showing that cultural and institutional differences can pose significant challenges for foreign firms seeking to engage in OI activities. The study suggested that firms need to carefully navigate these barriers to successfully engage in OI in China.

Savitskaya et al. (2014) investigated outbound OI in China and Russia, using an innovation system approach. The study showed how networks and relationships play a crucial role in the success of OI initiatives, highlighting the importance of social capital. G. Xu et al. (2014) explored the effects of control on OI in university-industry cooperation in China and found that too much control has a negative impact on innovation outcomes.

Zheng et al. (2018) reappraised outbound OI in the context of China’s ‘Market for Technology’ policy. The study showed that while this policy has created new opportunities for OI, it has also increased competition and intensified intellectual property disputes. H. Zhu et al. (2023) examined the moderating role of social capital in the relationship between OI and manufacturing firms’ performance in China and found that social capital strengthens the positive impact of OI on performance. Finally, Z. Zhu and Chen (2012) investigated the balance between exploitative and explorative learning under OI in China and found that firms need to strike a delicate balance between these two types of learning to maximise the benefits of OI.

In short, the literature on OI in China highlights the challenges and opportunities of this concept in the Chinese context. While there are cultural and institutional barriers to OI, firms that successfully navigate these challenges can reap significant benefits, including enhanced innovation performance and sustainable competitive advantage.

1.4 Open Innovation in Hong Kong

Manufacturing and trading sector was the largest contributor to Hong Kong's economy (Hong Kong Trade Development Council, 2006) in the twentieth century. Majority of firms in this sector were SMEs and many of them were original equipment manufacturing (OEM) companies that compete primarily based on low cost (Fitzgerald & Rowley, 2013). As a result, different scholars (e.g. Yam et al., 2011) considered Hong Kong as a low-technology, labour-intensive export economy. However, since the late 1990s, Hong Kong's business environment gradually changed because low labour cost lost its comparative advantage. Labour cost was ever-increasing. Many factories have been relocated to mainland China or other Asian countries. The Government of Hong Kong Special Administrative Region (HKSAR Government) rebuilt Hong Kong as an international financial centre. Hong Kong started to become a service economy. However, during the establishment of HKSAR, the first Chief Executive Tung Chee-wah proposed that Hong Kong should develop more in the technology sector to meet modern needs as well as provide more opportunities for employment. Commissioned by the Chief Executive, Professor Chang-Lin Tien submitted the Second and Final Report of the Commission on Innovation and Technology to Mr. Tung in 1999. The report established a consensus within the Hong Kong business community on the importance of innovation and technology to drive economic growth and competitiveness of Hong Kong. The Government proposed a development strategy to transform Hong Kong into a world-class high-tech city (Baark & So, 2006). Hong Kong SMEs have tried to apply technology in different parts of their business process, such as production, operation and marketing (Innovation, Technology and Industry Bureau, 2022; Siu, 2005). In recent years, SMEs have started to apply technology to improve its business process and develop new business models.

The Central Government of People’s Republic of China (the Central Government) has decided in recent years to build the Guangdong-Hong Kong-Macao Greater Bay Area (the GBA) as a world-leading city cluster with highlight on innovation and technology as well as modern services industries. Taking advantage of Hong Kong and Macau as free and open economies and Guangdong as the leader of reform and opening up, the GBA plays an exemplary and leading role in building institutional mechanisms for high-quality economic development. It aims to speed up institutional innovation and early and pilot implementation and introduced a series of liberal and convenient policies in industrial support, scientific and technological innovation, culture and education, and liveable living and ultimately to build a modern economic and social operation system. It is estimated that the construction of the GBA will also bring rich development opportunities and strong development momentum to local firms in the three regions so that the already active capital, technology, talent, and other resources in Guangdong, Hong Kong, and Macau will become more efficient (Our Hong Kong Foundation, 2022). Scholars pointed out that the construction of the GBA will create a favourable policy environment for Hong Kong’s SMEs and bring many policy dividends.

According to an analysis of Hong Kong’s recent investment climate (Our Hong Kong Foundation, 2022), one of Hong Kong’s most significant advantages lies in its close ties with the mainland China market, especially after its integration into the GBA. From 2000 to 2021, mainland China has been Hong Kong's largest trading partner: mainland China's share of Hong Kong's total imports has risen from 43% to 44.3%, while its share of Hong Kong's total exports has jumped from 34.5% to 59.8% (International Monetary Fund, 2023). In other words, mainland Chinese market has played an increasingly important role in Hong Kong over the past 20 years. This is an essential economic backdrop for the birth of the GBA initiative. Hong Kong also has the advantage of a relatively advanced financial services sector, an investor-friendly tax policy for businesses and individuals, a well-developed transport and telecommunications infrastructure, and a relatively efficient and open government. However, Hong Kong also has some disadvantages compared to both mainland China and abroad. Compared to mainland China, high property prices, rents, and labour costs increase the costs of running business in Hong Kong.

In recent years, trade conflicts between the US and China, the economic slowdown in mainland China, political unrest, and the global spread of COVID-19 have hampered Hong Kong's economic development and threatened its status as an international financial centre. Social unrest has raised concerns about Hong Kong's stability and the relocation of foreign companies to other regions. China's reforms to open its financial services sector have also gradually narrowed the gap between Hong Kong and mainland China's financial centres (e.g. Beijing and Shanghai), making Hong Kong less of a sole investment gateway to the Chinese market. There are also institutional factors that raise concerns about Hong Kong's long-term prospects, including the perceived convergence of Hong Kong's political and legal systems with mainland China and the removal of Hong Kong's special status for trade and visas by the US government (Country/Territory Report - Hong Kong SAR, 2023). However, on the positive side, Hong Kong will remain a transit point and an irreplaceable regional financial centre due to its well-established financial infrastructure and unique access to mainland China.

It is forecasted that Hong Kong's economy will likely grow at a slower rate of 2.4% during 2023-25, down from an average expansion of 2.9% in 2016-18 (Country/Territory Report - Hong Kong Special Administrative Region, 2023). To combat the recession, the Hong Kong Special Administrative Region (HKSAR) Government has introduced fiscal stimulus measures, including waiving fees and administrative charges in the retail, restaurant, and tourism sectors, reducing rents on government land, providing loans to small businesses, and keeping tax rates low.

Xu and Yu (2013) applied the Extended OI Model to analyse the strengths and weaknesses of developing technology and innovation industries in Hong Kong and suggested that a paradigm shift in OI could benefit Hong Kong. Their extended OI model is a good framework for analysing the R&D of innovation and technology (I&T) industries in Hong Kong. The authors discussed how small I&T firms can improve themselves from the extended OI model through collaboration and exchange with large companies, research institutions, and the government. Research institutions can work hand-in-hand with small I&T firms to commercialise and bring research projects to market. In their studies, venture capitalists were seen only as professional service providers, bridging the gap between small I&T firms, research institutions, and funding sources. However, the role of entrepreneurial financial institutions in facilitating the university-industry-research institution relationship has not been fully discussed and proven. Therefore, this study will revisit the extended OI model through an empirical study of Shenzhen-Hong Kong I&T industry cooperation as an example of cross-border cooperation in the GBA.

1.4.1 Open Innovation Research in Hong Kong

OI is an important concept that has been studied extensively in various parts of the world. However, there is a need for more research on the application of OI in Hong Kong. One of the earliest studies on OI in Hong Kong was conducted by Yam et al. (2011), which investigated the sources of innovation, technological innovation capabilities, and performance in Hong Kong’s manufacturing industries. The study found that the availability of external information affects all the innovation capabilities of a company, while external expert organisations only impact the R&D and resource allocation capabilities of the firm. It suggested the importance of adopting an OI approach to drive innovation in Hong Kong.

Another study by Y. Xu and Yu (2013) explored the strengths and weaknesses of Hong Kong’s technology and innovation industry with reference to the extended OI model. The authors found that Hong Kong had a solid foundation for OI due to its economic and geographic advantages but identified challenges related to collaboration between industry, academia, and government. They identified a lack of collaboration among stakeholders as a critical challenge and suggested that building trust and establishing networks among stakeholders could enhance the adoption of OI in Hong Kong.

More recently, the ‘Research on Digital Transformation in Hong Kong Business Sector’ conducted by the Hong Kong Productivity Council (HKPC) in 2019 revealed that over 70% of respondents believed that digital transformation could enhance business processes, alleviate issues such as rigid internal approval processes, lack of systematic management in the work process, and non-interoperability of internal data, thereby saving costs. However, the study found that budget constraints and a lack of talent with relevant knowledge were significant barriers to the adoption of digital transformation. Large corporations cited restrictions brought by legacy systems (49%), management awareness (44%), and employee awareness (42%) as reasons for not undergoing digital transformation. The research's focus group interviews revealed that the major obstacles to digital transformation in Hong Kong were 'lack of management vision and overall strategy in digital transformation, employees' reluctance to change, and insufficient talent and skills.' Overall, HKPC's (2019) research suggested that Hong Kong businesses recognise the importance of digital transformation but lack related implementation strategies.

Liu (2019) investigated social innovation design in Hong Kong and explored the impact of factors including monetary incentives, task significance, social engagement, and reputation on both the quality and amount of effort put into engaging in OI contributions. The study found that social innovation design can serve as an effective approach to promoting OI and facilitating collaboration among stakeholders, particularly in addressing social challenges. Rahimli (2021) examined the adoption of OI as a form of management innovation and its impact on individuals. The study found that adopting OI as management innovation positively influenced employees' performance and enhanced their career opportunities, highlighting the potential benefits of adopting an OI approach to drive innovation in Hong Kong's organisations.

Overall, few studies on OI in Hong Kong suggested that adopting an OI approach can drive innovation and enhance competitiveness in Hong Kong's industries. There is a need for more research to be conducted in this area, particularly on the role of culture, leadership, and technology in facilitating OI in Hong Kong's unique business environment. Moreover, the Guangdong-Hong Kong-Macao GBA initiative also brings new opportunities to OI in Hong Kong with increased availability of talents, industrial enterprises, supply chain excellence and incentives from Governments. The impact of OI in Hong Kong will also be studied.

1.4.2 Major technology policies after the establishment of HKSAR

After 1997, Hong Kong has increased funding for research and tried to transform its economy into innovation-driven growth. The HKSAR government has established various policies and institutions to lead knowledge-based innovation and promote cross-sector collaboration for long-term development.

1.4.2.1 From 1997 to 2007

Since the establishment of the HKSAR, several major technology policies have been implemented.

In the Policy Address of first Chief Executive of Hong Kong Kong SAR Government, Mr TUNG Chee-Wah outlined his blueprint for the development of Innovation and Technology. The Digital 21 Strategy, launched in 1998, aimed to develop Hong Kong into a leading digital city in Asia by promoting I&T and e-government services (Commerce and Economic Development Bureau, 2007). Mr TUNG established "HK$5 billion Innovation and Technology Fund ("ITF"). Hong Kong Applied Science and Technology Research Institute ("ASTRI")" was set up in 2000. The Hong Kong Science and Technology Parks Corporation was established in 2001 and the Hong Kong Science Park (HKSP) in Pak Shek Kok, New Territories was then opened in 2002. HKSP is a R&D complex aiming to promote innovation and bring together talent, companies, and investors to advance cutting-edge technologies in Hong Kong. In addition, Cyberport was opened in 2003. Cyberport is a digital community and innovation hub located in the Hong Kong Island and it is designed to support tech startups and entrepreneurs and nurture Hong Kong's position as a leading ICT hub in the region (Legislative Council Secretariat, 2017).

In 2002, Mr. TUNG established the Commerce, Industry and Technology Bureau and put the Innovation and Technology under this policy Bureau (Legislative Council Secretariat, 2017). In 2006, six Research and Development Centres were set up in 2006 to further support technology transfer and commercialization in applied research and development. The six Research and Development Centres include, Chinese medicine, automotive parts and accessories, innovation and communication technologies, textile and apparel (RTIA), logistics and supply chain management and advanced materials. But the proposal of Chinese medicine centre was subsequently dropped out due to unfavourable environment. The GERD of Hong Kong was improved to 0.45% in 2000 and 0.8% in 2005, a big improvement from 0.26% in 1995. We can observe that the I&T environment in Hong Kong was much improved under strong government drive.

1.4.2.2 From 2007 to 2015

In 2007, the Chief Executive Donald TSANG proposed to change the name of Commerce, Industry and Technology Bureau (CITB) to Commerce and Economic Development Bureau (Constitutional Affairs Bureau, 2008). Although it was still responsible for telecommunications, information technology, innovation and technology, technology-related matter as well as Creative industry were put under the

Communications and Technology Branch (CTB).

In the 2007-2008 Budget Speech of the HKSAR Government (Financial Secretary, 2007), Financial Secretary proposed University Grants Committee (UGC) and Research Grants Council (RGC) to encourage local universities to conduct more researches related to innovation and technology. The government has relaxed restrictions toward the Small Entrepreneur Research Assistance Programme (SERAP) and University-Industry Collaboration Programme (UICP). The aim was to enhance the development of applied scientific research. In the 2009-2010 Policy Address of Chief Executive Donald Tsang, he proposed the plan for developing new six industries including Medical Services, Environmental Industries, Testing and Certification Services, Education Services, Innovation and Technology as well as Cultural and Creative Industries under CEDB (Information Services Department, 2010). The ratio of gross domestic expenditure on R&D to GDP (GERD) of Hong Kong was kept around 0.73-0.79% from 2007 to 2011 (Innovation and Technology Commission, 2012). The I&T environment of Hong Kong did not improve.

Different partitioners from the technology field went on different protests during 2007 to 2015 and urge the government to put back "technology" in policy bureau level. The idea was supported by 2012 Chief Executive CY LEUNG. He put the government restructure proposal to Legislative Council but was unfortunately rejected by the politicians. After 8 years of effort, the Innovation and Technology Bureau (ITB) was finally set up in 2015.

1.4.2.3 From 2015 to 2023

Innovation and Technology Bureau (ITB) was set up in 2015 under the leadership of Chief Executive CY LEUNG. It was dedicated to take the lead in making holistic I&T policies of Hong Kong through a high-level leadership from Bureau's perspective (Legislative Council Secretariat, 2022).

In 2017, the Smart City Blueprint for Hong Kong was unveiled, aiming to transform the city into a smart city by leveraging technology to enhance the quality of life, business efficiency, and sustainability (HK Smart City Blueprint, n.d.). In 2018, the government instituted the Technology Talent Admission Scheme to attract top-tier overseas science and technology talent to work in Hong Kong's I&T industry. Hong Kong-Shenzhen I&T Park initiative was also launched in 2018, fostering innovation and collaboration across the region. These initiatives aimed to create a vibrant innovation ecosystem that spurs economic growth and development. The city's I&T atmosphere was much enhanced since 2015 and Hong Kong has started to build our city's I&T ecosystem. The GERD of Hong Kong started to raise to 1.09% in 2022 from 0.74% of 2019 (Census and Statistics Department, 2016; 2023). In the Policy Address of Chief Executive Carrie LAM in 2021, she proposed the Northern Metropolis Development Strategy (the Development Strategy) which was aimed at increasing land supply for the development of innovation and technology industry (HKSAR Government, 2021).

In July 2022, ITB was renamed as the Innovation, Technology and Industry Bureau under the Chief Executive John LEE and it further highlight the importance of advanced industrialization as well as Innovation and Technology for the economic transformation of Hong Kong.

As of March 2023, the ITF had approved over 50,018 projects with a total funding of HK$34.7 billion, primarily for projects related to foundation industries, information technology, and electrical and electronics (ITF, n.d.). With over 600 companies and research institutes across various industries, Hong Kong Science Park offers incubation, acceleration programs, access to funding and investment opportunities, and R&D support. Its industries span from biotechnology to fintech, smart city, robotics, and digital entertainment (HKSTP, n.d.). In addition, Hong Kong Science and Technology Park (HKSTP) offers comprehensive services to meet the needs of various industries, from supporting technology startups through incubation programmes to offering premises and services in the HKSTP for applied R&D activities. INNOPARKs (previously known as Industrial Estates) , managed by the HKSTP, provide land and premises for new manufacturing facilities. HKSTP provides one-stop infrastructural and support services to facilitate the growth of technology-based companies at different stages (HKSTP, n.d.). In 2015, the HKSTP revised its policy for INNOPARKs. Under this policy, it typically offers specialised multi-storey industrial buildings for rental to multiple I&T-based industrial partners. At the same time, it may grant sites to single users under exceptional circumstances, such as the need for a purpose-built factory or if the industry can make a significant contribution to Hong Kong's economic development.

On the other hand, the Hong Kong Cyberport Management Company Limited (Cyberport) now provides value-added services such as mentorship and incubation programs, networking events, access to funding, investment opportunities, and commercialisation support, Cyberport also organises various events and competitions to showcase new ideas and products to potential investors and partners (Cyberport, n.d.).

According to the website of Innovation and Technology Commission (2024), InnoHK is a major initiative of the HKSAR Government that aims to establish Hong Kong as a hub for global research collaboration by investing $10 billion. Two research clusters, Health@InnoHK and AIR@InnoHK, have been established at the Hong Kong

Science Park, focusing on healthcare technologies and artificial intelligence and robotics technologies, respectively. As of December 2023, 29 InnoHK research laboratories are in operation, involving seven local universities and research institutions, as well as over 30 institutions from 11 economies. It has brought together approximately 2,000 researchers from around the world to collaborate on groundbreaking research projects. In the 2023 Policy Address of the Chief Executive on 25 October 2023, the Generative AI research centre and The Hong Kong Microelectronics Research and Development Institute (HKMSRDI) will be established. Furthermore, the government has announced to conduct the feasibility study on AI Supercomputing Centre's development.

The Guangdong-Hong Kong-Macao GBA (the GBA) provides a critical context for technology policy development in the 2020s. In the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through the Year 2035 (14th FYP), the GBA has been positioned as an 'International Science and Technology Innovation Hub,' with Hong Kong as one of the pillar cities. The latest Central Government strategy emphasised the importance of R&D and technology transfer for sustainable economic growth (Xinhua, 2022). In response, HKSAR actively promotes R&D activities and encourages individuals and companies to own their core technologies or intellectual property rights through these activities (Brand Hong Kong, 2021). The Innovation and Technology Fund provides funding for R&D projects, while the Technology Transfer Office helps researchers and companies commercialise their technologies. The government invests in specialised R&D facilities and infrastructure such as Science Park and Cyberport, to support the growth of the I&T industry.

The Hong Kong Innovation and Technology Development Blueprint published by the Innovation, Technology and Industry Bureau (ITIB) of the HKSAR Government (2022) illustrated a stronger determination to develop the information and technology industry in the 2020s. The government set four broad directions for the industry, including enhancing the I&T ecosystem, promoting new industrialisation, enlarging the I&T talent pool, developing a smart city, and proactively integrating into the overall development of the country.

In addition, Hong Kong has taken several measures to attract and retain international I&T talents. To provide better support for talents, the Government established the Talents Service Unit to provide a one-stop service, which includes the Top Talent Pass Scheme launched for high-earning individuals and graduates from top universities. The General Employment Policy and Admission Scheme have been streamlined to simplify the application process for employers who wish to hire Mainland Talents and Professionals. To encourage more world-class talents to relocate to Hong Kong, the Government suspended the annual quota under the Quality Migrant Admission Scheme.

The Technology Talent Admission Scheme has also been expanded to include more emerging technology areas, making it possible for eligible companies to hire oversea and Mainland technology talent to work on R&D projects (Innovation and Technology Commission, n.d.). Additionally, subsidies for the Research Talent Hub Scheme have been increased to provide more funding support for organisations and companies undertaking R&D projects (Innovation and Technology Commission, n.d.). The government has launched the Re-industrialisation and Technology Training Programme to fund local enterprises on a government-enterprise matching basis, while accommodation facilities have been built for I&T talents at the HSITP (Innovation and Technology Commission, n.d.).

Recently, the Government is taking steps to leverage the vast opportunities presented by the rapid development in Mainland China and capitalise on Hong Kong's unique strengths to strengthen its position as an international I&T hub. Collaborating with the Shenzhen Municipal Government, the Government aims to establish the Shenzhen-Hong Kong I&T Cooperation Zone to facilitate cross-border I&T collaboration. Besides, they are planning to transform San Tin Technopole into an international I&T city that will be the catalyst for Hong Kong's rapid I&T industry growth (San Tin Technopole, n.d.). Additionally, the Hong Kong-Shenzhen Innovation and Technology Park (HSITP) in the Loop is under full-speed development, utilising innovative market-driven development models to attract investment and businesses from next year onwards (Hong Kong-Shenzhen Innovation and Technology Park, n.d.).

1.4.3 Adoption of Information Technology and Research and Development Input in Hong Kong

According to the Global Innovation Index report by World Intellectual Property Organization (2022), Hong Kong ranked 14th and scored 51.8, while China ranked 11th and scored 55 among 132 economies. The close competitor of Hong Kong, Singapore ranked 7th in the world. The GBA and Beijing ranked as the world's 2nd and 3rd global Science and Technology cluster, respectively, while the top one was Tokyo–Yokohama (Japan) and the 4th one was Seoul (Korea). According to the report, Hong Kong ranked 10th in Institutions, ranked 13th in Human capital and research, ranked 6th in Infrastructure, ranked 2nd in Market sophistication, ranked 27th in Business sophistication, ranked 60th in Knowledge and technology outputs and ranked 5th in

Creative outputs. The poor performance of business sophistication is reflected by an insufficient supply of knowledge workers and research talent as a percentage of the business, low GERD (Gross domestic expenditure on R&D) and low intellectual property payment as a percentage of global trade. The low ranking in Knowledge and technology outputs, to a certain extent, reflected the poor knowledge diffusion such as ‘low high-tech exports, low ICT services experts, low intellectual property receipts, low ICT service exports as percentage of total trade’ as well as fewer ‘patents by origins’ compared to other economies.

From the Hong Kong and Industry Profile by Hong Kong Trade and Development Council Research (2022), ‘biotechnology, artificial intelligence, smart city and financial technologies were identified as the four key areas for Hong Kong’s I&T industry’.

According to the Census and Statistics Department of Hong Kong, the total spending on R&D of Hong Kong in 2022 was HK$ 30,138 million, which accounts for 1.07% of the total GDP of Hong Kong. In 2017/18, policy address, the government set up a target of GERD 1.5% in five-years time. According to the Hong Kong I&T Development Blueprint published by the ITIB of the Hong Kong SAR Government in December 2022, the government refined its GERD target to 1.3% in 2027 and 2.0% in 2032.

It was disappointing that Hong Kong could only achieve about 1% GERD in 2021 and 0.86% in 2019, which was amongst the two lowest cities in the GBA due to the epidemic and slow growth economy. Research Office Information Services Division Legislative Council Secretariat (2021) revealed The GERD of Guangzhou was 2.87% and Shenzhen was 4.89%, respectively, in 2019. The number of R&D personnel in

Hong Kong in 2020 was 36,106 and in which 13,335 were from the Business sector, 21,715 from the Higher education sector and 1056 from the Government sector.

According to the report of the Census and Statistics Department in Hong Kong (2021), large establishments contributed 6% of the total number of business establishments that had undertaken R&D activities (including both in-house R&D and/or contracted-out R&D activities) in 2020 and they ‘accounted for 49% of total in-house R&D expenditure in the business sector, as compared with 32% and 19% by medium and small establishments respectively’. That means 94% of the total business establishments conducting R&D activities are SMEs, and they account for 51% of the total R&D expenditure. Regarding the Innovation Activities Statistics report 2020 by Census and Statistics Department (2020), ‘the expenditure on R&D activities performed in the business, higher education and government sectors amounted to $11,044 million, $14,129 million and $1,380 million respectively in 2020’. The Hong Kong Innovation Activities Statistics 2020 further elaborated that ‘the information and communications sector accounted for the largest share (38%) of the total expenditure on in-house R&D activities in the business sector, followed by the import/export, wholesale and retail trades, and accommodation and food services sectors (29%)’ in 2020. Independent Innovation in Hong Kong is less prevalent. The number of patent applications by Hong Kong residents was only 329 in 2020 (Ho, 2021), and the number of non-resident patent applications was 20,973 in 2020.

The ‘Research on Digital Transformation in Hong Kong Business Sector’ conducted by HKPC (2019) discovered that more than 70% of respondents expected that ‘digital transformation could save costs and improve business processes, solving issues like a rigid internal approval process, lack of systematic management in the work process, and non-interoperability of internal data'.

Hong Kong is dedicated to transform into a global I&T hub and has invested a record-breaking amount of HK$150 billion towards this goal. It is worth noting that a majority of these funds had been steered towards infrastructure building including the HSITP, expansion of HKSTP and new Cyberport 5. However, there were still a significant amount allocated to various new initiatives such as the InnoHK and RAISE+ programme. In a short period, there have been vast improvements in the I&T ecosystem, which has led to Hong Kong becoming home to more than ten unicorns, an increase in I&T employees from around 35,500 to approximately 45,300, and venture capital investment growing from around HK$1.2 billion to about HK$40 billion between 2014 to 2021. Additionally, Hong Kong is now the largest biotech fundraising hub in Asia and the second-largest worldwide. The Hong Kong I&T Development Blueprint was also released by the HKSAR Government this year to further strengthen the I&T strategy. Therefore, it is commonly believed that the future looks bright for Hong Kong's I&T development.

1.5 Challenges of Open Innovation of SME in Hong Kong

SMEs play a critical role in the economy of Hong Kong. In the sharing economy and knowledge era, OI has become an important management strategy for SMEs to adopt so they can remain competitive. OI can help SMEs solve problems related to managerial and technical skills and knowledge accumulation, as they can leverage external resources to achieve their own innovation initiatives. The Hong Kong government defines SMEs by the number of employees: manufacturing firms with fewer than 100 employees and non-manufacturing firms with fewer than 50 employees are classified as SMEs. As of March 2021, there are over 340,000 SMEs in Hong Kong, accounting for over 98% of all business establishments. These SMEs provide about 45% of the total employment in Hong Kong, excluding civil service employees (Hong Kong Trade and Industry Department, 2023). Today, the majority of SMEs are engaged in import/export trade and wholesale trade, followed by professional and business services, retail trade, and social and personal services; together, these sectors account for 72% of SMEs in Hong Kong and 69% of SME employment (Hong Kong Trade and Industry Department, 2023). Most SMEs in Hong Kong are sole proprietorships, partnerships, family businesses, and private companies, and their management structures are usually highly personalised and centralised (Lau, 2007).

Despite its critical role, SMEs in Hong Kong often face several challenges in adopting OI practices. These challenges include small scale, cash flow issues, insufficient momentum, clear-cut boundaries between universities and industry, talent attraction and retainment, digitisation, and economic downturn.

1.5.1 Small scale

The small scale of operations poses a threat to the OI of SMEs in Hong Kong because OI often involves significant investments of time, resources, and money. Limited resources may result in cash flow issues that can prevent SMEs from investing in R&D, acquiring new technology, or hiring qualified personnel. Additionally, SMEs have a relatively weak ability to prevent and control market economic risks due to their size. OI frequently involves sharing resources and knowledge, leading to increased expenditures and risks that SMEs may not have the financial capability to bear.

As a result, SMEs may be deterred from engaging in OI, resulting in missed opportunities to participate in challenging and meaningful projects. Besides, concerns about customer acquisition within Hong Kong are also brewing. In 2022, the number of Hong Kong SMEs with overseas representation declined from 37% to 29% in the previous year. However, almost half (47%) of SMEs intend to raise their overseas profile over the next one to two years, creating a need for partnerships.

Technological innovation can help SMEs to overcome challenges related to small scales and effectively control production and operation costs in a competitive market environment. By enhancing their core competitiveness through technological innovation, SMEs can enter a more efficient and stable state of competitive resource sharing. Studies suggest that adopting technological innovation can benefit SMEs in Hong Kong and help them thrive in the marketplace.

1.5.2 Cash flow issues

Cash flow issues represent a significant threat to OI for SMEs in Hong Kong. Survey results showed that cash flow (30%) was one of the greatest challenges facing SMEs in Hong Kong, with rising overheads or costs (36%) topping the list (Country/Territory Report - Hong Kong SAR, 2023). In 2017, 43% of respondents identified cash flow as the most problematic area in terms of cash flow management, compared to 47% this year. Hong Kong SMEs had the second-longest average waiting period to receive payment from customers as of 2019, with an average wait of 34 days — an improvement over the 41-day wait reported in 2017. However, cash flow problems are expected to remain the biggest challenge facing Hong Kong’s SMEs for the near future, compounded by increasing pressure from a lack of demand.

OI involves collaborating with external partners, such as other businesses, academia, or research institutions, to develop new products, services, and processes. However, SMEs in Hong Kong may struggle to allocate the necessary funds for these projects due to cash flow issues, which can affect their ability to invest in R&D, acquire new technology, or hire qualified personnel. Moreover, OI frequently involves sharing resources and knowledge, leading to increased expenditures and risks. As such, SMEs in Hong Kong may not have the financial capability to mitigate these risks or bear the associated costs, including licensing fees, legal expenses, or training costs. This can deter SMEs from engaging in OI or limit their potential to participate in challenging and meaningful projects. Despite improved government support, cash flow remained one of the key challenges for Hong Kong's SMEs, with 38% of SMEs calling for further support from the government to increase funding available to them. Out of all cash flow problems, Hong Kong SMEs said they struggled the most with the timely collection of payments from customers.

1.5.3 Insufficient momentum

Due to high land costs and a volatile business environment dependent on external economies in Hong Kong, the business sector tends to focus on projects that offer the highest returns in the shortest time possible. As a result, there are limited incentives for the business sector to invest in technology-related ventures, especially those that require significant investments to establish R&D production bases with long payback periods. This slow pace of innovation commercialisation may discourage R&D teams from realising the full potential of their outcomes. Yu's (2000) summary of the innovation characteristics of Hong Kong SMEs indicates that these firms are capable of producing ordinary discoveries and adaptive innovations rather than exploratory and transformative innovations (Fitzgerald & Rowley, 2013). Hong Kong SMEs have survived through guerrilla business strategies, rapid incremental innovation by imitation and adaptation, and regional arbitrage strategies, which is why they may struggle to produce anything beyond ordinary discoveries.

1.5.4 The clear-cut boundaries between universities and industry

The clear boundary between universities and industry can be detrimental to the OI of SMEs in Hong Kong as it can limit access to important knowledge, technologies, and resources needed for innovation. While university-industry collaboration is officially encouraged, many universities in Hong Kong traditionally focus on basic research while businesses focus on commercialisation, creating minimal opportunities for collaboration. This model, however, may not be suitable for SMEs as they often lack the resources to conduct R&D or acquire new technology. OI, or collaboration between universities and industry, can help SMEs access the latest knowledge and resources from academia and industry partners and accelerate the commercialisation process. By taking advantage of the expertise and facilities of academic institutions, SMEs can develop new products, services, or processes.

However, the clear boundary between universities and industry can hinder OI as it often leads to silos and restricts knowledge sharing between the two sectors. Universities that possess an assortment of upstream R&D inventions and core technologies may face challenges due to inflexible management regimes that hinder effective IP management and staff engagement in external industry-based I&T activities. They may also be hesitant to collaborate with SMEs due to concerns over intellectual property rights (IPR) or fear of commercialising research too early, resulting in lost opportunities for SMEs. SMEs may also face challenges in forming partnerships with universities due to a lack of networks or difficulty navigating the bureaucracy involved in collaborations. For instance, Lam et al. (2013) found that most Hong Kong

SMEs are eager to collaborate with universities in environmental innovation for a competitive edge. However, policy and institutional constraints create significant barriers, such as the unavailability of competent external partners to provide necessary knowledge and technologies, fear of disclosing intellectual property, and resistance to integrating external knowledge with existing ideas and technologies. Other barriers were identified but less common, including the absence of corporate policies to incorporate external ideas, the lack of manpower to oversee collaboration, the lack of government support, and the difficulty in integrating external knowledge.

1.5.5 Talent attraction and retainment

Hong Kong is a small, externally-oriented economy with high talent mobility and strong international connectivity. However, due to its lack of diversified economic and industry structure, many local graduates have preferred joining major traditional industries – including finance, trading, logistics, tourism, and real estate – instead of pursuing a career in scientific research and the I&T sector. Additionally, Hong Kong's technology industry lacks mature clusters, further dissuading young talent from pursuing careers in related fields. The government has also been criticised for lacking proactive policies to incentivise I&T talent to stay and work in Hong Kong. As a result, many local science and technology graduates choose to pursue career opportunities elsewhere. Moreover, Hong Kong has a high cost of living, particularly when it comes to housing rentals, which have been cited as one of the most expensive in the world for expatriates. This factor further undermines Hong Kong's competitiveness in attracting both mainland and overseas technology talent to live and work in the region. These structural issues highlight the importance of OI for Hong Kong SMEs to gain access to resources and knowledge needed for growth and development.

Another aspect related to talent is that SMEs often lack the talents in understanding technology and technology development. This crippled their ability to identify the right partner for OI and managing the partnership relationship.

1.5.6 Digitisation

Digitalisation can pose a challenge to SMEs engaging in OI in Hong Kong for several reasons. On a positive note, digitisation can help companies better manage, produce and sell their products and services. For example, SMEs can use big data analytics to optimise operations, reduce costs and improve efficiency. In terms of sales, SMEs can use digital platforms to expand their markets and customer base. In other words, the use of technology can help companies better adapt to the market and improve their competitiveness (Gassmann, 2006). Nevertheless, digitalisation presents new obstacles that smaller firms must overcome. One reason is the competition from multinational corporations, which can easily enter new markets and compete with local SMEs due to their resources for R&D. This puts SMEs at a disadvantage when trying to keep up with technological advancements. Another factor is the cost of technology, which can hinder SMEs' ability to invest in expensive digital tools and collaborate with other firms that have access to them. Finally, there may be a skills gap between SMEs and more advanced firms, making it difficult to leverage digital technologies for OI activities and collaborate effectively fully. In the Hong Kong context, several studies (e.g. Xu & Yu, 2013) have pointed out that Hong Kong SMEs face many technological challenges. First, SMEs often lack sufficient capital to invest in technology. Second, since SMEs usually do not have a dedicated technology team, they may not have sufficient technical knowledge to choose the right technologies and tools. Finally, SMEs may not know how to make the best use of technology in order to get the most out of it.

To combat the challenges posed by digitalisation and improve productivity and competitiveness, several studies have suggested strategies that SMEs in Hong Kong can apply. One such strategy is to choose the right technologies and tools and leverage digital platforms and big data analytics. According to Loon and Chik (2019), third-party technologies can enhance SMEs' technology portfolios as these enterprises adhere to worldwide standards, benefiting from network externalities and other positive spillover effects. Therefore, the authors suggested that Hong Kong SMEs should focus on improving management efficiency and innovation by incorporating marketing and consumer insight into their product development and technology management procedures. This approach ensures the generation of circular, incremental innovation, leading to improved productivity and competitiveness.

1.5.7 Economic downturn

The global economic downturns can be challenging for SMEs in Hong Kong engaging in OI because they can cause a lack of funding for innovation activities, a reduced willingness to collaborate and share knowledge, a decline in demand, limited access to talent, and regulatory constraints. According to a survey (Country/Territory Report - Hong Kong SAR, 2023), the three economic conditions most likely to deteriorate the situation Hong Kong SMEs face are deteriorating investor and consumer confidence, rising global inflation, and decreased demand from Hong Kong customers. Additionally, these SMEs expressed worries regarding customer retention and acquisition (37%) and increasing business costs (34%). During economic downturns, investors become more risk-averse, which limits the financial resources available for SMEs to invest in OI activities and partner with other firms. This can also lead to a lack of trust amongst stakeholders, making firms more protective of their intellectual property and less willing to share information. Additionally, during economic downturns, consumer demand for goods and services may decrease, reducing the incentives for firms to invest in innovation. The decline in the availability of skilled workers due to job losses can also limit the pool of talent available for OI activities. Lastly, governments may introduce stricter regulations aimed at protecting domestic industries, limiting opportunities for SMEs to engage in cross-border OI activities.

1.6 Drivers and Barriers for Open Innovation in Hong Kong

1.6.1 Drivers for Open Innovation in Hong Kong

Government support for I&T, and a growing interest in entrepreneurship are two most crucial drivers that promote OI in Hong Kong.

(1) Government support for innovation and technology

The Government support for I&T in Hong Kong has been a crucial factor driving OI. The 'innovation-driven development' strategy is a prime example of how the Government encourages companies to participate in OI. The Central Government recognises the importance of innovation-driven development and is committed to investing in science, technology, and education to achieve its long-term goals. By fostering an ecosystem that encourages innovation, entrepreneurship, and collaboration between industries, universities, and research institutes, China hopes to continue its leadership in technological innovation and achieve its vision of becoming a modern socialist country in all respects.

The 'Two-sessions' of China in 2021 marked a significant turning point for the country's technological innovation agenda. During this event, the 14th FYP was announced, which prioritised ‘OI’ and ‘Independent Innovation’ as the major driving forces for achieving sustainable economic development in China (Xinhua, 2022).

In the Government Work Report (2022), delivered by Premier Li Keqiang, in March 2022, the term ‘innovation’ was mentioned 24 times. The report emphasised that the innovation capacity of China was strengthened and the accelerated ‘integration of digital technology in the real economy’. The report highlighted that the Central Government would pursue an innovation-driven development strategy and adopt more reform and Innovation to push market dynamism and social creativity in 2022. The Central Government aims to carry out an innovation-driven development strategy to strengthen the foundation and base of the real economy. Therefore, the Central Government will provide incentives and policy measures to support enterprise’s innovation initiatives. From the Government work report, we can understand the importance of scientific and technological innovation as a Central Government strategy.

During the 20th National Congress of the Communist Party of China (CPC) held in 2022, President Xi Jinping emphasised the critical importance of education, science and technology, and human resources as the foundational and strategic pillars for building a modern socialist country in all respects (Xi, 2022). In China, science and technology are considered the primary productive force, while talent is the primary resource, and innovation is the primary driver of growth. To achieve its long-term goals, the Central Government recognises the critical role of investing in science and education, workforce development, and innovation-driven development.

The 20th CPC’s National Congress report stated that innovation will remain at the heart of China’s modernisation drive. The Central Government aims to boost its strength in strategic science and technology and improve the allocation of innovation resources. To achieve this, the roles of national research institutes, research levels of universities, and the layout of high-tech enterprises will be improved to enhance the overall performance of the national innovation system in China. The Central Government also plans to expand exchanges in science and technology and collaborate with different countries, creating an internationalised environment for research and a competitive innovation ecosystem in the global market.

China targets better self-reliance and strength in its development of science and technology. The Central Government plans to promote closer enterprise-led collaboration between industries, universities, and research institutes, emphasising goal-oriented innovation and promoting the industrial application of scientific and technological advances. The role of enterprises in innovation will be enhanced to create a balanced and healthy ecosystem that supports the presence and healthy growth of micro, small, and medium technology companies, as well as the integration of innovation, industries, capital, and talents.

The GBA initiative is another example of encouraging companies to participate in OI. The GBA ranks second among the top science and technology clusters globally, providing an ideal environment for research, product development, and advanced manufacturing. The GBA's cities' complementarity provides an enabling platform for Hong Kong to integrate further into the country's overall I&T development.

Furthermore, with strong capabilities in R&D and originality, Hong Kong possesses the necessary abilities for breakthrough innovation. The Research Assessment Exercise 2020 conducted by the University Grants Committee demonstrated that over 70% of local universities' research projects are internationally excellent or above. In particular, 25% of these are world-leading, highlighting the remarkable achievements in scientific research. With five world top-100 universities, Hong Kong has one of the highest concentrations of quality universities globally, surpassing major metropolises such as London, New York, and Tokyo.

Additionally, Hong Kong's scientific research standards have received significant international recognition, thanks to the many world-renowned scholars and experts who have delivered revolutionary R&D outcomes in their respective fields. Hong Kong's I&T talent internationalisation is also exceptional, with three local universities ranking among the top ten most international universities globally. This, coupled with the accumulated international experiences and established reputation and networks, enables Hong Kong to attract both local and overseas talent and become a hub for international I&T collaboration and exchange.

(2) A growing interest in entrepreneurship

Hong Kong has been witnessing a growing trend in entrepreneurship, being ranked as the world's second-most entrepreneurial economy (Global Entrepreneurship Index, 2021). This can be attributed to various factors, such as a favourable business environment, the Government's concerted efforts to promote I&T and the increasing availability of resources and support networks for entrepreneurs. The Government has launched several initiatives to bolster an innovation-driven economy, which has led to a surge in entrepreneurship activities. These include funding schemes, startup support programs, financial assistance and mentorship opportunities that encourage aspiring entrepreneurs to take the leap into entrepreneurship. Furthermore, Hong Kong's strategic location, established business infrastructure, and close proximity to mainland China's vast market make it an attractive destination for startups and entrepreneurs looking to leverage these advantages. According to InvestHK (n.d.), there were nearly

4,000 startups in Hong Kong as of 2022, with the majority of them operating in the fintech, e-commerce, and logistics sectors. There are now many unicorn startups in Hong Kong, such as Lalamove, WeLab, and SenseTime.

Entrepreneurship fuels OI in Hong Kong by fostering collaboration between individuals and organisations across different industries. With a thriving ecosystem of startups, entrepreneurs, and investors, there is immense potential for knowledge exchange, creative problem-solving, and experimentation, leading to innovative solutions and products. Moreover, the culture of entrepreneurship encourages risk-taking and experimentation, thereby creating an environment that is conducive to OI.

1.6.2 Barriers for Open Innovation in Hong Kong

However, there are also a few barriers to OI in Hong Kong, including a lack of communication and trust between stakeholders, limited funding opportunities and risk-averse investors, and cultural challenges related to the traditional business practices that place a strong emphasis on confidentiality and intellectual property protection.

OI in Hong Kong faces barriers due to a lack of communication and trust between stakeholders. This can result in fewer opportunities for collaboration, hindering knowledge-sharing among companies and stakeholders in the ecosystem. A survey conducted by the Hong Kong Science and Technology Parks Corporation revealed that over half of the startups surveyed felt there were insufficient opportunities for collaboration. Moreover, the HKPC’s (2019) report identified a shortage of networking events and platforms as a barrier to OI. Without clear communication channels, sharing ideas effectively or establishing fruitful partnerships can be difficult, further impeding the progress of OI.

Limited funding opportunities and risk-averse investors also present a significant challenge to OI in Hong Kong. A report by the Hong Kong Venture Capital and Private Equity Association revealed that recent startup funding levels have remained relatively stagnant compared to other regions like Singapore and Mainland China. As a result, projects that receive funding are limited in number, reducing the scope for OI. This could lead to established companies or technologies receiving more support, making it even harder for startups and entrepreneurs to secure funding and gain traction.

Apart from communication and funding challenges, cultural factors also play a significant role in hindering OI in Hong Kong. The local business culture places great importance on confidentiality and intellectual property protection, which makes it challenging to collaborate openly and share knowledge freely. While these measures are necessary for safeguarding proprietary information, they can limit the scope of OI. Furthermore, traditional attitudes towards hierarchy and authority can prevent employees from questioning established practices and challenging the status quo, potentially reducing the likelihood of OI.

Another significant barrier to OI in Hong Kong is the limited availability of land due to tight land supply and lengthy processes for land development. Land supply has been a critical issue for many years, and with the need to balance various social needs, especially housing needs, there has been limited land designated for I&T purposes. The process of land development involves multiple statutory and administrative procedures, which can take a relatively long time to complete, further reducing the available land for I&T purposes.

As a result, the limited supply of land in Hong Kong may not be able to meet the rising demands arising from I&T development. This lack of available land can restrict the growth of I&T-related companies, limiting opportunities for collaboration and hindering the progress of OI in Hong Kong

1.7 This Study

1.7.1 Research Problem

OI is a well-explored topic in strategic management (Sivam et al., 2019; Subtil de Oliveira et al., 2018; Zhang et al., 2018). The spirit of OI is also well-aligned with the recent call for 'new quality productive forces' (新質生產力) in China, which refers to 'the huge innovation-led increases in productivity, quality and efficiency' (Li, 2024). However, most of the earlier literature on OI focus more on large enterprises rather than SMEs, which are suggested to have distinct challenges in participating in OI (Brunswicker & Vanhaverbeke, 2015; Wynarczyk et al., 2013). These challenges are often attributed to SMEs' insufficient resources for innovation (see review by Oduro et al., 2021), yet the reasons are still understudied. In this thesis, I will focus on Hong Kong SMEs' adoption of OI, including how they incorporate the OI strategy and which 'players' would be involved in the adoption of OI. Players of OI also refer to network partners (Brunswicker & Vanhaverbeke, 2015; Lopes & de Carvalho, 2018).

There are more than 340,000 SMEs in Hong Kong which account for 98% of business establishments in Hong Kong and 45% workforce in the private sector, supporting the profitable growth of Hong Kong in the past 100 years (TID, 2021). It is essential for SMEs to adopt OI strategies to stay competitive in the rapidly changing business environment and in the digital transformation age. As SMEs often have limited resources, low employee incentives, and a lack of understanding of the idea-generation process, by leveraging external resources, they can acquire new or missing knowledge and achieve their innovation goals and enhance their competitiveness in the market (Vrgovic et al., 2012).

The research problem stems from three significant gaps identified in the existing knowledge related to the OI ecosystem of SMEs in Hong Kong (See Section 2.8). The first research gap pertains to the scarcity of studies focusing on the OI system within small, service industry-based systems, specifically in the context of Hong Kong. Existing literature predominantly overlooks the nuances and dynamics of OI within this particular sector in the region. Meanwhile, there are only very few studies about OI of SMEs in Hong Kong regarding the implementation and effectiveness of OI strategies in SMEs and the factors that affect their adoption and success.

Noteworthily, among very few studies focusing on OI in Hong Kong, Y. Xu and Yu (2013) examined the Hong Kong SMEs’ adoption of OI the most thoroughly. However, there are still several key issues left unanswered. The extended OI model proposed by Y. Xu and Yu (2013) may have ignored the heterogeneity of enterprises regarding industry, size, industry and sector, ownership and structure, business maturity, innovation orientation, financial resources, management skills and capabilities, market orientation, and internationalisation.

The second research gap highlights a dearth of knowledge concerning the perceptions and insights of managers regarding the various actors and their roles within an OI system. Understanding the perspectives and strategies adopted by managers is crucial for comprehending the functioning and effectiveness of OI initiatives within SMEs.

The third research gap underscores the understudied nature of other key OI actors, such as science parks, business incubators, financial institutions, and media organizations, within the OI ecosystem of SMEs in Hong Kong. These entities play vital roles in fostering innovation and collaboration but have not received adequate scholarly attention in the context of OI among SMEs in the region.

Addressing these gaps through empirical research and theoretical analysis will contribute significantly to broaden our understanding of the OI ecosystem of SMEs in Hong Kong and provide valuable insights for academia, policymakers, and practitioners in the field of innovation management.

1.7.2 Research aims and objectives

The primary aim of this thesis is to investigate the OI ecosystem of SMEs in Hong Kong. This exploration seeks to provide insights into how SMEs in the region engage with OI, the various actors involved, and the factors that influence their participation in OI activities. Understanding these dynamics will contribute to the development of strategies to foster OI adoption and growth among SMEs in Hong Kong.

To achieve this aim, four specific objectives have been outlined.

- 1. To identify the key ‘players’ and their roles in Hong Kong’s OI ecosystem.
- 2. To collect and analyse data on Hong Kong SMEs’ participation in OI activities and their relationships with other players.
- 3. To examine the push and pull factors that encourage SMEs in Hong Kong to engage in OI activities.
- 4. To provide recommendations for establishing a support mesh to facilitate Hong Kong SMEs’ participation in OI activities.

1. First, this study seeks to identify the key ‘players’ in Hong Kong’s OI ecosystem and to understand their respective roles in driving and shaping OI engagement among SMEs.
2. Second, the research will involve the collection and analysis of data on Hong Kong SMEs’ participation in OI activities, as well as their relationships with other actors in the ecosystem. This will provide a comprehensive understanding of how SMEs interact with different stakeholders in the OI landscape. In particular, types of inbound and outbound OI involved will be analysed. Inbound OI means using external resources outside the organisation for internal innovative activities, whereas Outbound OI refers to commercialising internal ideas to the environment. Inbound OI activities include purchasing intellectual property rights and technology procurement, insourcing and outsourcing. Outbound OI activities include technology licensing and intellectual property trading. Moreover, the research will focus on the OI activities involved by Hong Kong SMEs, particularly technology sourcing, horizontal technology collaboration, and vertical technology collaboration.
3. The study will examine the push and pull factors that encourage SMEs in Hong Kong to engage in OI activities, shedding light on the underlying motivations and challenges that influence their involvement.
4. Based on these insights, recommendations will be provided for establishing a support mesh that facilitates Hong Kong SMEs’ participation in OI activities. Ultimately, this thesis aims to contribute to the development and growth of a vibrant OI ecosystem for SMEs in Hong Kong.

1.7.3 Research Questions

The research questions are as follows:

1. What kind of ‘players’ can be found in Hong Kong’s OI process? (e.g. government, universities, financial institutions, agencies, media and SMEs)

2. What is the relationship between SMEs and each of the other players?

3. What kinds of inbound and outbound OI activities are between SMEs and other players?

4. What are the roles of each actor in facilitating (or prohibiting) OI activities in Hong Kong?

5. Why SMEs would/would not involve OI activities with their counterparts (i.e. Government, universities, financial institutions, agencies and media)

6. What kind of support is offered by the government, universities, financial institutions, agencies and media to SMEs and vice versa?

Notably, for simplicity, government refers to government departments and government organisations. Government organisations would include government-funded research institutions (i.e. Hong Kong Applied Science and Technology Research Institute), technology parks such as HKSTP, Cyberport) and related statutory bodies such as HKPC and Airport Authority. Universities are those tertiary education institutions that provide undergraduate or above courses. Financial institutions refer to private organisations or bodies such as banks, angel investors, and venture capital companies giving financial support to SMEs. Agencies mean incubators, accelerators and financial advisors for SMEs. Finally, media are online or offline media that provide publicity for SMEs.

1.8 Overall Structure of the Thesis

The thesis is divided into six chapters, each addressing different aspects of OI in SMEs in Hong Kong. Chapter 1 provides an introduction to the study by briefly discussing the history and overview of OI research, as well as OI in Hong Kong. This chapter also highlights the challenges, drivers, and barriers for OI in Hong Kong and introduces the research problem, aims, objectives, and questions that this study aims to address.

Chapter 2 presents a literature review on OI, covering definitions, related theories, challenges, impact, and the quadruple helix model of OI, with a focus on OI and SMEs. This chapter also identifies the research gaps in the existing literature and lays the foundation for the research methodology.

Chapter 3 explains the research methodology employed in this study, including the research development and quantitative and qualitative research methods. This chapter also outlines the sampling methods, data collection, and analysis techniques used in the research.

Chapter 4 presents the results of the quantitative data analysis, including the adoption of OI among SMEs, reasons for adopting or not adopting OI, types of OI SMEs are involved in, and other relevant observations.

Chapter 5 provides a similar analysis of the qualitative data and discusses the drivers and barriers for OI, the role of various organisations, inter-organisational relationships, and the development of the I&T industry in Hong Kong.

Finally, Chapter 6 is dedicated to triangulating the quantitative and qualitative research results and discussing their implications, drawing conclusions from the research. This chapter also concludes the thesis by offering recommendations for OI and SMEs and discusses future research directions and outlines limitations of the study.

CHAPTER II
LITERATURE REVIEW

The concept of OI has gained significant attention in recent years as a strategic approach for organizations to enhance their innovation capabilities. This chapter aims to provide a comprehensive literature review on OI, exploring its definitions, related theories, challenges, impact, and its specific implications for SMEs. Additionally, this chapter delves into the significance of university-industry collaboration and the evolving concept of the Triple/Quadruple Helix model in the context of OI. Finally, the chapter concludes with an identification of the research gap.

2.1 Definitions and Related Theories about Open Innovation

2.1.1 Definition of Open Innovation

The original definition of OI emphasized the significance of both internal and external sources of valuable ideas, as well as internal and external paths to market. According to Chesbrough (2003), “Valuable ideas can come from inside or outside the company and can go to market from inside or outside the company as well. This approach places external ideas and external paths to market on the same level of importance as that reserved for internal ideas and paths” (p. 43).

Over time, both innovation scholars and Chesbrough himself have refined the original definition of OI. Chesbrough (2006a) highlighted the deliberate nature of knowledge inflows and outflows in his revised definition, stating that “Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation, respectively” (p. 1).

Building upon the concept of business models, Chesbrough and Bogers (2014) further developed the definition of OI. They proposed that OI is a distributed innovation process that involves purposeful management of knowledge flows across organizational boundaries. These flows utilize pecuniary and non-pecuniary mechanisms in alignment with the organization’s business model. They defined “open innovation as a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization’s business model” (p. 17).

By incorporating these modifications, the definition of OI has evolved to encompass intentional knowledge exchange and collaboration within and beyond organizational boundaries, with a focus on leveraging various mechanisms and business models to drive innovation.

There is growing agreement that each of the three innovation processes - knowledge discovery, retention, and usage - may occur both inside and outside the organization (e.g., Lichtenthaler & Lichtenthaler, 2009). Researchers (e.g., Chesbrough, 2006) defined “inbound OI” as the internal application of external information, whereas “outbound OI” refered to the exterior application of internal knowledge. According to empirical research, businesses tend to do more inbound activity than outbound actions (e.g., Huizingh, 2011). Several studies have identified a variety of plausible causes for the external exploitation of internal information, including historical issues, the probability of leveraging existing ties, and the concern over dispersing related knowledge (Dahlander & Gann, 2010; Kline, 2003).

Outbound OI, albeit less common than inbound OI, has been gaining traction since 2010 (Chesbrough & Brunswicker, 2014; Hu *et al.*, 2015; Kutvonen, 2011; Lichtenthaler, 2015). Companies endeavor to explore external knowledge to achieve their financial and strategic objectives (Kutvonen, 2011). Companies can boost their income streams by selling or licensing their technology to others and using their own knowledge (Hu et al., 2015; Lichtenthaler, 2015). In this sense, powerful grant procedures can frequently enhance outbound OI (Dahlander & Gann, 2010; West, 2006). Firms participate in outbound OI to achieve a number of strategic goals in addition to producing income. These include growing product and service markets, gaining complementary expertise through cross-licensing agreements, and developing new industry standards, among other things (Kim et al., 2021; Lee & Kim, 2019).

2.1.2 Theories of Open Innovation

(1) Resource-based theories (RBT)

The resource-oriented perspective was first put forward by Wernerfelt (1984) in *The Resource-Based Theory of the Firm*, in which he argued that a company is a collection of multiple resources. For various reasons, the resources possessed by a firm are heterogeneous, which determine the differences in its competitiveness.

Before the late 1950s, management research viewed the organization as a closed, self-contained entity. Contrary to old-school thinking, RBT is founded on the assumption that organizations are immersed in their environment and reliant on external resources to function and thrive. The environment of an organization encompasses all of the structures, actors, and events that impact the organization's reliance on external resources. Thus, RBT considered companies to be open systems (Hatch, 2018). The open systems approach emphasizds the relational nature of the organization (Scott & Davis, 2015): the resources obtained from or supplied to the external environment are critical to the system's operation.

The environment of an organization provides access to resources. “Raw materials, employees, capital, facilities, and equipment” are examples of tangible resources (Barney, 1991, p. 101). Suppliers, customers, rivals, unions, regulatory bodies, and interest groups can all be exchanging partners. In addition, many other resources, such as trust, gratitude, and personal commitment, are intangible (Blau, 2017). According to social exchange theory, the steady development of mutual support is followed by a corresponding increase in these intangible resources (Uehara, 1990).

Moreover, social exchange theory emphasizes “respect, reputation, and especially status in interpersonal and inter-organizational relations” (Blau, 2017, p. 5; Emerson, 1962). With institutionalist and constructivist ideas becoming part of RBT, organizational scholars re-examined how intangible resources play a role in relationships between organizations (Barney, 1991; Hatch, 2018; Podolny, 1993). Recent studies emphasized that interactions between organizations generate power of various types (Gentile-Lüdecke et al., 2020; Ma et al., 2013; Yun & Liu, 2019). They stressed that through partnership, organizations can obtain legitimacy, an important resource for their development (Drees & Heugens, 2013; Ma et al., 2013). In this context, it is important to distinguish between tangible and intangible resources, given that their exchange may cause organizations various consequences. Generally, exchanging tangible resources is often beneficial for both sides, while exchanging intangible ones – for example, the exchange of trust or legitimacy – is usually a zero-sum game. This is because this exchange of intangibles may involve more perceived risks and uncertainties, causing potential losses for one participant (Cook et al., 2013).

According to RBT, organizations can alter their resource reliance by modifying the environment. They are thought to have a great deal of freedom and discretion

(Aldrich & Pfeffer, 1976). However, the uncertainty of environmental demands in this theoretical perspective is a critical constraint to organizations' survival and development and has generated many discussions. This is because organizations never have full control over their surroundings and the resulting circumstances required for their own efficiency and existence (Biermann, 2008; Biermann & Harsch, 2017). RBT is concerned with how organizations address and possibly overcome external constraints. Moreover, the organization's dependence on external resources risks its autonomy (Harsch, 2015; Sherer et al., 2019). As a result, much effort is expended on the strategic management of resource dependence.

Nevertheless, critics argue that RBT overlooks the operational environment, networks, and inter-organizational power dynamics. RBT is essentially a functionalist theory of rational agents who follow utility-maximizing calculus. The theory focuses on the material circumstances while disregarding environmental demands in relation to values and norms inside the societal context of the organizations. Additionally, critics contended that RBT minimizes the role of macrostructure (Granovetter, 1985). RBT viewed organizations as "shapers of their own destiny" (Katila et al., 2008, p. 326). According to the theory, companies actively control and modify their surroundings in addition to adapting to external restrictions. But for most organizations, that is a bit of an overstatement (Huxham & Beech, 2008).

A firm's operation is often based on a certain level of resources and a certain degree or level of R&D investment. Generally, large enterprises have more allocatable resources and have independent R&D departments, so they can make use of their own assets to carry out R&D and realize their competitive strategic advantages – in brief, they have the advantage of independent innovation R&D. In comparison, in the process of OI, SMEs have to use external resources because their resource base is relatively weak and they tend to be influenced by market fluctuations, especially given the high transaction cost related to information asymmetry and resource deficit that they are facing. In the process of resource allocation, any firm will have to consider the impact of transaction costs in participating in OI in the forms of market purchase, cooperative R&D, or independent R&D investment.

(2) Valley of Death

The concept of "Valley of Death" (VoD) (Roberts et al., 2012) originates from the field of translational medicine, referring to the disparity between bench research and clinical application. Despite intriguing observations and innovative scientific discoveries, most basic scientific findings fail to progress to therapeutic development, either due to their lack of relevance to human diseases or insufficient funding, incentives, and technical expertise. These potentially crucial discoveries encounter a widening gap in funding and support required to advance basic science findings towards therapeutic development. This phenomenon, commonly referred to as the "translational gap", has been widely recognized as the VoD (Roberts et al., 2012).

Subsequently, this concept has been extended to the broader business literature. The VoD represents the stage at which a business, often technology-oriented, possesses a functional prototype for a product or service that has yet to be sufficiently developed to generate revenue through commercial sales. In order to bring the prototype to a level where it can generate enough income to sustain and expand the company, additional funding is needed.

This problem arises because companies typically evaluate the potential benefits of innovation against investment risks when deciding whether to invest. Challenges emerge particularly during the stage of deciding whether to commercialize an innovation, as the risks associated with this stage are higher than in other stages of the innovation process. Firstly, the transition from producing a limited series of test products to manufacturing commercial volumes necessitates significant investment. Secondly, this risk coincides with the stage in the innovation process when public support often ceases, creating a risk profile known as VoD for innovations.

The journey from a discovery arising from basic research to a commercial product or process is lengthy and, according to some, fraught with significant obstacles. Innovators and investors frequently argue that a “funding gap” or VoD exists during an intermediate stage of this process, between basic research and the commercialization of a new product. The absence of financing specifically available for this intermediate stage may significantly impact the productivity of government-supported R&D efforts. Without access to intermediate-stage funding, individuals and firms may struggle to transform a new innovation or discovery into a commercial product, resulting in a diminished return on early-stage R&D investment by society (Mcintyre, 2014).

Much of the literature has discussed possible solutions to VoD. According to the majority of scholars, securing adequate funding for operations and commercialization is crucial for startups to successfully transition to VoD (Gbadegeshin et al., 2022). It is widely acknowledged that businesses require additional funds to support their activities. Within this context, several scholars have proposed specific sources of funding for startups. For instance, Hossain et al. (2014) and Zhou et al. (2015) recommend that startups seek support from business angels, venture capitalists, and government grants during the pre-commercialization stages to overcome financial obstacles. Other scholars have suggested utilizing government subsidies to navigate the challenges associated with VoD (e.g., Collins et al., 2016).

Conversely, scholars including Maulina et al. (2020) and Ibata-Arens (2009) propose early commercialization of technologies as a means to mitigate the impact of VoD on startups. These scholars argued that the commercial value of any new innovation should be identified and discussed at the preliminary stages of the research process. They also asserted that academia should adopt a business-oriented approach to maximize the benefits derived from innovations for society’s betterment. Therefore, new innovations should be problem-solving solutions to provide societal benefits.

Another perspective suggests engaging relevant stakeholders to tackle VoD challenges and facilitate the growth of businesses during this critical transition. Scholars such as Lettner et al. (2020) and Prasad et al. (2016) emphasized the importance of identifying and involving all key stakeholders in new business activities. These stakeholders, as advocated by Wong (2014) and Roberts et al. (2012), should include market opinion leaders, government officials, technology users or beneficiaries, and experts. Similarly, Nemet et al. (2018) and Hartley and Medlock III (2017) recommended that startups should collaborate with academic and research institutes, highlighting the significance of such partnerships.

Another VoD solution for startups is to assemble a qualified team capable of effectively managing the process (Markham, 2002; Zhu et al., 2012). These scholars highlighted the importance of having individuals with relevant expertise and business skills. It is emphasized that a diverse team, consisting of members from different backgrounds with complementary competencies, can provide strength to the business.

In order to navigate the VoD transition, Fujiwara (2008) and Merceret et al. (2013) suggested various management strategies for companies. These strategies include agile learning and decision making, intrusive management, strategic niche management, and technology management.

Another proposed solution to address VoD challenges is to acquire both internal and external knowledge. Kogure et al. (2019) and Midler (2019) recommended that startup teams should proactively seek knowledge about specific technology supply chains. Startups should carefully consider industrial and market information that may impact different aspects of a product's supply chain. Factors such as competition, suppliers, and customer information are crucial for the successful commercialization of new technology in the market.

Furthermore, scholars advocated for government support in creating a favourable business environment and infrastructure. They proposed allocating more funds for innovation commercialization, establishing facilities for entrepreneurial use, providing tax breaks for new and emerging businesses, and offering subsidies for these organizations. Abereijo (2015) and Bandera et al. (2016) emphasized the need for governments to implement policies specifically tailored to entrepreneurship, enabling companies to overcome the challenges of the VoD transition.

(3) The Advanced Manufacturing Research Centre (AMRC) Model

According to the AMRC's group website (AMRC, 2023), The Advanced Manufacturing Research Centre (AMRC) was established by the University of Sheffield in 2001. It was a collaboration of £15 million between the university and aerospace conglomerate Boeing. AMRC is also supported by Yorkshire Forward and the European Regional Development Fund. The University of Sheffield has been a forerunner in metallurgy and engineering research and has a long history of expertise in metalworking and innovation. It closely partners with the industry in developing novel manufacturing techniques and technologies.

The AMRC with Boeing is an outstanding hub for "industry-focused research and development of technologies used in high-value manufacturing sectors" (AMRC, 2023). AMRC group gathers both specialists and expertise in the area of high-tech engineering such as "machining, casting, welding, additive manufacturing, composites, designing for manufacturing, testing and training" (AMRC, 2023). AMRC is reputable for helping companies tackle manufacturing problems. AMRC is a good model to illustrate collaborative research among universities, academics and industry.

The University of Sheffield will provide manpower, capital, and equipment support to the industry through its AMRC Training and Research Centres for the industry grade of the whole industry. In addition, the university will gain equipment and capital support from global industry giants. Small industry suppliers are tenants of AMRC, and they provide technical equipment and support to the global giants with the order and loan support by the bank or financial institutions (Figure 1.1). The AMRC demonstrated the University-Industry-Research-Finance partnership in facilitating OI.

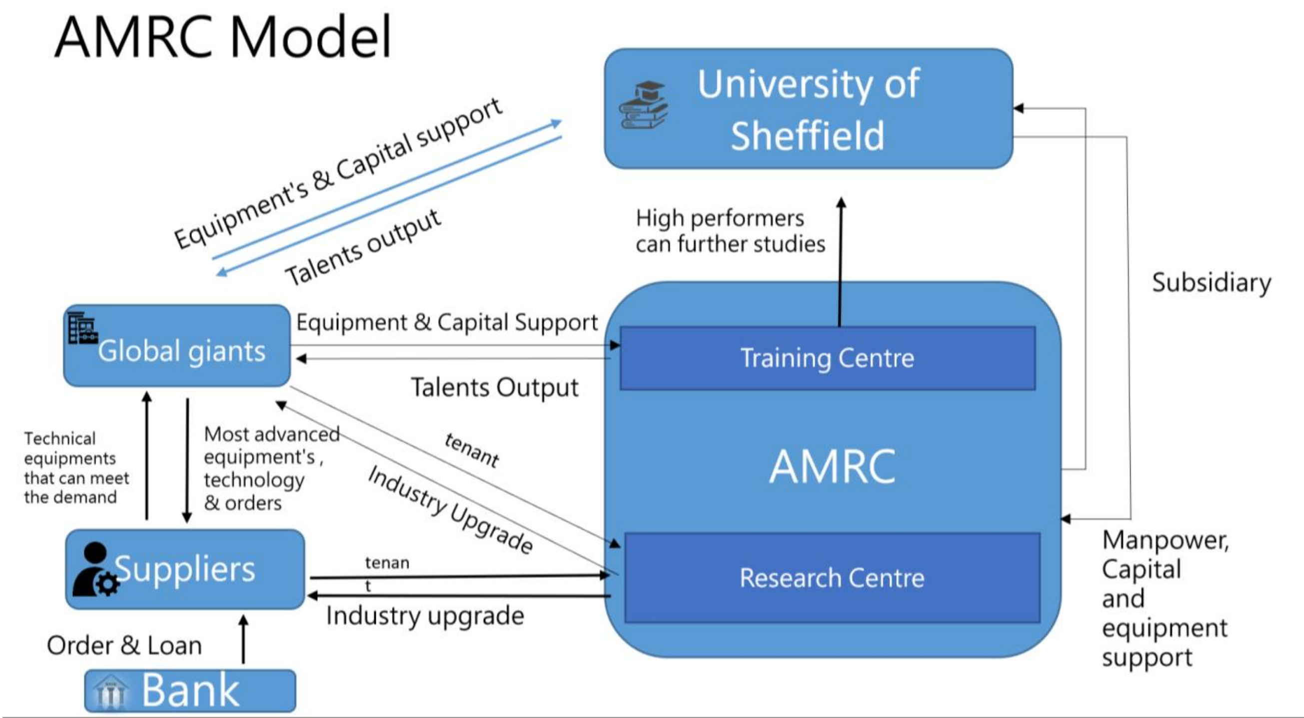

Figure 2.1 The Advanced Manufacturing Research Centre Model of the University of Sheffield (AMRC, 2023)

5. Entrepreneurial Financial Institution

After reviewing different pieces of literature, the role of entrepreneurial financial institutions in the OI model and regional innovation system studies looks inadequate. To enrich the discussion of the OI model with empirical findings, the role of entrepreneurial financial institutions in facilitating OI among university-industry-research institutes in terms of capital and value transfer will be studied in Chapters IV and V of this thesis.

2.2 General Challenges of Open Innovation

According to West and Gallagher (2006), there are three main challenges of OI, including maximizing returns to internal innovation, incorporating external innovations, and motivating spillovers.

Firstly, maximizing returns to internal innovation presents a significant challenge within the context of OI. In order to address this challenge, firms require a diverse set of strategies and approaches that go beyond simply fuelling their product pipeline. The literature emphasized the importance of adopting various methods such as outbound licensing of intellectual property (IP), patent pooling, and even the deliberate giveaway of technology to stimulate demand for complementary products (Zhang & Ji, 2023). A key focus of OI lies in effectively leveraging a firm's internal research and development (R&D) capabilities. This involves utilizing these capabilities for multiple purposes, including generating innovations intended for internal commercialization through a proprietary model, building absorptive capacity to identify external innovations, creating innovations that generate returns via external commercialization (such as licensing patent portfolios), and generating IP that may not directly contribute to economic benefit but indirectly generates returns through spillovers or the sale of related goods and products. Notably, successful firms often employ a combination of these approaches. For instance, Intel has demonstrated success by establishing research labs in close proximity to esteemed university research groups, fostering open information flow between academia and industry. Additionally, they recruit top academic researchers to aid in the commercialization and production of promising innovations. Similarly, the creation of the GSM patent pool by European telephone manufacturers exemplified a cooperative strategy that offers advantages by providing favourable access to intellectual property rights (IPR) associated with the GSM standard, thus positioning European participants ahead of potential Asian competitors (Candelin-Palmqvist et al., 2012; Luoma et al., 2010).

Past research has also found that many organizations failed to reap the benefits desired by their open collaboration programs due to a lack of capacity to detect external expertise and capitalize on chances (Lichtenthaler & Lichtenthaler, 2010). Ziegler et al. (2013) underlined the reasons large enterprises emphasize fostering external knowledge growth, suggesting that this influences their decisions on IP management and organizational structure. Several organizations have built specific organizational structures in response to the numerous obstacles involved with the external development of intellectual assets (Gentile-Lüdecke et al., 2020; Naqshbandi & Kaur, 2013). These organizations seek to expedite the external development of internal ideas and technology by utilizing specialized resources and expertise, as well as arranging commercial deployments for initiatives that lack internal uses (Vanhaverbeke et al., 2008). Furthering this line of literature, Masucci et al. (2020) investigated how a large oil and gas producer's venture arm facilitates the development of innovative technologies. They discovered that two of the five innovations in their research were important to the effective implementation of the proposed technology: they could grow the service provider's portfolio and retain control of the related intellectual property.

Particularly, a group of the study revealed that IPRs are key challenges related to the choice that firms face in whether to engage in OI activities. The concept of OI encourages knowledge and creativity to cross permeable organizational boundaries. However, IPRs are often designed to prevent others from using a company's creativity and inventions (e.g., Candelin-Palmqvist et al., 2012). IPRs are mainly used to avoid unintended knowledge drain and to enable firms to benefit from OI partnerships (e.g., Bogers & West, 2012). As a result, many business managers tend to see the two concepts as contradictory. Ismail et al. (2017) found that university IP management, government policies, and laws are deterrents to the adoption of OI in Malaysia. To protect and derive value from innovation, firms may use both formal (i.e., patents, trademarks, industrial designs, and copyright) and informal (i.e., lead time, first-mover advantage, and lock-in) methods (e.g., Luoma et al., 2010; Zhang & Groen, 2021).

Secondly, incorporating external innovations poses a significant challenge within the realm of OI. For organizations to benefit from external knowledge, it is crucial to first identify relevant innovations and subsequently integrate them into their own innovation activities. This process necessitates activities such as scanning the external environment, developing absorptive capacity, and showcasing the political willingness to embrace external ideas. In order to fully leverage external innovations, organizations must not only identify them but also possess the necessary absorptive capacity to comprehend their implications. Furthermore, they need to combine these external spillovers with their internal innovation efforts to create tailored products that align with their specific needs (Wang et al., 2022).

However, even when external innovations are identified, there are barriers to their incorporation into a firm’s product strategies. Successful firms that have previously excelled in integrated innovation models may develop a belief in the superiority of their own internal ideas over externally sourced concepts. This can lead to a mindset where external ideas are rejected, often accompanied by the sentiment of “not invented here” (Agrawal, 2006). Overcoming this resistance to external innovations requires organizations to recognize the value and potential of external ideas alongside their internal capabilities in order to foster a truly OI ecosystem.

Thirdly, motivating spillovers is a critical aspect of OI, as it determines the sustainability of external sources of innovation. The challenge arises in ensuring that the stream of external innovation remains continuous and that firms are willing to contribute their intellectual property (IP) despite the potential benefits it may offer to competitors. This dilemma is often referred to as the “paradox” of firm investments in open-source software (Brunswicker & Ehrenmann, 2013; Tang et al., 2021). The assumption is that sources of external innovations will continue to produce them; however, if organizations become “free riders” by solely absorbing external innovations, the supply may diminish. Consequently, it is essential to examine incentives for generating knowledge spillovers at both the individual and organizational levels (West & Gallagher, 2006).

Motivating individuals to contribute their IP without immediate financial returns poses a management challenge (Van de Vrande et al., 2009). Expectancy theory offers valuable insights into individual motivation, suggesting that individuals are driven by the attractiveness of rewards and the perceived path to achieving them. In the context of OI, the proprietary innovation model has traditionally addressed this challenge through extrinsic compensation and adherence to scientific norms. On the other hand, the external model relies on intrinsic factors or external entities, such as universities, to provide motivation for creating IP.

Organizational factors for contributing spillovers fall into two categories. First, when an innovation benefits the innovator without reducing any potential gains, sharing such benefits becomes logical. For instance, customers often share their innovations with vendors to improve future products. Second, although spillovers to direct competitors pose greater challenges, they can still be economically rational within the framework of ‘co-opetition’. In industries where firms cooperate in creating markets but compete in dividing them, accepting spillovers that contribute to market growth can be advantageous if the returns from increased market share are enticing enough (Terpend & Krause, 2015).

2.3 The Impact of Open Innovation

Prior literature has explored the impact of OI across various dimensions, including its effects on firm performance, radical innovation, industrial innovation input-output relationships, technological entrepreneurship capabilities, technology intelligence, business models, value creation, innovative behaviours, technology transfer, and policy applications.

The vast majority of the researches have investigated the link between OI and firm performance, particularly how OI affects performance and which aspects of OI contribute to firm performance (e.g., Dahlander & Piezunka, 2014). These studies utilized a variety of indicators to measure the performance of OI, including not only financial benefits (e.g., lower costs) but also non-financial benefits such as less time to market and higher sales, innovation capacity, the volume of innovations, availability of new markets, and improved technological position of the firm (e.g., Fuglsang, 2008; Greco et al., 2019). However, the conclusions reached by researchers are inconsistent. Many publications have identified a positive impact of OI on innovation performance. For example, Tomlinson (2010) showed that vertical partnerships are a critical element in explaining the level of companies’ innovation performance. However, he also emphasized that it is the strength of such relationships, not just their existence, that matters, i.e., stronger dynamic relationships between firms exert a positive and significant influence on the magnitude of innovation. Reed et al. (2012) provided an analysis of how OI provides valuable insights into how it can benefit organizational performance. They explored how community-controlled OI affects competitive advantage based on cost and differentiation and elucidate the way in which it enables some sources of economic rent to be retained whereas others are removed. The authors found that economic rents from property rights disappeared and economic rents from economies of scale and capital requirements were reduced, but economic rents from experience curve effects, differentiation, allocation, and switching costs remain. Similarly, rents from networks and reputation, resources that are difficult to imitate, remained intact, while rents from employee knowledge and culture remained, but they may be reduced in number. That said, the finding that OI implies that firms have the potential to profit from the intellectual property they do not own goes some way to allaying concerns about firms' participation in OI.

However, other studies suggested that too much OI may harm firm performance. For example, Laursen and Salter (2006) used a large sample of industrial firms to link search strategies to innovation performance and found an inverted U-shaped relationship between extensive and intensive search and performance. Similarly, Zhang et al. (2018) focused on Chinese machinery manufacturing and found an inverted U-shaped relationship between OI and firm profitability. That is, firms are able to benefit from OI when they start to engage in it, but this benefit diminishes beyond a certain limit. Zhang et al. (2018) also found that the higher the education level of employees, the greater the positive impact of OI on firm performance, and that the inflection point of the relationship shifted to the right. However, the authors revealed that this relationship did not hold in production-oriented firms. In addition, several studies focused specifically on the costs of OI, that is, the management of the network of experts involved in adopting an OI paradigm. For example, Kim and Park (2010) pointed out that such costs increase with interdependence and relationships.

According to several studies, inbound OI will have numerous good results, such as increased internal R&D, innovation capability, and performance (Chesbrough, 2003; Garriga et al., 2013; Laursen & Salter, 2006). Researchers usually regarded inbound OI as a reflection of the diversity of information, technology, and ideas among major corporate innovation drivers and external partners. According to some studies (e.g., Chesbrough, 2006b), enterprises scan their external environment and/or market and utilize (source) or purchase ideas and technology as needed. Moretti and Biancardi (2020) showed that higher inbound openness improves firm performance, but the impact of development on firm performance is impacted by firm size - development will only improve firm performance if the business is large enough to capitalize on internal R&D outcomes. Some studies (e.g., Christensen et al., 2005) found that, while openness is crucial for a business's external resources, the association differs depending on the sort of firm. Furthermore, several studies (e.g., Huang et al., 2015; Tortoriello, 2015; Von Zedtwitz & Gassmann, 2002) stressed the necessity for enterprises to seek for and analyze the benefits of utilizing external sources. Tortoriello (2015), for example, showed that the influence of knowledge from external sources on an individual's innovation ability varies depending on the person's position in his/her internal social structure using sociometric data collected from academics and engineers in the research and development department of a multinational high-tech enterprise. At the same time, he discovered that these good benefits will be amplified when people's external information across structural gaps in internal knowledge-sharing networks. Based on an investigation of 165 businesses in Taiwan's ICT industry, Huang et al. (2015) showed that the link between R&D expenditure and firm innovation differs between enterprises with varying absorptive capabilities. Furthermore, their findings indicated that R&D autonomy had a negative moderating influence on the connection between absorptive ability and business innovation. Moreover, Wang et al. (2015) discovered that being able to construct well-developed external connection channels led to a bigger contribution of inbound OI to firm performance.

A considerable amount of literature has lately investigated and compared the link between inbound and outbound OI. For example, Tang et al. (2021) investigated the effects of inbound and outbound OI, as well as team role diversity, on the success of open-source software projects. They discovered that a strategy with high outbound OI, high inbound OI, and low team role diversity increases technical performance. Yet, inbound OI tactics are most useful to market performance when there is job diversity in the team. Gentile-Lüdecke et al. (2020) demonstrated the relevance of organizational structure for OI using a cross-sectional study of Chinese SMEs. They discovered that specialization and centralization both enhance the usage of inbound and outbound OI; formalization, on the other hand, is detrimental to outbound openness but can boost incoming OI.

Besides the focus on firm performance, literatures demonstrated that the impact of OI on different aspects such as radical innovation, industrial innovation input-output relationships, technological entrepreneurship capabilities, technology intelligence, business models, value creation, innovative behaviours, technology transfer, and policy applications. For instance, Sanchez-Henriquez and Pavez (2021) found that knowledge sources such as clients, suppliers, competitors, and consultants in OI positively influence eco-innovation performance in firms. Combining client sourcing with supplier and consultant sources further enhances eco-innovation performance. Hejazi et al. (2017) revealed that implementing OI improves technology and economic competitiveness. Meanwhile, the exploitation of “in-out” mechanisms has a greater effect on technology paradigm and linkage dimensions, while the “out-in” mechanism primarily affects learning capabilities. Yun et al. (2020) argued that effective OI policies should consider knowledge and technology production, distribution, and consumption. They developed a causal loop diagram and a system dynamics model to simulate the effects of OI policies on national innovation systems, an example being Cambodia’s national science and technology master plan.

Frank et al. (2022) explored the moderating effects of OI brokers on different innovation input-output relationships. While the broker benefited some relationships, it could hamper others due to the diversity of collaboration partners. Khosropour et al. (2015) aimed to survey the effect of OI on technology intelligence application in Iran’s aviation industry. They found that OI and technology intelligence could be applied exclusively within organizations for technology trend analysis and acquisition. Wu et al. (2022) found that OI through overseas mergers and acquisitions could effectively enhance innovation performance and investment. The positive effects are sustained, with the maximum impact observed in the year of mergers and acquisitions and gradually decreasing over the next two years. The heterogeneous impacts indicated the influence of ownership and technology intensity.

Audretsch and Belitski (2023) addressed the gap in research linking OI strategies to different types of innovation in startups. It demonstrated that startups not only benefit from OI but also the extent of product innovation and the tendency to innovate new processes are significantly influenced by the characteristics of external partners and their geographical locations. Cheng (2022) found that collective openness can significantly enhance innovation performance in Research and Innovation Networks. However, there is an “inverted U-shaped” relationship, suggesting that excessive openness may not always lead to better outcomes. In a study by Pundziene et al. (2023), it was confirmed that OI indirectly influences clinical and economic value through enhancing patient and physician experience. The research also highlighted that the effects of OI vary across different countries, indicating its context-dependency.

2.4 Open Innovation and SMEs

While early studies of OI focused on investigations of large multinational companies (Chesbrough, 2006b), OI processes in SMEs have gradually gained attention in recent years (Albors-Garrigós et al., 2011; Brunswicker & Vanhaverbeke, 2015; Doh & Kim, 2014; Lee et al., 2010).

2.4.1 Enabling SMEs to adopt an Open Innovation approach

Studies showed that just the same as large corporates, SMEs need innovation to survive and thrive. Hilmersson et al. (2023), for example, demonstrated that the higher the rate of innovation, the faster the rate of internationalization of SMEs. According to Lichtenthaler (2008), only closed innovation reduces a firm’s competitiveness in the long term, but proactive openness can lead to substantial strategic advancements. As a result, according to a number of studies (Tranekjer & Knudsen, 2012), managers should aggressively encourage organizations to engage in OI and reap the benefits. Crossing boundaries is required for openness, but there is insufficient evidence on the extent to which an SME should do so. Yet, shifting an SME from a closed to an open approach is difficult, and Lichtenthaler (2008) discovered that the majority of SMEs' innovation models remain in the closed innovation stage. According to research, whether or not SMEs engage in OI is influenced by a variety of factors. Individual human capital endowment and individual and organizational social capital are the key factors of border bridging (Comacchio et al., 2012). According to Grimaldi et al. (2013), SMEs with good perception, comprehension, and configuration capabilities were more likely to create OI techniques. Moreover, emphasizing the benefits of OI to employees through communication management and motivation activities might help overcome the opposition that firms face when implementing OI.

According to researches, a shortage of resources is a double-edged sword for enterprises engaging in OI, operating as both a motivator and a constraint (Livieratos et al., 2022). On the one hand, while OI is critical, SMEs adopt it to a far smaller level than MNCs due to resource restrictions and scale limits (e.g., Lee et al., 2010). Several structured innovation approaches cannot be applied to SMEs due to limited resources (Spithoven et al., 2013). Nonetheless, it is crucial to highlight that practically all SMEs are active in some forms of OI (Livieratos et al., 2022). According to Theyel (2013), more than half of SMEs in the United States are active in OI efforts. On the other hand, a lack of resources may compel SMEs to engage in OI approaches, so overcoming their liabilities by exposing their innovation process (Engelsberger et al., 2022; Urbinati et al., 2020). Lecocq and Demil (2006) discovered that, despite a lack of resources, new entrants in a sector were more likely to use open systems than incumbents.

Using the key concept of "OI move" to examine the way in which SMEs weigh out potential benefits and risks, Livieratos et al. (2022) discovered that SMEs often consider OI partnerships for the "attention capital" demanded to create and attract value, rather than the financial rewards. The authors also discover that enterprises' desire to engage in OI differs based on the OI's target audience: while SMEs might be extremely successful with OI projects engaging communities and populations, they are hesitant to try such novelties.

2.4.2 Challenges of SMEs for OI and potential solutions

Previous research has found that SMEs are hampered by internal and external structural barriers such as small size, a lack of R&D resources, insufficient management capacity, a lack of knowledge of external knowledge and finance, unsystematic innovation activities, and insufficient coordination of innovation activities with operational functions (e.g., Henttonen & Lehtimäki, 2017; Spithoven et al., 2013; Wynarczyk et al., 2013). Bigliardi and Galati (2016, p. 869) identified four major impediments (i.e., "knowledge", "collaboration", "organizational", and "financial and strategic") and perceived hindrances based on a survey of 157 Italian SMEs ("knowledge", "financial and strategic", "collaboration" and "organizational" barriers). The authors discovered that several of these characteristics substantially impede organizations' adoption of OI. The capacity of SMEs to deploy OI systems is influenced by the firm's size, organizational stage, ability to build collaborations, and ability to discover partners with complementary resources (Ahn et al., 2015; Lichtenthaler, 2008).

Numerous studies showed that the benefits of OI strategies in SMEs often differ from those in large enterprises. For example, Spithoven et al. (2013) discovered that SMEs are more successful and adaptable when they concurrently adopt multiple OI approaches while bringing new products into the market. IP protection systems significantly improve SMEs' new product turnover, whilst large enterprises profit more from their searching techniques. Because SMEs have fewer resources, they have more challenges in developing and sustaining collaborative networks, as well as creating and enforcing IPRs. Such a negative effect is seen to have an impact on both incoming and outgoing activity (Lichtenthaler & Ernst, 2009). According to Henttonen and Lehtimäki (2017), OI is employed for commercialization rather than research and development in SMEs. According to the authors, the collaborative commercialization model is decided by the firm's core capabilities and OI approach. According to Padilla-Meléndez et al. (2013), SMEs do not pay enough attention to knowledge transfer and exchange, despite the fact that both are critical for OI because they involve the recognition of researchers, the development of intellectual property contracts, and the determination of project time scales. Even if high-tech SMEs understand how to link with external resources, Kim and Park (2010) found their OI outcomes to be poor. Christensen et al. (2005) identified two major challenges that explain the poor performance of high-tech SMEs: the lack of a deep technological base, which allows their new technologies to be immediately imitated and replicated; the inability to make technology-based demand appealing for complementary work. As a result, experts advise SMEs to exercise extreme caution, continuously monitor the market, and strengthen their internal R&D skills in order to please their clients (Kim & Park, 2010).

In addition, literature emphasized the necessity for integrated management systems to enable both inward and outbound OI (Brunswicker & Ehrenmann, 2013). In order to export technology and knowledge outside of internal R&D, SMEs must monitor the external environment in inbound OI. In the case of outbound OI, SMEs must, for one thing, build their own internal routes to market, and, for another, seek out external firms to help with technological commercialization (Chesbrough & Crowther, 2006). According to the literature, adopting outbound OI is particularly difficult for SMEs since it necessitates a concentrated company portfolio, a specialized knowledge pool, and resource scarcity (Gentile-Lüdecke et al., 2020). SMEs must carefully prepare to explore licensing options for technology that are not vital to their operations (Bianchi et al., 2010). To accomplish successful innovation, SMEs must collaborate closely with living labs, public institutions, incubators, and universities (Apa et al., 2021; Kang et al., 2013). According to research, corporations' active engagement in supplying ideas, technology, and solutions to outsiders helps them innovate in product creation (Tranekjer & Knudsen, 2012).

According to Padilla-Meléndez et al. (2013), social capital is vital in knowledge transmission and exchange in SMEs. A formal, methodical, interdisciplinary, and creative understanding of the external world is also required for SMEs (Bocken et al., 2014). To tackle the difficulties of OI, SMEs had better introduce new management paradigms (Mendy, 2021). According to Grimaldi et al. (2013), emphasizing the benefits of OI to employees through communication management and motivating activities might help overcome the resistance that businesses face when embracing OI. According to Laursen and Salter (2006), managers tend to excessively highlight internal resources while underemphasizing external resources because of their relative isolation from the external world.

Furthermore, the literature indicated that Internet technologies have reduced certain obstacles to SMEs engaging in OI (Bell & Loane, 2010). For example, some studies pointed out that Web 2.0 technologies have helped SMEs communicate more easily with external stakeholders to gain access to new information and technologies. Tranekjer and Søndergaard (2013) discovered that using market sources was connected with greater expenses, whilst using scientific sources was associated with lengthier projects. They concluded, however, that combining market and scientific sources resulted in more affordable costs in completing the project. R&D collaboration between companies is critical to innovation because product creation is inevitably complex, expensive, and risky. Firms should assess the possible gains of partnering with external stakeholders, as well as the drawbacks, including high expenses and complex procedures (Fitjar & Gjelsvik, 2018).

2.5 University–Industry Collaboration

University – Industry collaboration is a preliminary form of OI. Initially, through university-industry collaboration, corporations may benefit by accessing cutting-edge research, expertise, and talent from universities. This enables them to leverage academic knowledge and technology to develop new products, improve processes, and maintain competitiveness.

According to Sjöö and Hellström (2019), university-industry innovation is driven by seven key themes, namely resource availability, university structure and support, roles that bridge boundaries, prior collaborative experience, cultural considerations, the significance of reputation, and the environmental context. Provision of organizational resources, including funding and infrastructure, is essential for supporting collaborative research (Franco & Haase, 2015; Tartari & Breschi, 2012). Incentives, both monetary and non-monetary, play a crucial role in motivating researchers and organizations to engage in collaborative initiatives (Debackere & Veugelers, 2005; Siegel et al., 2003). The presence of project champions and boundary-spanning roles helps bridge the gap between academia and industry, facilitating effective communication and building trust (Franco & Haase, 2015; Van Looy et al., 2003). Prior experience in collaboration enhances future collaborative efforts by leveraging familiarity with collaboration processes (D’Este & Perkmann, 2011; Schartinger et al., 2002). Cultural factors should be addressed to overcome potential barriers and concerns that may exist between academic and industry partners (Azagra-Caro et al., 2006; Tartari & Breschi, 2012). High-status actors, such as prestigious universities and researchers, are often preferred collaborators due to their expertise and reputation (Fontana et al., 2006; Giuliani et al., 2010). Geographical and policy contexts also influence collaborative innovation, as government policies and incentives can promote collaboration, and regions with a strong research and development ecosystem tend to facilitate university-industry partnerships (Veugelers & Cassiman, 2005). These factors collectively contribute to the successful implementation of collaborative innovation.

Companies in various industrial settings have always been the driving forth in OI, since they tend to believe that innovation can be converted to profits (Alexy et al., 2009; Van de Vrande et al., 2009). However, literature showed that not all companies are equally attracted by the idea of university-industry collaboration, let alone participate in it. It is closely related to the field of industry. OI was first adopted and studied in “high-technology” industries at that time, for example, electronics, and telecommunications (e.g., Chesbrough, 2006a), before spreading and being studied in traditional industries such as automotive, consumer electronics, and food (e.g., Bigliardi & Galati, 2013; Sarkar & Costa, 2008). According to certain surveys, the adoption of OI varies by industry (Van de Vrande et al., 2009). The use of OI is also connected to corporate strategy (e.g., Alexy et al., 2009). Internal variables, they said, are more significant than external factors in explaining OI adoption.

Universities are both suppliers and consumers of knowledge and partnerships because they can gain from knowledge and partnership exchange for their own research and educational assignments (Kautonen et al., 2014). Participatory research between universities and enterprises can enhance their mutual exchange of knowledge and technology resources in the OI process (Laine et al., 2015). However, a university may refuse to collaborate with the industry due to the threat of losing control (Laine et al., 2015). By studying the Tongji Creative Cluster in Shanghai, Cai and Liu (2015) illustrated the government-university-industry Triple-Helix relationship in China’s regional innovation systems. They claimed that universities might generate and transfer more knowledge to the industry while also obtaining extra money from industry and the government to boost research. Universities can commercialize their knowledge through patent and license of projects, direct cooperation with industry, and university-run or spin-off enterprises.

Several studies (e.g., Doh & Kim, 2014; Kang & Park, 2012) demonstrated that networks between SMEs and universities provide financial assistance for developing novel technologies. Other studies supported the significance of networks, as illustrated by the triple helix model. Radicic et al. (2020), for example, showed how funding for innovation fosters collaboration between enterprises and knowledge from external sources, for instance, consultancies and public research organizations. Jugend et al. (2018) discovered that in radical innovation (as opposed to incremental innovation), enterprises must employ more external information, which is an essential component of radical innovation, and that the acquisition of this external knowledge is contingent on public support.

2.6 University–Government–Industry Collaboration

The Triple Helix model (i.e., University–Government–Industry collaboration) expands collaboration possibilities to include government and public research institutions as a partner. This provides corporations with supportive policies, funding opportunities, and infrastructure development that fosters innovation. Collaborating with universities and government also allows companies to tap into diverse networks and knowledge resources, facilitating joint research projects, technology transfers, and access to specialized skills. This contributes to sustained competitiveness and innovation.

Much of the literature has justified the necessity of government involvement in the evolution from university–industry collaboration to the Triple Helix model. Many studies supported the idea that government should fund private R&D (Acosta et al., 2015; Mardones & Zapata, 2019; Radas et al., 2015). Jugend et al. (2020) conducted a systematic review and suggest that public support was essential for innovation in four aspects: "(a) financial support for R&D activities, (b) development through innovation, (c) support for sectorial programs, and (d) university–industry–government collaboration (triple helix)." Acosta et al. (2015) demonstrated, using the case of the Spanish food industry, that companies that get state assistance invest more in R&D than those that do not. As such, Acosta et al. believed that reducing the budget for innovation programs may have an influence on these enterprises' R&D efforts. Radas et al. (2015) proposed various ways of assistance for various types of innovation. They suggested that government subsidies should be used to assist more radical breakthroughs, while tax breaks should be used to support incremental advancements. According to Mardones and Zapata (2019), public funding supported R&D activities by facilitating corporations to establish R&D departments.

On the dimension of support for R&D activities, three primary strands of work have specifically examined financial support for R&D in SMEs in various countries (Belitz & Lejpras, 2016; Doh & Kim, 2014; Yang et al., 2018). First, government R&D support has a greater favourable influence on small enterprises and their performance when compared to other firms (e.g., Yang et al., 2018). Radas et al. (2015) established this by demonstrating that R&D intensity is much higher in SMEs getting direct subsidies. Hottenrott and Lopes-Bento (2014) showed that subsidies increase firms' R&D spending, which supports product innovation; this beneficial effect is most obvious in small and medium-sized businesses. Furthermore, Doh and Kim (2014) found that government support for technological development assistance predicts patent acquisition by SMEs in the Korean scenario.

The second strand is innovation for development. There are two major themes: (a) assistance with the development of trained human resources; and (b) technical and managerial assistance for technology-based startups, spin-offs, and startups. According to several studies, the more educated and skilled the population, the more likely it is that more enterprises will engage in innovative activities (Castillo et al., 2020; Mohan et al., 2018). According to Rojas and Huergo (2016), graduate students participating in new technology-based enterprises is also a critical element of the public innovation system. According to Afcha and García-Quevedo (2016), getting government R&D subsidies has a long-term positive influence on R&D employment in enterprises.

Support for sectoral initiatives is a third strand in this literature. Because of their importance for infrastructure and environmental protection, as well as their high running costs, governments choose to finance innovation in the information technology (Lee et al., 2015), semiconductor, and biotechnology industries (Elia et al., 2020; Wu et al., 2015). Shin et al. (2017) utilized the Korean biotechnology sector as a case study to highlight the crucial importance of government assistance for the growth of SMEs at a time when the country's venture capital financing system is still in its early stages. Some studies (e.g., Greco et al., 2017; Lacerda & van den Bergh, 2020) focused on renewable energy development and emphasized that it is the best for governments to support technology development in the early stages of immaturity when firms need the most money to improve their technology. Bergek and Norrman (2015) noted that there is a possibility of bias in public support for particular sorts of new technology-based enterprises, given the growth of new high-tech companies and the significance of support. As a result, they underlined that public policymakers must be aware that industry may be a breeding ground for innovative and unconventional ideas. According to Bertoni et al. (2019), getting government-sponsored participatory loans benefits new and small businesses as well as enterprises in the high-tech sector.

From the triple-helix perspective, several studies emphasized public assistance that encourages SMEs to collaborate (e.g., Doh & Kim, 2014; Grotenbreg & van Buuren, 2018). Hewitt-Dundas and Roper (2018) emphasized the significance of public support in OI: Public support facilitates the mitigation of market failures in terms of information access (e.g., failure to recognize the benefits of collaboration and poor knowledge of potential partners' functional capabilities), thereby broadening the range of external innovation partners available to microenterprises. Caloffi et al. (2018)

argued that governments should encourage enterprises with minimal R&D expertise to strengthen their links with external groups, claiming that this works better than granting R&D subsidies.

Liu and Cai (2018) applied the triple helix model to study the institutional logic of Shenzhen. The balanced interaction of Shenzhen city government, industry, and universities contributed to the market-oriented economy and innovative knowledge society of Shenzhen was observed. Private enterprises like Huawei, ZTE, Tencent, and BYD emerged in Shenzhen and built the city's indigenous innovation capability (Liu & Cai, 2018). Akpinar and Qi (2020) also applied the triple helix model to study the innovation ecosystems in China. They observed that research-oriented universities, public research institutes, and corporate research and development spending are key actors in China's innovation ecosystem. However, insufficient research funds and talented engineers limit the innovation capabilities of the technology industry. We need to propose ways to boost university-industry-research collaboration by encouraging the commercialization of research projects and encouraging intellectual property trade.

2.7 Quadruple Helix of Open Innovation

The Triple-helix model highlights three partners in a regional innovation system, namely the state, universities, and private firms (Becker & Eube, 2018), whereas the Quadruple-helix model (as illustrated in Figure 1.2) adds civil society to the extant model, highlighting its irreplaceable role in the whole innovation ecosystem. For corporations, this means actively involving citizens, communities, and societal actors in their innovation processes. In the Quadruple-Helix OI model, government, university, industry, and society co-create values with each other by sharing resources and knowledge for the sustainability economy, environment, and society (Yun & Liu, 2019).

By incorporating societal needs, aspirations, and concerns into their strategies, corporations can develop products and services that align with societal expectations. Engaging with non-governmental organizations and community groups offers opportunities for social innovation, co-creation, and shared value initiatives. This not only enhances reputation and stakeholder relationships but also contributes to long-term business sustainability.

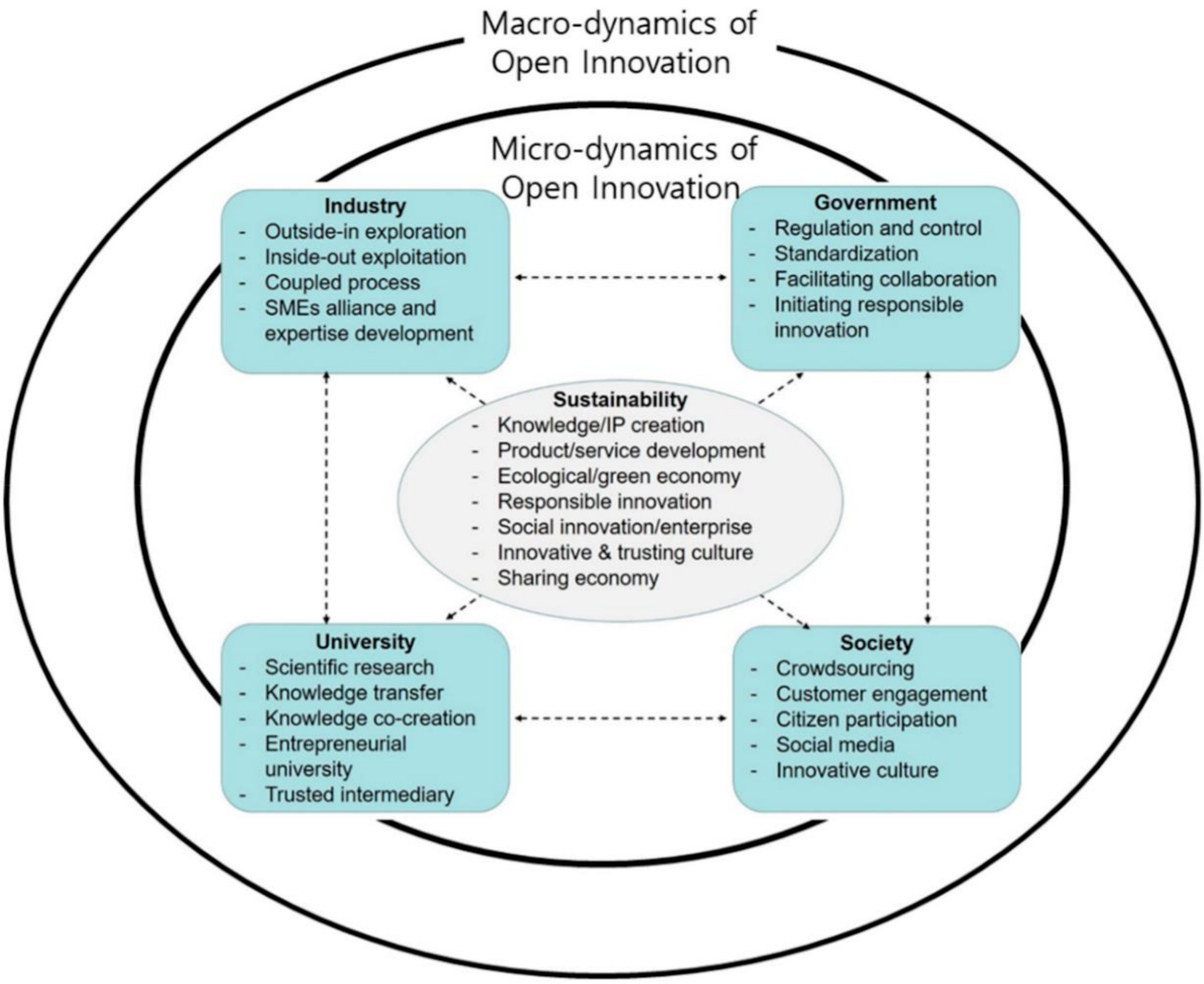

Figure 2.2 The quadruple helix Model (Yun & Liu, 2019)

Parveen, Senin, and Umar (2015) defined the Quadruple-Helix innovation model as a collaborative framework wherein users, firms, universities, and public authorities cooperate to generate innovations. These innovations encompass a broad spectrum, including technological, social, product, service, commercial, and non-commercial advancements. It is important to note that the Quadruple-Helix model should be perceived as a continuum or space rather than a singular entity, allowing for various Quadruple-Helix models to exist along this continuum. The specific configuration of a Quadruple-Helix model depends on the chosen perspective. In this research report, we primarily focus on the innovation perspective, specifically examining innovations related to the development of products and services in both the private and public sectors.

When considering the role of public authorities, including regional and local governments, in promoting Quadruple-Helix, it is crucial to acknowledge that their involvement and the impact of Quadruple-Helix activities on them remain areas that lack sufficient research and documentation. There is a dearth of studies examining the roles played by different public authorities, such as state, regional, and local governments, in the context of Quadruple-Helix innovation activities. Furthermore, the challenges posed by user involvement to public authorities have received inadequate attention (Arnkil et al., 2010).

Since the adoption of Quadruple-Helix model, researches have been done to analyse the role of agencies other than industry, university, and research institutions in influencing the OI process. These agencies include financial institutions, science parks, business/innovation incubators, financial advisors and media. However, extant literature tends to presume that these agencies have particular functions, with little empirical examination of these functions. In the literature, non-public financial agencies, such as venture capitalists and angel investors, tend to be simplified as merely funding providers (Gobble, 2016; Roijakkers et al., 2014). The literature assumed that science parks and incubators provide infrastructure and fundamental services, including coaching, mentoring, and offering institutionalized networks necessary to attract external sources of innovation (Bruneel et al., 2012). These measures are intended to aid in the development of an entrepreneurial team and to facilitate innovation networking among resident businesses (Mortara & Minshall, 2011). Chesbrough et al. (2006) called agencies like science parks and incubators “innovation intermediaries”, positing that they enhance trust relationships between stakeholders and prompt companies to innovate by matching ideas, talent, and technology (Winch & Courtney, 2007). Through analysis of publicly funded industry incubators in Norway, Clausen and Rasmussen (2011) evidenced the “open innovation intermediaries” role played by incubators, claiming that these incubators can transfer knowledge from large firms to society and bring greater value to society than to the private sector.

Media, be it traditional or digital, plays an increasing role in the OI process, although its effects have largely been unexamined. It is believed that OI is becoming more prevalent in the social media age nowadays because of the pursuit of a collaborative atmosphere. In the past, traditional media served as almost the sole channel for disseminating OI-related information to potential collaborators, and organizations must maintain good relations with the media for advertisement. Yet, with the proliferation of information technology, social media is gradually replacing traditional media as the dominant channel for advertisement. This change suggests a shift in relationships between companies and media organizations. Studies regarding companies' use of social media have begun to emerge. For instance, through a multiple case analysis, Mount and Martinez (2014) put forward a series of organizational and technological adaptations for managers to reap the benefits of applying social media to the OI process.

2.8 Research Gaps

OI is a well-explored topic in strategic management. OI of SMEs is also a popular research topic because they are the group with insufficient resources for innovation. OI can assist SMEs in addressing the problem of resource deficiency. However, my synthesis of the literature above has identified several research gaps.

First, the extant literature on inter-organizational relations in the OI system tends to neglect contextual differences, such as industry configuration in a region. While most of the empirical studies were conducted in large, industrialized regions, few have examined the OI system in a small, service industry-based system such as Hong Kong. Accordingly, it is largely unknown whether the OI model, which is an imported concept , is applicable to different industrial environments. Thus, further investigation is needed to determine the extent to which the OI model can be adapted to different regional contexts and industries. This research should focus on examining the specific challenges and opportunities that arise in small, service industry-based systems like Hong Kong, shedding light on whether the OI model can be successfully implemented and its impact on innovation outcomes.

Notably, Y. Xu and Yu (2013) conducted a comprehensive study on the adoption of OI by SMEs in Hong Kong, which is one of the limited studies on this topic. However, there are still a number of important questions that remain unanswered. The OI model proposed by Y. Xu and Yu (2013) may not have taken into account the differences among enterprises in terms of industry, size, ownership and structure, business maturity, innovation focus, financial resources, management skills and capabilities, market orientation, and internationalization.

Second, while theorists have endeavoured to update the OI model and made it as inclusive as an ecosystem that involves all possible actors, little is known about what the managers have in their minds regarding the actors and their roles in an OI system. This is particularly important for the SME context because the managers there may have comparatively insufficient knowledge of the OI system compared to those in large enterprises. If so, this would be a hindrance to their choice of the OI strategy in the first place. Thus, research should delve into the perspectives, beliefs, and decision-making processes of managers within SMEs. By exploring their understanding of the OI system and their perceptions of the roles of different actors, researchers can gain valuable insights into the challenges faced by SMEs in adopting OI strategies. This research will contribute to a better understanding of the specific knowledge and resource constraints that SME managers encounter, enabling the development of tailored strategies to enhance their participation in the OI system.

Third, while prior literature has revealed the roles of companies, government, and universities in the OI process, other OI actors, such as science parks, incubators, financial institutions or financial advisors, and media, have been understudied. Prior studies tend to presume these actors merely play the role posited in the theoretical models. Yet, these presumptions may hinder scholars from comprehending the complexity of the collaboration between companies and external stakeholders. Therefore, it is imperative to investigate the roles and contributions of frequently overlooked OI players. This research should explore how these players facilitate knowledge exchange, resource mobilization, and collaboration between companies and external stakeholders. By examining the specific functions and interactions of these actors, researchers can gain a comprehensive understanding of the multifaceted nature of the OI system.

The research gaps shown above warrant the research in this thesis, which aims to understand relevant players involved in Hong Kong's OI system to identify the facilitators and barriers to applying OI strategy from an institutional perspective.

2.9 Chapter Summary

Chapter 2 provides an extensive literature review on OI, examining various aspects of this concept. It begins by defining OI and differentiating between inbound and outbound OI activities. The chapter then explores the theories of OI, including resource-based theories, the valley of death, and the AMRC Model, which shed light on the underlying principles and mechanisms of OI.

Next, the chapter discusses the general challenges faced in implementing OI practices within organizations, considering factors such as organizational culture, intellectual property concerns, and the need for effective collaboration. The impact of OI is then examined, highlighting its potential benefits in terms of enhanced innovation outcomes, increased competitiveness, and improved sustainability.

The focus then narrows down to the implications of OI specifically for SMEs. The chapter examines the challenges faced by SMEs in adopting an OI approach and proposes potential solutions to overcome these barriers. Moreover, the importance of university-industry collaboration is emphasized, showcasing the role of universities in facilitating OI activities. Literature reveals when and how SMEs realize the necessity of engagement in OI practices as well as the challenges they face in their transition from closed to OI. The frequently discussed barriers include small size, a lack of R&D resources, insufficient management capacity, a lack of knowledge of external contributors and finance, unsystematic innovation activities, and insufficient coordination of innovation activities with operational functions. Literature also offers suggestions with respect to adopting integrated management systems, accumulating social capital, and incorporating Internet technologies into their daily operations, among others. Yet, it should be noted that the perceptions of actors and their roles in the OI system are still largely underexamined in the SME contexts.

Furthermore, the chapter explores the concept of university-research institute-industry collaboration, highlighting the synergies that can be created through tripartite partnerships. The emerging concept of the Triple/ Quadruple Helix model, which involves the active engagement of civil society in the innovation process, is also discussed in the context of OI.

Lastly, the chapter concludes by identifying the research gap in the existing literature. This chapter lays the foundation for further exploration of OI and its implications in subsequent sections of this research.

CHAPTER III
RESEARCH METHODOLOGY

This chapter aims to provide a comprehensive overview of the research design and methods employed to explore the interplay between players in OI among Hong Kong SMEs. This chapter outlines the overall research development, including the research philosophy, approach, and strategy. It further delves into the quantitative and qualitative methods utilised, along with the details of sample selection, data collection, and analysis. It then discusses the triangulation of findings to enhance the reliability and validity of the research outcomes. Lastly, ethical considerations are discussed.

3.1 Research Philosophy and Strategy

3.1.1 Research Philosophy

In this study, I aligned with the pragmatist perspective, which was common in mixed methods research. The pragmatist perspective posits that knowledge was constructed through the interaction between individuals and their environment and was based on both the mind-independent reality and constructed elements. It emphasised the instrumental role of theories in research (Morgan, 2014).

According to the pragmatist perspective, there were multiple realities, including the mind-independent physical world and the constructed social and psychological world. Social scientific research was value-oriented, aiming to solve problems (Johnson & Gray, 2010; Teddlie & Tashakkori, 2010). This perspective allowed social scientists to avoid an exclusive choice between the postpositivist and the constructivist/interpretivist positions (Teddlie & Tashakkori, 2009). Researchers had the freedom to select methods, data, and procedures that best suit their needs and goals.

They could employ both quantitative and qualitative methods and data in their research design and execution (Greene, 2006; Teddlie & Tashakkori, 2009).

3.1.2 Research Strategy

To learn about the adoption of OI by SMEs in Hong Kong, an explanatory sequential design (Creswell and Clark, 2018) was adopted, combining both quantitative and qualitative data collection methods.

The explanatory sequential design was an appropriate choice for this study as it allowed for a systematic exploration of the research topic, starting with quantitative data collection and then followed by qualitative analysis. This design offered a complementary and comprehensive approach to understand the adoption of OI practices by SMEs in Hong Kong, as it enabled the researcher to delve deeper into the underlying reasons and mechanisms behind the quantitative findings (Ivankova et al., 2006).

The research process began with the collection of quantitative data. A structured questionnaire was used to gather quantitative data from a diverse sample of SMEs in Hong Kong. This quantitative phase provided insights into the prevalence and patterns of OI adoption, as well as identified any correlations or associations between different variables.

After the quantitative data had been collected and analysed, the research moved on to the qualitative phase. This phase aimed to provide a more holistic understanding of the adoption of OI by SMEs in Hong Kong. Qualitative data were collected through interviews with selected participants from the quantitative phase. These qualitative data explored the motivations, challenges, and experiences of SMEs in adopting OI practices.

In the explanatory sequential design, the merging of quantitative and qualitative data was essential to gain a comprehensive understanding of the research topic. The qualitative data were then analysed using thematic analysis to identify emerging themes, patterns, and explanations that complement and expand upon the quantitative findings. The integration of the two types of data resulted in a more robust and nuanced understanding of the interactions between players in the OI system in Hong Kong.

The choice to use a mixed method approach was justified for several reasons. Firstly, OI was a multifaceted concept that involved both tangible and intangible aspects, and its adoption by SMEs was influenced by various contextual factors. A mixed method approach allowed for a comprehensive exploration of these complex phenomena, capturing both the breadth and depth required for a thorough analysis.

Secondly, a quantitative dominant mixed method approach offered distinct benefits. The initial quantitative phase provided a broad overview and generalizability, allowing for the identification of patterns, trends, and associations within a larger sample. It established a foundation for understanding the prevalence of OI adoption among SMEs in Hong Kong. The subsequent qualitative phase built upon this foundation, delving into the underlying mechanisms, motivations, and challenges faced by SMEs. Qualitative data enriched the understanding by capturing the nuances of individual experiences. The mixed method approach provided a balanced combination of breadth and depth, capturing both the general patterns and the contextual intricacies of the research topic.

3.2 Quantitative Phase

3.2.1 Sampling

The sampling strategy employed in this study consists of convenient sampling. I employed convenience sampling as the main method and sent electronic survey questionnaires to around 10,000 managers working in SMEs. These contacts were accumulated through my years of work experience in trade or professional association networks, and the questionnaires were distributed via QQ and email. This choice of sampling strategy is justified based on two key factors: the unavailability of a publicly accessible full list of SMEs in Hong Kong and the high proportion of SMEs covered by my professional network.

Firstly, it is important to note that a comprehensive and up-to-date list of all SMEs in Hong Kong is not readily accessible to researchers. As such, utilising convenient sampling methods becomes necessary to acquire the targeted data effectively. My professional network offers an opportunity to collect information from a significant number of SMEs within Hong Kong. Although the generalizability of the findings may be somewhat limited, I carefully checked the sample characteristics and found no significant differences between the sample and the target population.

Secondly, my accumulated professional network covers a substantial proportion of SMEs in Hong Kong. As such, leveraging this pre-existing connection grants the opportunity to reach a significant pool of prospective participants for the research. By targeting these customers, the sample obtained is likely to capture a diverse range of SMEs operating in Hong Kong, ensuring a comprehensive representation of the population of interest.

The target population of this study encompasses all SMEs that have their headquarters or branches located in Hong Kong. This includes SMEs from various sectors and industries that are registered and conducting business in Hong Kong. In the end, 181 responses were collected from the distributed 10,000 electronic questionnaires. The characteristics of the sample will be described in detail in the next chapter.

Ethical considerations have been taken into account in the design and implementation of this study. While a few sensitive questions, such as inquiring about the relationship between the company and various players, are included in the questionnaire, privacy and confidentiality measures have been clearly explained in the informed consent form provided to participants. Participants were given the assurance that their answers would be handled in a manner that ensures anonymity and confidentiality. Furthermore, all collected data would be presented in an aggregated manner to safeguard their identity and maintain the privacy of their responses.

3.2.2 Variables

The quantitative research tool utilised in this research is a questionnaire, which is a widely employed instrument in business research that allows for the systematic collection of data from respondents in a structured manner.

The questionnaire used in this study was designed to gather information pertaining to the adoption of OI by SMEs in Hong Kong. It consisted of multiple-choice questions, which provided respondents with predefined options and required them to select the most suitable response.

The questionnaire was divided into five parts to collect information on different aspects related to OI.

Part 1: Company Information

This part, which includes Questions 1, 2, 3, 4, 11, and 23, covered questions regarding the company itself. It sought information about the company headquarters, size, nature, the percentage of R&D expenses towards total annual company expenditure, intellectual property protection strategies, and the number of years the company has been established in Hong Kong.

Part 2: Personal Backgrounds

This section, including Questions 5, 6, 7, 8, 9, and 10, focused on gathering information about the participants. It included questions about their qualifications, job positions, roles in the company, and whether they are major decision-makers.

Part 3: Participation in OI

This part, including Questions 9 and 10, explored the types of inbound and outbound OI activities involved by the company. It included questions about the company's involvement or interest in OI, as well as any limitations or constraints the company might face in participating.

Part 4: Partners in OI

This section, including Questions 12,13, 14, 15,16, 17, and 22, delved into the partners involved in the company's OI activities. It asked about the types of partners involved, the relationship between the company and its partners, the roles played by facilitators and financial institutions, the ways in which media facilitates OI, and the origins of the company's partners.

Part 5: Factors Influencing OI Participation

This part, including Questions 18, 19, 20, 21, and 24, aimed to identify the barriers preventing SMEs from participating in OI activities, the main motivations for companies to participate, factors influencing participation in inbound and outbound OI projects, push factors driving participation, and any other views on OI that participants might have.

The questionnaire is displayed in Appendix 1. Some descriptive statistics have been displayed in Section 3.1, while the remaining will be shown in Chapter 4.

3.2.3 Data Collection

The questionnaire was distributed via instant message applications and email. These digital communication tools enable me to efficiently collect a considerable amount of data from respondents located in different geographical locations (Dillman et al., 2014). To expand the participant pool, participants were encouraged to engage in a snowball sampling technique. They were asked to forward the questionnaire to their network and potential respondents who play some role in SMEs in Hong Kong.

The aim and objectives of the survey as well as the definition of OI were clearly communicated in the foreword of the questionnaire. By explicitly stating the aims of the study, participants are more likely to feel motivated to complete the questionnaire without unnecessary concerns.

The approximate time required to finish the survey was approximately 10 minutes. This timeframe was thoughtfully chosen to achieve a balance between obtaining an adequate amount of data and reducing the burden on respondents. By keeping the questionnaire concise, I aimed to boost response rates and enable participants to comfortably complete the survey within a reasonable period. In the questionnaire, there was a specific question asking respondents to indicate their willingness to be interviewed as part of the qualitative data collection process. This question can identify potential participants for the qualitative phase.

No monetary incentives were offered to participants in exchange for completing the questionnaire. Instead, participants were given the chance to enter a lucky draw for a 30 HKD gift card as a token of appreciation. This strategy recognized the value of participants' time and dedication, aligning with ethical principles that discourage providing excessive monetary incentives that could impact responses (Bryman, 2016). The selection of a gift card recipient through a random lucky draw introduces an element of unpredictability and equity to the reward system, ensuring fairness in the process.

3.2.4 Data Analysis

The quantitative analysis focused on providing a comprehensive understanding of the status quo of OI participation among the surveyed companies, as well as examining the factors related to both overall OI engagement and specific types of partnerships. Various statistical techniques, mainly descriptive statistics and regression were utilised.

The survey data were first cleaned by removing the extreme abnormalities and put in Excel format for the online survey. Data errors, contradictions, inconsistencies and omissions were checked, edited or discarded. Falsified data were rejected. Then, it was transformed and analysed by Stata software. Stata is a well-established and widely used software package that provides a range of statistical analysis tools. Its extensive capabilities make it suitable for handling and analysing large datasets, such as the one collected in this study. Data were converted, coded and transformed for further quantitative analysis. General descriptive statistics relationships among variables were testified using Stata. The objectives of the quantitative part were to find out relations among variables and significant trends of findings. It also gave directions and insights for individual in-depth interviews. At the same time, survey results were summarised and interpreted.

The primary analysis involved descriptive statistics, which aimed to present an overview of the OI participation status among the surveyed companies. Descriptive statistics included measures such as frequencies, percentages, means, and standard deviations. These statistics provided a quantitative representation of the data, enabling a clear understanding of the current state of OI practices within the sample.

To gain a deeper understanding of whether different characteristics of SMEs (such as the age of the company, size of the company, proportion of R&D activities, and industry) affect their participation in OI, regression models were employed. Table 3.1 offers a comprehensive overview of the regression models utilised in the study. The choice of regression method was based on the specific characteristics of the response variables being analysed.

The initial models investigated the factors that influence the geographical networking scope of OI, categorised as either within Hong Kong, within the GBA, or outside the GBA. To accommodate this multinomial dependent variable, an mlogit model was deemed appropriate (Gu et al., 2013). Considering that the motive for participating in OI may significantly impact this relationship, the response variable was first regressed on the characteristics of the SMEs, then on motivation, and finally on both sets of variables.

The second and fourth sets of regression models examined SMEs' relationships with their partners in OI, which represent a multinomial variable. Therefore, an ologit model was employed (Grilli & Rampichini, 2014). In these models, explanatory variables included the age of the company, size of the company, proportion of R&D activities, and industry sector of the SMEs.

The third, fifth, and sixth sets of regression models explored the factors influencing barriers to adopting OI and different forms of OI. These variables were represented by dummy variables, necessitating the use of a logit model.

Table 3.1 Regression models in this thesis

No.	Regression method	Response variables	Explanatory variables
1	mlogit	Geographical scope of OI partnership	Age of company, Size of company, R&D proportion, Industry of SMEs, Motives for participating OI
2	ologit	SMEs' relationship with their partners in OI	Age of company, Size of company, R&D proportion, Industry of SMEs
3	logit	Barriers for adopting OI	Age of company, Size of company, R&D proportion, Industry of SMEs
4	ologit	SMEs' relationship with their partners	Motives for participating OI
5	logit	Forms of inbound OI	Age of company, Size of company, R&D proportion, Industry of SMEs
6	logit	Forms of outbound OI	Age of company, Size of company, R&D proportion, Industry of SMEs

The six specific equations used are as follows:

$$Mlogit\ (Scope) = f_1(Age,\ Size,\ R\&D\ proportion,\ Industry,\ Motives\ for\ participating\ OI) \quad (1)$$

$$Ologit\ (RELATIONSHIP\ WITH\ PARTNERS) = f_2(Age,\ Size,\ R\&D\ proportion,\ Industry) \quad (2)$$

$$Logit\ (BARRIERS) = f_3(Age,\ Size,\ R\&D\ proportion,\ Industry) \quad (3)$$

$$Ologit\ (RELATIONSHIP\ WITH\ PARTNERS) = f_4(MOTIVES\ FOR\ PARTICIPATING) \quad (4)$$

$$Logit\ (INBOUND\ OI) = f_5(Age,\ Size,\ R\&D\ proportion,\ Industry) \quad (5)$$

$$Logit\ (OUTBOUND\ OI) = f_6(Age,\ Size,\ R\&D\ proportion,\ Industry) \quad (6)$$

Please note that variables with all uppercase letters represent a series of variables, while others represent individual variables.

3.3 Qualitative Phase

3.3.1 Choice of Method

The purpose of the individual interviews was to understand various stakeholders' perception of OI and their reasoning for their answers in the quantitative survey. The qualitative research component served as a follow-up to the quantitative phase within the framework of an explanatory sequential design. Through qualitative analysis, I can delve deeper into the underlying reasons and motivations behind the observed patterns identified during the quantitative data collection.

To achieve this goal, thematic analysis was employed as the chosen qualitative method. Thematic analysis is a widely recognized and extensively used technique for exploring and interpreting qualitative data (Braun & Clarke, 2012). It allowed for the identification of recurring patterns and themes regarding the reasons why certain companies interact more with specific players than others in the OI system within Hong Kong.

The inductive coding approach was adopted in the thematic analysis process. This method involves an iterative and systematic examination of the qualitative data, enabling the emergence of themes and patterns directly from the data itself. By employing an inductive approach, the analysis stayed open to unforeseen insights and novel perspectives that may arise during the coding process.

Upon completion of the data collection phase through one-on-one semi-structured interviews, the recorded interviews were transcribed verbatim. Thematic analysis proceeded through several iterative stages, including familiarisation with the data, generating initial codes, searching for themes, reviewing and refining themes, and finally, producing a comprehensive analysis report.

The thematic analysis focused on identifying and interpreting the reasons behind companies' differential interactions with various players in the OI system specifically within Hong Kong.

3.3.2 Sampling Method

To provide a comprehensive understanding of the interaction between various players in the realm of OI within Hong Kong SMEs, two key sampling techniques, purposeful sampling and maximise variation sampling, were utilised.

Through purposeful sampling, I selected participants working in various sectors related to OI. These participants are expected to possess valuable insights that can help unravel the perplexing phenomenon observed in the quantitative data and thus help to gain a deeper understanding of the intricacies surrounding the OI practices implemented by Hong Kong SMEs.

All the interviewees were invited through personal or professional networks or referrals to increase the chance of arranging the interview. Initially, an email invitation was sent to the potential interviewees, introducing the aim and objectives of the study. The invitation provided a clear explanation of the research goals, emphasising the importance of their participation in contributing to the understanding of OI practices within the context of this study.

There are a total of 19 participants for 21 interviews. Please note that the institutions of Participants #2 and #3 play dual roles as both 'Agency' and 'Investor' as defined in this thesis, so each of them was asked two sets of questions. The interviewees' profile is listed in Table 3.2.

Table 3.2 Interviewees' profile

Participant #	Interview #	Sector	Description of their duties
#1	A1	Agency	Co-working Space without investment function
#2	A2	Agency	A Hong Kong Co-working space owner
#3	A3	Agency	An Incubator / Accelerator operated in Hong Kong usual virtual platform
#4	G1	Government	Government Organization representative
#5	G2	Government	Government Organization representative
#6	G3	Government	Government Department head
#7	G4	Government	Member of Legislative Council (with university and technology industry background)
#8	I1	Investor	Private equity fund management firm and responsible for operation of start-up teams

#9	I2	Investor	A tech-based startup investor and innovation enabler
#2	I3	Investor	Co-working space owner and start-up projects investor
#3	I4	Investor	An Incubator and Accelerator with working space for start-up / technology start-up investor
#10	M1	Media	Traditional media with online and printed media
#11	M2	Media	Radio station with online media platform
#12	M3	Media	Pure online media
#13	SME1	SME	Red Wine Trader
#14	SME2	SME	Trading Company
#15	SME3	SME	SME Association head
#16	SME4	SME	University-related start-up team
#17	U1	University	University's Technology Transfer Office representative
#18	U2	University	University Entrepreneurship Centre's representative
#19	U3	University	Senior Management of a local university and established a programme to facilitate collaboration with industries

Additionally, maximum variation sampling was employed to ensure a diverse representation of participants. This strategy seeks to maximise variations in several dimensions, including employment sector, company size, nature of the business, intellectual property protection strategies, number of years since establishment, and the participants' role within their respective companies. By encompassing a wide spectrum of these variables, the study can capture a holistic view of the phenomenon in interest.

The final sample size for this qualitative study consisted of 19 participants, with three from each of the six categories of OI players. Each participant was engaged in individual, one-on-one semi-structured interviews, providing ample opportunity for in-depth exploration of their experiences with OI.

3.3.3 Data Collection and Interview Questions

Interview protocol had been defined before the interview. Before the interviews took place, participants were required to sign a consent form, showing that they fully understand that the interviews would be recorded and analysed. The consent form outlines the purpose of the study, the voluntary nature of participation, and ensures confidentiality and anonymity of the respondents. To protect the privacy of each respondent, the organisation's name was not disclosed in the research. This step ensured that participants are fully informed about the research objectives, their rights as participants, and the handling of their data, promoting ethical considerations and respecting their autonomy.

The interviews were conducted in private places, such as the participants' offices or other appropriate venues. This selection of confidential locations ensured that participants can freely express their thoughts and experiences without external disturbances or interruptions. By providing an environment that fosters open communication, respondents are more likely to share candid and authentic insights into their OI activities (Hennink et al., 2020). During the interviews, I avoided discussing any sensitive business secrets or proprietary information that could compromise the confidentiality and competitiveness of the participating companies.

The average duration of each interview was 60 minutes. This timeframe turned out to allow for in-depth exploration of participants' experiences and perceptions regarding OI. I asked each interviewee to use the language they were most comfortable with for the interviews. In the 19 interviews, one person used Mandarin and English, while the remaining interviews were conducted in Cantonese. The interviewer adopted an open and flexible approach, allowing participants to elaborate on their answers and share additional information beyond the prepared interview questions. This flexibility enabled a richer understanding of participants' perspectives and ensured that no valuable insights are missed.

To gather valuable insights and perceptions regarding OI activities in Hong Kong and their facilitating role played during the process, semi-structured interviews were also conducted with various stakeholder groups besides SMEs, including government organisations, universities, financial institutions, agencies (such as incubators/co-working spaces/accelerators), and media outlets. Although the relationship between SMEs and these players has already been asked in the survey to SMEs, directly interviewing these OI players can achieve triangulation and provide a more comprehensive understanding of the issue from various perspectives. The following interview questions were utilised during the research process:

For interviewees from SMEs, I asked about experiences with OI and its impact on the organisation, factors influencing participation and any encouraging organisations, role they played in the OI process and specific benefits, and challenges faced and examples of how they were overcome. Also, the chosen SMEs were invited to elaborate their answers and the reasons behind their answers so that I could triangulate the answers.

For interviewees from the government, I asked about initiatives and policies facilitating OI collaborations, roles the government should play in the process and evaluations, successful instances of government involvement and benefits derived, and suggestions for improving incentives and ensuring fairness.

For interviewees from universities, I asked them about promotion and support for OI collaborations with SMEs, roles universities should play and effective contribution methods, successful university-SME partnerships and factors contributing to success, and incentives for professors to engage in OI projects.

For interviewees from financial institutions, I asked about their roles in facilitating OI between invested companies and SMEs, funding options and support for SMEs engaged in OI, examples of successful and unsuccessful industry collaborations, and criteria for selecting SMEs and additional support provided.

For interviewees from agencies, such as incubators, accelerators, I asked about programs and measures to facilitate OI activities, assistance and services supporting SMEs in OI, active role in promoting the OI environment, and success stories of startups and SMEs within programs. For participants from media outlets, I asked coverage of industry events and promotion of collaboration, coverage of collaboration stories involving SMEs and start-ups. media’s mission in promoting a positive start-up atmosphere, media’s role in promoting an OI environment, and challenges faced when reporting on OI initiatives.

The specific interview questions are displayed in Appendix 2.

3.3.4 Data Analysis

The interview audios were firstly transcribed to Chinese by using Csubtitle software with human editing. Then, the valid data obtained from the transcripts were extracted and prepared for analysis. This involved carefully examining the responses to ensure accuracy and relevance to the research objectives. Data abstraction techniques were employed to condense the information into manageable units while retaining key details.

After importing the data into NVivo 12, a qualitative analysis software, coding and thematic analysis were then performed on the extracted data. This involved systematically organising the data based on recurring patterns, themes, and concepts that emerged from the responses. With coding frameworks, relevant codes were assigned to segments of the data to facilitate the identification of commonalities and differences in perspectives. Note that using NVivo 12 facilitated the analysis process. This powerful qualitative data analysis tool enabled efficient coding, organisation, and retrieval of data. It allows for a comprehensive exploration of the data.

To deepen the analysis, within-group and across-group differences were compared. This involved examining the responses from different participants within the same group (e.g., SMEs, government organisations, universities) and comparing the findings across these groups. This comparative analysis provided valuable insights into the diverse viewpoints and experiences of the participants.

Throughout the analysis, strict adherence to a code of ethics and confidentiality of results was ensured. Participant anonymity was maintained, and all data were handled in a secure and confidential manner. Ethical considerations, such as informed consent and privacy protection, were rigorously followed to uphold the rights and well-being of the interviewees.

To maintain focus and coherence, the number of codes used during the analysis was limited. This approach aimed to avoid complexities and ensure a clear interpretation of the data. Additionally, detailed notes and interview findings were transformed into a usable format through various techniques, such as conversion, adjustment, or reconstruction. This step facilitated a comprehensive understanding of the interview data and ensured that nuances and key insights were captured accurately.

Lastly, the results from the one-on-one interviews were summarised and carefully scrutinised. Each case was thoroughly examined and interpreted in detail to enhance the richness and depth of the analysis. This process allowed for the identification of key themes, patterns, and relationships among the variables, shedding light on the interplay between players in OI practices among Hong Kong SMEs.

3.4 Validity, Reliability, and Triangulation

In order to increase the validity and reliability of my research, I followed three techniques suggested by Lincoln and Guba (1985) as well as Merriam (1998): the investigator's position, triangulation, and audit trial.

1. The investigator's position: I explicitly explained the different processes and phases of the inquiry in the thesis. I elaborated on every aspect of the study, including the rationale behind it, the study design, and the subjects involved.

2. Triangulation: I employed various procedures, including both questionnaires and interviews to collect data. In addition to survey data collected from SMEs, this research incorporates insights from participants representing various stakeholders, such as government organisations, universities, financial institutions, agencies, media, and additional SMEs. By collecting diverse types of information from multiple sources, I aimed to enhance the reliability of the data and the resulting findings.

3. Audit trial: To fulfil this procedure, I provided a detailed description of how I collected and analysed the data, derived different themes, and obtained the results. By

offering this level of transparency and specificity, I aimed to facilitate the replication of my research and contribute to its overall reliability. This approach also allows for easier replication of the study.

Particularly, data triangulation was a vital aspect of this study as it involved corroborating evidence from different individuals and utilising multiple types of data to enhance the reliability and validity of the research findings (Fielding, 2012). By including perspectives from diverse entities involved in OI practices, a comprehensive understanding of the interplay between players can be achieved (Flick, 2018; Patton, 2014).

Triangulating data from multiple sources helps in reducing bias and provides a more robust analysis of the research topic (Denzin, 2012). The inclusion of participants beyond SMEs allowed for a broader spectrum of viewpoints, ensuring that the findings were not solely based on a single group's experiences and perceptions. This approach added richness to the research by capturing different perspectives and potential variations in OI practices among various actors in the ecosystem.

The main data source for this research was the survey conducted among SMEs. The survey data provided quantitative information about the prevalence, extent, and impact of OI practices in Hong Kong SMEs. It offered statistical insights into the relationships between variables and allows for the identification of trends and patterns. To complement and enrich the survey data, interviews were conducted with participants from government organisations, universities, financial institutions, agencies, media, and additional SMEs. These interviews served as auxiliary data and provide qualitative insights into the factors influencing OI practices, the challenges faced, and potential strategies to foster collaboration and innovation.

The qualitative part can give an overall description of the current situation to set the scene for further discussion. It can also help define the current socioeconomic context for OI in Hong Kong. The qualitative part further explained the quantitative results. The overall OI activities and related support activities were studied in the quantitative part. Detailed mechanisms and processes in the proposed OI model of the SMEs were reviewed qualitatively. The benefit of mixed methods approach is that it can integrate and connect both quantitative and qualitative results before drawing the conclusion. In this way, a more thorough explanation of the proposed research model can be provided. Mixed methods approach can provide a more in-depth understanding of the research question. Questionnaire surveys and in-depth interviews can complement with each other. They can help readers understand OI in Hong Kong from different dimensions.

The integration of both quantitative and qualitative data through triangulation strengthens the research findings. The convergence or divergence of results from different data sources provided robust evidence and increase the overall validity of the research outcomes. Triangulation ensured that the findings are not reliant on a single type of data and helps to address potential limitations or biases inherent in any individual data source.

This research aligned with the recommendations of various scholars regarding the benefits of data triangulation in qualitative and quantitative research (Flick, 2018; Patton, 2014). After the qualitative data analysis, the interviews and survey results were interpreted and compared. Data were integrated and triangulated with research models to identify possible discrepancies. The extent that the qualitative interviews explain the quantitative survey was scrutinised and discussed. Research observations, comparison, analysis and conclusion were made in the triangulation stage.

3.5 Ethical Considerations

In this study, ethical considerations were carefully addressed to ensure that the research activity met the University's Research Ethics and Integrity Code of Practice. The researcher submitted the Ethical Approval Form to the University Research Ethics Committee for review and approval.

1. Privacy Protection: Respondents in this study are networked through my business relationships or friend's referrals, and special attention was given to protecting their privacy. The questionnaires were distributed in a completely anonymous manner and no personal identifiers were accessible, allowing respondents to answer with confidence. Personal information and sensitive data of the research participants were appropriately protected in accordance with privacy protection regulations.

2. Informed Consent: Prior to participating in the study, all research participants were provided with clear information about the research objectives, methods, and potential risks involved. They were given the opportunity to voluntarily participate and provide informed consent.

3. Data Security: Electronic data was encrypted to ensure its security, while hard copies of materials such as signed consent forms and interview transcripts were stored securely in locked cabinets. Measures were taken to prevent data breaches or loss during storage and transmission.

4. Conflict of Interest: Although the researcher's works is closely related to the innovation and technology sector of Hong Kong, there are no potential conflicts of interest between personal interests and those of the research participants or institutions

involved. The study adopted a positivist approach to objectively analyse the collected data.

5. Respect for Participants: The researcher respected the autonomy and rights of the research participants. They were given the option to withdraw from the survey or interviews at any time without consequence.

6. These ethical considerations demonstrated the researcher's commitment to conducting the study with integrity, respecting the rights and privacy of the participants, and ensuring the security of the collected data.

3.6 Chapter Summary

In summary, this chapter has outlined the methodological framework adopted in this study. The overall research development was discussed, including the research philosophy, approach, and strategy employed to guide the investigation of the interplay between players in OI among Hong Kong SMEs.

The quantitative method section provided insights into the sample selection process, highlighting the rationale behind selecting specific participants and the identification of key variables. Details regarding the data collection techniques employed, such as surveys or questionnaires, were presented. Furthermore, the data analysis techniques and statistical procedures used to analyse the quantitative data were described.

The qualitative method section focused on the specific choices made for this research, including the chosen method, sampling method, and the development of interview questions. The data collection process was explained, along with the steps taken to ensure privacy and confidentiality. Moreover, the data analysis techniques, including coding and thematic analysis, were elaborated upon.

To strengthen the research outcomes, a triangulation of findings approach was employed. This involved comparing and contrasting both the quantitative and qualitative results to enhance the reliability and validity of the findings. By integrating multiple sources of data, a more comprehensive understanding of the interplay between players in OI among Hong Kong SMEs was achieved.

Overall, this chapter presents a clear and systematic approach to capture and analyse data, enabling a robust exploration of the research topic. The methodological decisions made support the research objectives and contribute to the generation of meaningful insights into OI practices among Hong Kong SMEs.

CHAPTER IV
QUANTITATIVE DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter, along with the subsequent one, showcases the findings of this study. The current chapter outlines the results and discoveries derived from the quantitative surveys, addressing research questions 1 through 6. The following chapter concentrates on the qualitative aspects of the study, specifically the results and findings obtained from interviews. While it addresses all research questions in a similar manner, it places greater emphasis on uncovering the underlying reasons for the landscape observed in the quantitative segment.

Specifically, Chapter 4 presents a comprehensive analysis of the adoption and implementation of OI practices among Hong Kong SMEs surveyed. The chapter explores various aspects, including the adoption rate of OI among SMEs, the geographical scope of partnerships, the types of OI partners, the relationships with different OI players, the roles played by each player, reasons for non-adoption and adoption of OI, and the factors influencing the forms of OI involved. By examining these factors, this chapter provides valuable insights into the current landscape of OI adoption among SMEs, informing policymakers and practitioners on how to foster innovation and competitiveness within the SME sector.

4.2 Sample Characteristics

In the quantitative part, the sample comprises survey responses from 144 people working separately in 144 SMEs in Hong Kong. The quantitative sample of companies surveyed encompasses a diverse range of characteristics, as shown in Table 4.1. The largest proportion of companies, constituting 76.39%, have a workforce size ranging from 0 to 20 people. However, there are also companies with 21-40 people (11.81%), 41-60 people (5.56%), 61-80 people (4.17%), and 81-100 people (2.08%). According to the Hong Kong government's definition of SMEs, I excluded companies with more than 100 employees after data collection and further eliminated non-manufacturing firms with more than 50 employees. Ultimately, out of the 181 responses initially collected, 144 remained.

Table 4.1 Characteristics of the companies surveyed (N=144)

Variables	Freq.	Percent
Size		
0-20 people	110	76.39
21-40 people	17	11.81
41-60 people	8	5.56
61-80 people	6	4.17
81-100 people	3	2.08
Age of company		
Within 12 months	9	6.25
13 - 24 months	5	3.47
2 - 5 years	37	25.69
6 - 10 years	23	15.97
11 years or above	70	48.61
%R&D over expenditure		
0%	15	10.42
1-5%	37	25 .69
6-10%	40	27.78
11-15%	16	11.11
15-20%	13	9.03
20%-25%	6	4.17
25%-30%	6	4.17
30%+	11	7.64
Industry		
Professional and producer services	42	29.17
Innovation and technology	36	25.00
Financial services	17	11.81

Trading and logistics	16	11.11
Culture and sports related	16	11.11
Tourism & Retails	17	11.81

The sample covers a broad range of company lifespans. A small but noteworthy percentage of companies, 6.25%, were established within the past year, reflecting a component of recently founded businesses. Similarly, 3.47% fall within the range of 13-24 months of existence. In contrast, the majority of companies, accounting for 48.61 %, have been operating for 11 years or longer, indicating a significant representation of well-established enterprises. Furthermore, 25.69% of the companies surveyed have an age ranging from 2 to 5 years, showcasing the involvement of relatively young businesses in the sample.

Regarding R&D investment, the sample companies exhibit a wide range of allocations as a percentage of their total expenditure. Notably, 10.42% of the companies reported no R&D investment. However, the majority of companies, approximately 90%, allocate a portion of their expenditure to R&D activities. More specifically, 25.69 % invest between 1-5% of their expenditure, 27.78 % allocate between 6-10%, and 11.11% invest between 11-15%. Moreover, there are companies that allocate higher percentages, with 9.03% investing between 15-20%, 4.17 % allocating between 20-25%, 4.17% investing between 25-30%, and 7.64% of companies dedicating more than 30% of their expenditures to R&D.

The sample also consists of companies representing various industries. The industry standard classification adopted in this study is based on the categorisation of Hong Kong’s major industries by the Census and Statistics Department of the Hong

Kong government (https://www.censtatd.gov.hk/en/scode80.html). Given the study's focus on the innovation and technology sector, a separate category of "Innovation and Technology" has been included. The largest industry category within the sample is professional and producer services, accounting for 29.17% of the companies surveyed. Following closely is the innovation and technology sector, constituting 25.00% of the sample. Financial services companies represent 11.81% of the sample, while trading and logistics make up 11.11%. In addition, culture and sports-related industries account for 11.11%, whereas the tourism and retail sectors encompass 11.81% of the sample.

As shown in Table 4.2, the characteristics of these respondents, including their qualifications, positions, and decision-making roles, were analysed to ensure a diverse and representative sample.

Table 4.2 Characteristics of the respondents (N=144)

Variables	Freq.	Percent
Qualification		
Master Degree / Postgraduate Diploma	61	42 .36
Bachelor Degree	50	34.72
Secondary education or equivalent	15	10.42
Associate Degree / High Diploma or equivalent	11	7.64
Doctor Degree or above	5	3.47
Professional engineer	1	0.69
Honorary academician	1	0.69
Position		
Senior Management or Above	108	75.00
Professionals	19	13.19
Middle Management	6	4.17
Non-management	4	2.78
Owner / Director	7	1.39
Whether decision maker		
Yes	121	84.03
No	10	6.94

Maybe	13	9.03

The majority of respondents hold a master's degree or postgraduate diploma, accounting for 42.36 % of the sample, whereas 34.72% of the respondents possess a Bachelor Degree. This indicates a broad range of academic backgrounds. Additionally, a small proportion of respondents have secondary education or equivalent (10. 42%), associate degree or high diploma (7.64%), doctoral degree or above (3.47%), professional engineer qualification (0.69%), and honorary academician status (0.69 %).

The positions held by the respondents offer insights into their organisational roles and levels of responsibility. The majority of respondents, accounting for 75.00%, occupy senior management positions or above. This indicates the involvement of individuals with substantial decision-making power and strategic responsibilities within their organisations. Moreover, 13.19% of the respondents are professionals. Additionally, middle management representatives constitute 4.17% of the sample, while non-management personnel represent 2.78%. Furthermore, owners/directors make up 1.39% of the sample.

84.03% of the respondents are decision-makers within their organisations. This includes individuals who have the authority to make or influence strategic decisions. Additionally, 6.94% of the respondents are non-decision-makers, while 9.03% fall into the category of 'maybe,' indicating some level of involvement in decision-making processes. The high proportion of decision-makers in the sample warrants that the respondents can largely represent their organisations. Also, the inclusion of such a representative sample enhances the validity and reliability of the findings.

4.3 Landscape of Hong Kong SMEs' Participation in OI

This section showcases the research findings of the quantitative analysis in this paper. Addressing the six research questions, the quantitative aspect indicates that Hong Kong SMEs demonstrate high OI participation with a locally-focused collaboration orientation, robust customer-supplier relationships among OI participants, and the presence of key factors that drive SMEs to engage in various types of open innovation. Additionally, a multidimensional OI support network for OI development is observed, along with push and pull factors of OI among Hong Kong SMEs.

4.3.1 High OI participation within a locally-focused collaboration orientation

The quantitative analysis tackled Research Question 1 (i.e., What types of 'players' are involved in Hong Kong's OI process?) from three angles. The examination of OI adoption among SMEs revealed a relatively high participation rate of Hong Kong SMEs in OI. The analysis of OI partners among SMEs and the geographical scope of OI partnerships among SMEs demonstrated that Hong Kong SMEs display a significant local preference when collaborating with external organizations.

(1) Adoption of OI among SMEs

Descriptive statistics show a fairly high rate of inbound and outbound OI participation, with the former (79.2%) slightly higher than the latter (72.2%). Figures 4.1 and 4.2 demonstrated varying levels of adoption of OI among SMEs across different forms. Overall, the table demonstrated the level of engagement in different OI activities.

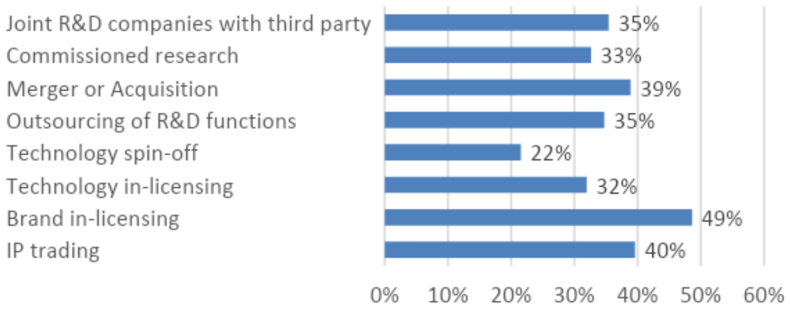

Figure 4.1 Adoption of inbound OI among SMEs (N=144)

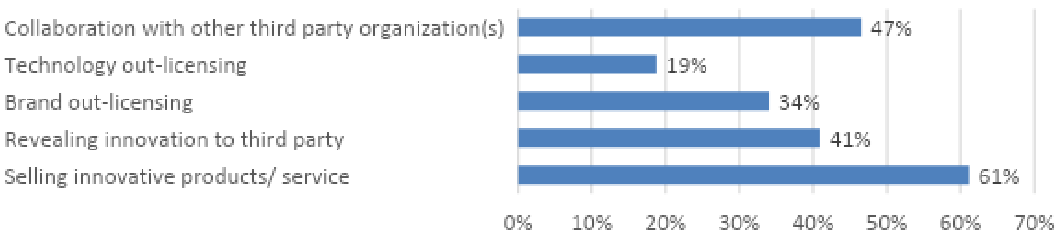

Figure 4.2 Adoption of outbound OI among SMEs (N=144)

Among all forms of OI, at the top of the list was ‘selling innovative products/service’ under the category of outbound OI, with a participation rate of 61%. This indicates a high level of involvement in selling unique and groundbreaking products or services to external parties.

Following closely behind was ‘collaboration with other third-party organisations,’ also categorised as outbound OI, with a participation rate of 47%. This suggests a significant interest in cooperating with external entities to foster innovation.

Moving on to inbound OI activities, ‘brand in-licensing’ occupied third place, with a participation rate of 49%. This involves obtaining licences from external sources to incorporate established brands into one’s own business strategies.

Next on the list was ‘revealing innovation to third parties’ within the outbound OI category, garnering a participation rate of 41%. This involves sharing innovative ideas with external entities to seek potential collaborations or partnerships.

Tied at a participation rate of approximately 40% were two inbound OI activities: ‘IP trading’ and ‘merger or acquisition.’ This indicates a relatively equal interest in engaging in intellectual property exchanges and acquiring or merging with other companies to enhance innovation. Subsequently, ‘joint R&D companies with third parties’ and ‘outsourcing of R&D functions’ both fell under the inbound OI category, with a participation rate of 35%. These activities involve collaborating with external entities for joint research and development projects or outsourcing specific R&D tasks.

A participation rate of 32% was recorded for ‘technology in-licensing’ under inbound OI and ‘brand out-licensing’ within outbound OI. Both these activities highlight a notable engagement in obtaining external technology or licensing one’s own brand to external parties. Continuing down the list, ‘commissioned research’ is categorised as inbound OI, with a participation rate of 33%. This involves commissioning external entities to conduct specific research on behalf of the organisation.

The participation rates dropped further for ‘technology spin-off’ under inbound OI, with 22%, and ‘technology out-licensing’ within outbound OI, with 19%. These activities indicate a relatively lower engagement in spinning off new technologies and licensing existing technologies to external parties.

(2) OI partners among SMEs

Figure 4.3 displays Hong Kong SMEs’ partners of inbound OI, showing that the SMEs engage with a variety of partners in their inbound OI efforts. Other companies within the industry, suppliers, and customers were the most prevalent types of partners. Specifically, the most prevalent type of partner in inbound OI was other companies in the industry and suppliers, both with a participation rate of 35%. The reasons behind this finding were explored in the qualitative part and were discussed in detail in Chapter 6. Collaboration with industry peers allows organisations to leverage complementary strengths, share risks, and jointly develop innovative solutions. The high involvement of these two types of partners highlights the role of intra-industry collaborations and supply chains in driving innovation among Hong Kong SMEs.

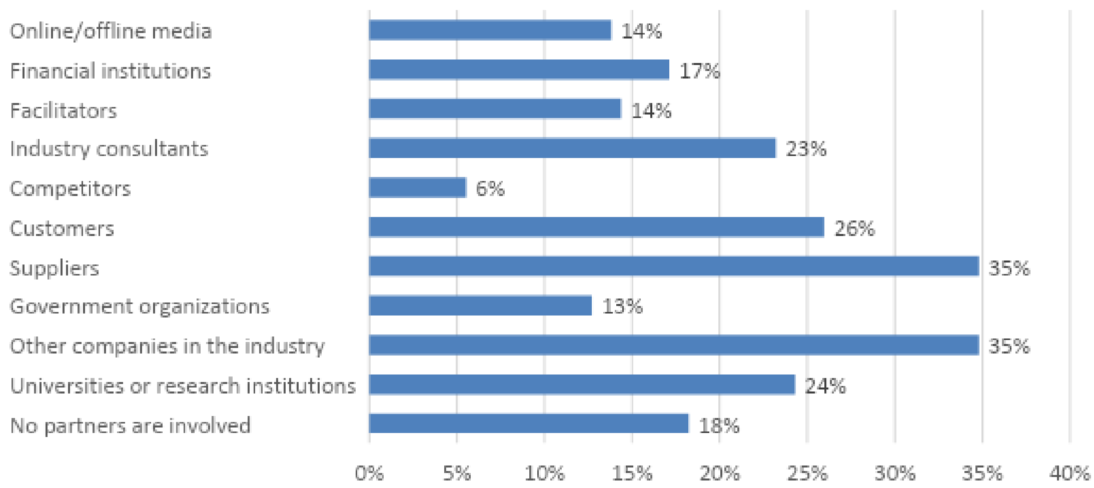

Figure 4.3 Partners of inbound OI

Customers were also actively engaged in inbound OI, with participation rates of 26%. They usually offer valuable insights and requirements that drive innovation efforts, making their participation significant. Universities or research institutions were identified as significant partners in inbound OI, with a participation rate of 24%. This finding highlights the importance of collaboration between academia and industry in leveraging external knowledge and research expertise to foster innovation.

Inbound OI also involved industry consultants and facilitators, with participation rates of 23% and 17%, respectively. These partners provide valuable external expertise, guidance, and support to organisations seeking to enhance their innovation capabilities.

In contrast, it is found that Hong Kong SMEs tend to have limited engagement with financial institutions, online/offline media organisations, government organisations, and competitors in their inbound OI, with all the participation rates lower than 15%. Particularly, competitors were identified as the least common partners in inbound OI, with a participation rate of only 6%. The low participation rates indicate that in the Hong Kong context, while these OI players foster innovation, they seem to play a less active role in OI. The underlying reasons deserve more exploration in the qualitative part of this study.

Figure 4.4 displays Hong Kong SMEs' partners of outbound OI, showing that the SMEs engage with a variety of partners in their outbound OI efforts. Similar to the results of inbound OI, other companies within the industry, suppliers, and customers were the most common partners in outbound OI. Specifically, the most prevalent type of partner identified in outbound OI was suppliers, with a participation rate of 34%. Other companies within the industry and customers were also actively involved in outbound OI, with a participation rate of 31% and 29%, respectively. The relatively high participation rates indicate they play a vital role in providing insights and requirements that can drive innovation. The related reason was explored in the qualitative interviews with the respondents, which were discussed in detail in Chapter 5.

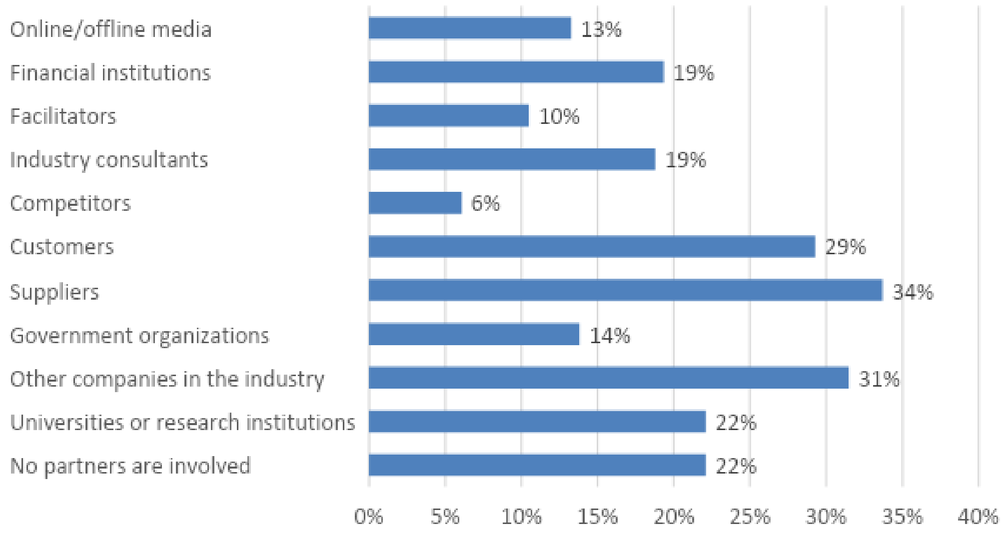

Figure 4.4 Partners in outbound OI

Universities or research institutions were identified as significant partners in outbound OI, with a participation rate of 22%. In the qualitative section, the reasons for this were investigated, which highlights the importance of collaboration between industry and academia in leveraging external knowledge and research expertise to drive innovation. These reasons were further discussed in-depth in Chapter 6.

Industry consultants and financial institutions both had a participation rate of 19% in outbound OI. Aligned with the qualitative findings, this finding suggests that these partners provide external expertise, support, and resources to organisations seeking to expand their innovation networks and secure funding for innovative projects.

In comparison, it is found that Hong Kong SMEs tend to have limited engagement with government organisations, online/offline media organisations, facilitators, and competitors in their outbound OI, with all the participation rates lower than 15%. Particularly, competitors were identified as the least common partners in outbound OI, with a participation rate of only 6%. Also, the facilitators were found to be the second least partners in outbound OI. The low participation rates indicate that in the Hong Kong context, these OI players seem to play a less active role in OI. The underlying reasons deserve more exploration in the qualitative part of this study.

Overall, comparing the inbound and outbound OI partners, it is clear that other companies within the industry, suppliers, and customers are the most common partners in both types of OI. Universities or research institutions, industry consultants, and financial institutions also play an important role in OI. Yet, compared with the existing OI model (Arnkil et al., 2010; Urbinati et al., 2020; Xu & Yu, 2013), online/offline media organisations, government organisations, competitors, and facilitators are relatively inactive in the Hong Kong OI system.

(3) Geographical scope of OI partnership among SMEs

Figure 4.5 revealed the geographical distribution of Hong Kong SMEs' OI partners, shedding light on the collaboration patterns within the innovation ecosystem.

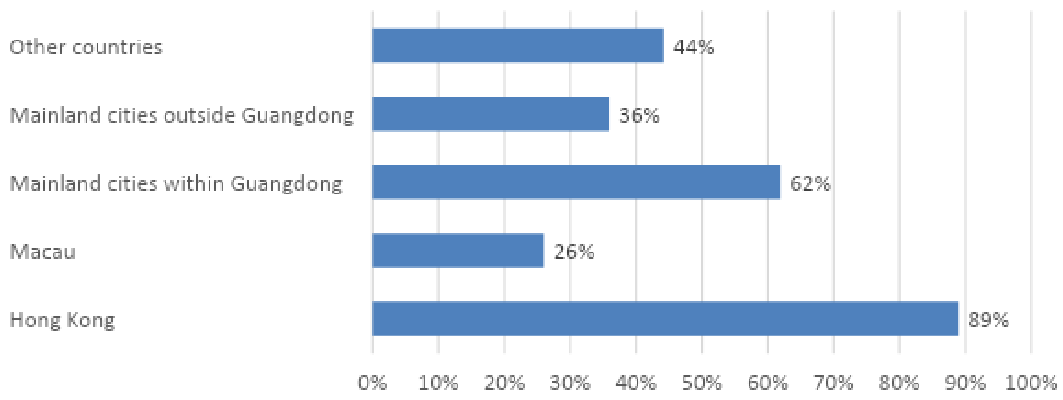

Figure 4.5 Origin of OI partners of HK SMEs

The majority of OI partners originated from Hong Kong, accounted for 89% of the partnerships. This result suggests a strong emphasis on local collaborations, highlighting the importance of leveraging resources within the local ecosystem to drive innovation.

Partners from mainland cities within Guangdong province were the next most prevalent, with a participation rate of 62%. This finding indicates the significance of cross-border collaborations within the GBA, which encompasses several dynamic innovation hubs in the region. Such collaborations are not surprising, as they are now strongly encouraged by the GBA initiative.

Partners from mainland cities outside Guangdong province were also actively engaged in OI with Hong Kong SMEs, representing 36% of the partnerships. This suggests that geographic boundaries are not limiting factors when it comes to seeking external expertise and resources to fuel innovation. Collaborations with partners from diverse regions in mainland China provide access to a broader range of knowledge and market opportunities for Hong Kong SMEs.

Partners from other countries accounted for 44% of the OI partnerships. This highlights the importance of international collaborations in driving innovation for Hong Kong SMEs. Engaging with partners from different countries brings diverse perspectives, technological advancements, and market insights that can contribute significantly to the innovation process.

Analysing the frequent combinations of OI partners presented in Table 4.3, several common trends can be observed. The data highlights the diverse and interconnected nature of OI partnerships among Hong Kong SMEs, with multiple origins of partners being involved in various combinations.

Table 4.3 Frequent combinations of OI partners (no less than three times, n=140)

Origins of OI partners	Freq.	Percentage
Hong Kong	30	21%
Hong Kong, Mainland Cities (Within Guangdong)	22	16%
Hong Kong, Mainland Cities (Within Guangdong), Mainland Cities (Outside Guangdong), Other countries	18	13%
Hong Kong, Macau, Mainland Cities (Within Guangdong), Mainland Cities (Outside Guangdong), Other countries	11	8%
Hong Kong, Mainland Cities (Within Guangdong), Other countries	11	8%
Hong Kong, Other countries	11	8%
Hong Kong, Macau, Mainland Cities (Within Guangdong), Mainland Cities (Outside Guangdong)	7	5%
Hong Kong, Mainland Cities (Within Guangdong), Mainland Cities (Outside Guangdong)	6	4%
Hong Kong, Macau, Mainland Cities (Within Guangdong), Other countries	5	4%
Hong Kong, Macau, Other countries	3	2%
Hong Kong, Macau, Mainland Cities (Within Guangdong)	3	2%
Other countries	3	2%

The most frequent combination of OI partners involved Hong Kong alone, which accounted for 21% of the cases participating in OI, indicating a significant reliance on local collaborations for OI. This suggests that Hong Kong SMEs primarily tap into the resources and expertise available within their immediate geographical vicinity to drive innovation.

The combination of Hong Kong and mainland cities within Guangdong province served as the second most common form (16%), illustrating the relative popularity of cross-border collaborations within the GBA. The proximity and strong economic ties between Hong Kong and other GBA cities make them attractive regions for SMEs seeking external expertise and market access opportunities.

Notable is the occurrence of combinations involving Hong Kong, mainland cities within Guangdong, mainland cities outside Guangdong, and other countries. This combination made up 13% of the cases, indicating a desire for diverse sources of knowledge, expertise, and market exposure. It reflected the global mindset of Hong Kong SMEs in their pursuit of innovative solutions. In another 8% of the cases, the geographical scope also included Macau.

There was also evidence of repeated combinations involving Hong Kong, Macau, and Guangdong. This combination indicates the significance of collaborations spanning across the GBA. This suggests that partnerships within this regional innovation hub provide valuable synergies and resources for driving OI.

Overall, the observed trends emphasise the importance of both local and global partnerships for driving innovation among Hong Kong SMEs. While collaborations with local partners dominated, there was also a strong inclination towards engaging with partners from outside of Hong Kong. This highlights the recognition of Hong Kong SMEs that diverse knowledge sources, expertise, and market opportunities are crucial for fostering innovative solutions. For one thing, by leveraging the resources within their immediate geographical vicinity and actively seeking partnerships beyond borders, Hong Kong SMEs are able to tap into a rich network of collaborators to enhance their OI practices. For another, while Hong Kong has its reputation for international collaboration and is believed to have more commercial ties with international rather than mainland partners, the data showed that partners from mainland China are now playing an irreplaceable role in the Hong Kong open innovation system.

I also explored factors influencing the networking scope of OI using the multinomial logistic regression, as it is important to identify what kinds of SMEs are more likely to find partners in GBA and even beyond rather than only partner with local organisations. I first regressed networking scope on characteristics of SMEs and their motivations for participating in OI separately. Then, I added both sets of explanatory variables together into the regression model. Results presented in Table 4.4 revealed that the associations between characteristics of SMEs and their geographical scope of OI partnership are not significant. In comparison, motivations for OI participation were found to have significant relationship with geographical OI partnership. Specifically, the motive for non-financial performance was negatively correlated with having partners outside of Hong Kong. According to models 3 and 4 in Table 4.4, compared with those without, SMEs with motives for non-financial performance are only 28.9% likely to have OI partners in mainland cities located in GBA ($p<0.05$) and 25.2% likely to have OI partners outside of China ($p<0.01$). When controlling for characteristics of SMEs, it was found that the former association became insignificant, while the latter remains significant, with the odds ratio increasing to 25.9% ($p<0.05$). The reasons might be that SMEs might find it hard to improve their non-financial performance with international partners, particularly regarding their performances with respect to customer satisfaction, employee engagement, social responsibility, and environmental impact (Anwar & Li, 2021; Jamai et al., 2021).

Additionally, the motive for technology acquisition was also negatively correlated with having partners outside of China. According to model 4, compared with those without, SMEs with motives for technology acquisition were only 35.1% likely to have OI partners in mainland cities located outside of China ($p<0.01$). When controlling for characteristics of SMEs, it was found that the association remains significant, with the odds ratio increasing to 41.6% ($p<0.05$). There was a lack of direct evidence to support the negative association between the motive for technology acquisition and establishing OI partnership abroad. It might be that there are many high-tech companies based in mainland China, making Hong Kong SMEs find it unnecessary to find technology related partners abroad. Yet, more evidence should supplement this idea and further explore the related reasons in the qualitative part of this study.

Table 4.4 Factors influencing the networking scope of OI

	m1	m2	m3	m4	m5	m6
	GBA vs local	Overseas vs local	GBA vs local	Overseas vs local	GBA vs local	Overseas vs local
Age of company	-0.168	-0.046			-0.121	0.037
	(0.184)	(0.164)			(0.209)	(0.183)
Size of company	-0.181	-0.211			-0.178	-0.202
	(0.150)	(0.126)			(0.169)	(0.139)
R&D proportion	-0.148	-0.099			-0.092	-0.013
	(0.125)	(0.103)			(0.144)	(0.119)
Industry_Culture and sports related (as reference)	0.000	0.000			0.000	0.000
	(.)	(.)			(.)	(.)
Industry_Financial services	-0.552	0.324			-0.343	0.319
	(0.834)	(0.749)			(0.960)	(0.847)
Industry_Innovation and technology	-1.250	-0.686			-1.220	-0.856
	(0.762)	(0.703)			(0.873)	(0.792)
Industry_Professional and producer services	-0.481	-0.434			-0.502	-0.458
	(0.705)	(0.692)			(0.819)	(0.773)
Industry_Tourism & Retails	-0.482	0.496			-0.613	0.184
	(0.948)	(0.825)			(1.080)	(0.931)
Industry_Trading and logistics	-1.278	-0.573			-0.896	-0.728
	(0.901)	(0.793)			(1.014)	(0.895)
Motive_no_benefit			1.813	-15.741	1.651	-14.415
			(0.935)	(1182.287)	(0.979)	(582.930)
Motive_performance_financial			0.575	0.274	0.422	0.179
			(0.529)	(0.434)	(0.554)	(0.465)

Motive_performance_nonfinancial			-1.240*	-1.379**	-0.992	-1.351*
			(0.621)	(0.503)	(0.641)	(0.526)
Motive_cost_reduction			-0.910	-0.678	-0.971	-0.542
			(0.534)	(0.420)	(0.593)	(0.469)
Motive_sales_marketing_channels			-0.068	-0.206	-0.067	-0.303
			(0.514)	(0.401)	(0.536)	(0.427)
Motive_transaction_cost_reduc			0.456	0.252	0.410	0.218
			(0.564)	(0.449)	(0.605)	(0.477)
Motive_interorg_relationship			-0.725	0.133	-0.830	-0.055
			(0.676)	(0.496)	(0.723)	(0.529)
Motive_knowledge_transfer			0.213	-0.401	0.053	-0.464
			(0.697)	(0.617)	(0.768)	(0.655)
Motive_talent_acquisition			0.734	-0.114	0.800	-0.071
			(0.510)	(0.425)	(0.537)	(0.442)
Motive_technology_acquisition			-0.965	-1.046**	-0.815	-0.876*
			(0.502)	(0.403)	(0.530)	(0.422)
Constant	1.459	0.892	-0.310	0.896*	1.524	1.565
	(0.986)	(0.925)	(0.513)	(0.412)	(1.188)	(1.094)
N	136		122		116	
ll	-173		-154		-149	
chi2	17.9		54.8		65.2	

* p<0.05, ** p<0.01, *** p<0.001

4.3.2 Strong customer-supplier relationships among OI players

The analysis of the relationship with various OI players tackles Research Question 2—What is the connection between SMEs and each of the other participants? The findings suggested that strong customer-supplier relationships exist among OI players in Hong Kong.

Table 4.5 presented data on the mean and standard deviation for the relationship of SMEs surveyed with various stakeholders. The higher the mean value, the closer the relationship between the SMEs and the relevant stakeholders. It is worth noting that mean values below 2.5 might be considered problematic.

Table 4.5 SMEs' relationship with OI partners

Variable	Obs	Mean	Std. Dev.	Min	Max
SMEs of the same industry	144	2.87	1.46	1	5
SMEs of other industry	144	2.67	1.36	1	5
Large companies of the same industry	144	2.62	1.40	1	5
Large companies of other industry	144	2.49	1.30	1	5
Universities or Research Institutes	144	2.38	1.41	1	5
Government organisations	144	2.55	1.42	1	5
Suppliers	144	3.07	1.37	1	5
Customers	144	3.39	1.45	1	5
Competitors	144	2.40	1.23	1	5
Industry consultants	144	2.51	1.33	1	5
Online / offline media	144	2.64	1.35	1	5
Financial institutions	144	2.36	1.30	1	5
Facilitators	144	2.25	1.26	1	5

Based on the mean values, the closest relationship was observed with customers, with a mean of 3.39 and a standard deviation of 1.45. Following customers, the next stakeholders with whom SMEs had relatively close relationships were suppliers (mean = 3.07, std. dev. = 1.37) and SMEs within the same industry (mean = 2.87, std. dev. = 1.46). These findings suggest that SMEs prioritise maintaining strong ties with their customers, suppliers and other companies operating in the same industry.

It was found that SMEs had moderately close relationships with SMEs from other industries (mean = 2.67, std. dev. = 1.36), as well as with online/offline media (mean = 2.64, std. dev. = 1.35). Moving further down the list, SMEs reported relatively weaker relationships with large companies in the same industry (mean = 2.62, std. dev.

= 1.4), government organisations (mean = 2.55, std. dev. = 1.42), industry consultants (mean = 2.51, std. dev. = 1.33).

However, it is important to note that the mean values of relationships with other stakeholders are below 2.5, indicating a potential issue regarding the strength of the relationships. Specifically, Hong Kong SMEs' relationship with large companies from other industries was weaker than the stakeholders mentioned above (mean = 2.49, std. dev. = 1.3). Moreover, the data suggested that SMEs had even weaker relationships with their competitors (mean = 2.4, std. dev. = 1.23), universities or research institutes (mean = 2.38, std. dev. = 1.41), financial institutions (mean = 2.36, std. dev. = 1.3), and facilitators (mean = 2.25, std. dev. = 1.26). These mean values indicate a need for improvement in the relationships with these stakeholders.

Overall, the SMEs surveyed demonstrated strong relationships with customers and suppliers, followed by relatively weaker relationships with other SMEs in the same industry and media. However, there is room for improvement in their relationships with large companies, government organisations, industry consultants, and other stakeholders.

To investigate whether the relationships between SMEs and their OI partners differ based on the characteristics of the focal company, an ordered logistic regression model, which is suitable for models with ordinal dependent variables, was employed to analyse the relationship variables in relation to SME characteristics. The results presented in Table 4.6 demonstrate that the age, size, and industry of SMEs can predict the nature of their relationships.

The analysis reveals a positive and significant association between the age of SMEs and their relationships with government organisations (Coef. = 0.303, $p < 0.05$), large companies in the same industry (Coef. = 0.273, $p < 0.05$), and other SMEs in the same industry (Coef. = 0.258, $p < 0.05$). Holding all other factors equal, SMEs with a longer history tend to maintain stronger relationships with these organisations compared to their counterparts. This finding supports the descriptive observation that Hong Kong SMEs tend to form partnerships primarily with companies in the same or related industries, with those having a longer history maintaining particularly robust relationships with these stakeholders.

Furthermore, the regression results indicated a significantly positive association between the size of the company and SMEs' relationships with their competitors (Coef. = 0.217, $p < 0.05$). This suggests that all else being equal, larger SMEs are more likely to have closer relationships with their competitors compared to smaller SMEs. This is likely because smaller SMEs perceive the market to be too small, providing limited opportunities for collaboration. Additionally, it should be noted that this difference is also related to the business mindset of SMEs. Based on my observations, smaller SMEs are particularly reluctant to collaborate on core technologies because they do not want to disclose their own technology. In contrast, they are more inclined to collaborate on general technologies to understand what is happening with their competitors.

The analysis also highlighted the significance of the industry in which an SME operates in influencing its relationships with other stakeholders. Specifically, SMEs in the trading and logistics industry exhibit a higher likelihood than their counterparts of maintaining closer relationships with suppliers (Coef. = 1.769, $p < 0.01$), financial institutions (Coef. = 1.596, $p < 0.05$), facilitators (Coef. = 1.294, $p < 0.05$), and large companies in the same industry (Coef. = 1.287, $p < 0.05$), all else being equal. Similarly, being in the financial services industry is positively associated with closer relationships with financial institutions (Coef. = 1.340, $p < 0.05$) and facilitators (Coef. = 1.257, $p < 0.05$). Additionally, the analysis reveals that, all else being equal, being in the professional and producer services industry is positively linked to closer relationships with suppliers (Coef. = 1.101, $p < 0.05$). Similarly, it was found that SMEs in the tourism and retail industry tend to have closer relationships with suppliers (Coef. = 1.446, $p < 0.05$). It is also noteworthy that compared with those in the field of culture and sports, SMEs in the innovation and technology industry exhibited less close relationships with media (Coef. = -1.136, $p < 0.05$), all else being equal.

Table 4.6 Factors influencing SMEs' relationship with their partners in OI

	m1	m2	m3	m4	m5	m6	m7	m8	m9	m10	m12	m13	m14
	SMEs_same industry	SMEs_other industry	Large companies_same industry	Large companies_other industry	Universities/ Research Institutes	Government organisations	Suppliers	Customers	Competitors	Industry consultants	Media	Financial institutions	Facilitators
Age of company	0.258*	0.153	0.273*	0.120	0.073	0.303*	-0.005	-0.032	-0.079	-0.078	-0.102	-0.050	-0.033
	(0.129)	(0.123)	(0.132)	(0.130)	(0.127)	(0.134)	(0.123)	(0.127)	(0.126)	(0.133)	(0.128)	(0.130)	(0.128)
Size of company	-0.005	-0.118	0.197*	0.145	-0.004	0.028	0.169	0.086	0.217*	0.115	0.023	0.094	-0.015
	(0.094)	(0.091)	(0.097)	(0.095)	(0.094)	(0.092)	(0.091)	(0.091)	(0.093)	(0.094)	(0.092)	(0.096)	(0.096)
R&D proportion	0.061	-0.008	0.029	0.018	-0.039	0.016	0.094	0.016	-0.100	-0.025	0.046	-0.134	-0.028
	(0.082)	(0.078)	(0.079)	(0.080)	(0.080)	(0.078)	(0.079)	(0.078)	(0.079)	(0.076)	(0.076)	(0.080)	(0.078)
Industry_Culture and sports related (as reference)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Industry_Financial services	-0.102	0.512	0.782	0.299	0.087	-0.367	0.090	0.062	0.398	1.058	-0.486	1.340*	1.257*
	(0.551)	(0.564)	(0.576)	(0.566)	(0.568)	(0.547)	(0.552)	(0.555)	(0.558)	(0.589)	(0.556)	(0.568)	(0.564)
Industry_Innovation and technology	0.441	0.573	0.612	-0.076	0.405	-0.354	0.247	0.136	-0.041	0.306	-1.136*	0.706	0.999
	(0.515)	(0.529)	(0.536)	(0.527)	(0.521)	(0.496)	(0.521)	(0.526)	(0.530)	(0.559)	(0.515)	(0.526)	(0.525)
Industry_Professional and producer services	0.253	0.527	0.740	0.445	0.078	-0.273	1.101*	0.250	0.213	0.569	-0.615	0.595	0.516

	(0.480)	(0.504)	(0.511)	(0.500)	(0.503)	(0.473)	(0.496)	(0.501)	(0.500)	(0.543)	(0.488)	(0.507)	(0.499)
Industry_Tourism & Retails	-0.332	0.180	0.156	-0.169	-0.635	-0.728	1.446*	0.349	0.193	-0.136	0.375	0.396	0.191
	(0.604)	(0.609)	(0.629)	(0.616)	(0.640)	(0.601)	(0.594)	(0.587)	(0.613)	(0.641)	(0.592)	(0.609)	(0.610)
Industry_Trading and logistics	0.882	0.843	1.287*	0.480	-0.109	-0.048	1.769**	0.579	0.787	0.960	-0.491	1.596*	1.294*
	(0.570)	(0.594)	(0.608)	(0.591)	(0.611)	(0.585)	(0.589)	(0.584)	(0.578)	(0.639)	(0.573)	(0.621)	(0.592)
/													
cut1	0.336	-0.220	1.301	0.186	-0.156	0.353	-0.312	-1.396	-0.882	-0.534	-1.821**	-0.370	-0.034
	(0.694)	(0.697)	(0.719)	(0.686)	(0.690)	(0.688)	(0.689)	(0.720)	(0.691)	(0.711)	(0.703)	(0.696)	(0.702)
cut2	1.339	0.815	2.315**	1.188	0.525	1.156	0.816	-0.519	0.291	0.500	-0.730	0.560	0.967
	(0.698)	(0.696)	(0.732)	(0.690)	(0.692)	(0.691)	(0.686)	(0.713)	(0.688)	(0.714)	(0.691)	(0.696)	(0.705)
cut3	1.890**	1.739*	3.170***	2.174**	1.309	1.961**	1.754*	0.179	1.402*	1.362	0.077	1.567*	1.983**
	(0.702)	(0.702)	(0.744)	(0.700)	(0.696)	(0.699)	(0.695)	(0.714)	(0.696)	(0.716)	(0.687)	(0.704)	(0.718)
cut4	3.078***	2.797***	4.209***	3.508***	2.382***	3.086***	2.950***	1.112	2.856***	2.753***	1.471*	2.991***	3.294***
	(0.725)	(0.725)	(0.770)	(0.736)	(0.717)	(0.723)	(0.718)	(0.718)	(0.744)	(0.742)	(0.703)	(0.744)	(0.761)
N	136	136	136	136	136	136	136	136	136	136	136	136	136
ll	-282	-283	-274	-273	-267	-276	-280	-282	-265	-274	-278	-262	-259
chi2	11.3	5.4	21.2	9.3	4.0	8.9	21.9	2.4	13.9	10.8	10.9	18.4	10.6

* p<0.05, ** p<0.01, *** p<0.001

4.3.3 Key factors driving SMEs to engage in various types of OI

The analysis of factors influencing forms of OI involvement in SMEs addresses Research Question 3—What types of inbound and outbound OI activities occur between SMEs and other participants? The findings uncovered what motivates SMEs to delve into the dynamic realm of open innovation.

To explore the factors influencing SMEs' participation in specific types of inbound OI, I performed a logit regression analysis. The independent variables considered in the model were Age of company, Size of company, R&D proportion, and Industry. Among these variables, five significant relationships were found, while the remaining relationships were found to be insignificant.

Table 4.7 Factors influencing forms of inbound OI

	m1	m2	m3	m4	m5	m6	m7	m8
	IP trading	Brand in-licensing	Technology in-licensing	Technology spin-off	Outsourcing of R&D functions	Merger or Acquisition	Commissioned research	Joint R&D companies with third parties
Age of company	0.233	0.203	-0.021	0.120	0.350*	0.075	0.093	0.129
	(0.149)	(0.144)	(0.148)	(0.176)	(0.171)	(0.149)	(0.151)	(0.151)
Size of company	-0.005	-0.077	0.252*	0.125	0.187	-0.017	0.045	0.134
	(0.106)	(0.104)	(0.105)	(0.119)	(0.112)	(0.108)	(0.108)	(0.104)
R&D proportion	0.144	0.104	0.037	0.073	-0.022	-0.100	0.049	0.102
	(0.090)	(0.087)	(0.091)	(0.099)	(0.095)	(0.093)	(0.090)	(0.089)
Industry_Culture and sports related (as reference)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Industry_Financial services	0.213	-0.310	0.826	1.927*	-0.020	2.569***	0.932	0.824
	(0.620)	(0.623)	(0.706)	(0.860)	(0.668)	(0.771)	(0.640)	(0.670)
Industry_Innovation and technology	-0.296	-0.122	0.842	1.578	1.547*	1.133	0.355	0.725
	(0.570)	(0.563)	(0.656)	(0.821)	(0.619)	(0.718)	(0.591)	(0.618)
Industry_Professional and producer services	-0.895	-0.166	0.329	-0.075	-1.041	1.135	-0.488	0.185
	(0.574)	(0.550)	(0.663)	(0.899)	(0.646)	(0.699)	(0.610)	(0.622)
Industry_Tourism & Retails	-0.136	1.125	1.017	1.335	-0.124	1.344	-0.030	1.003
	(0.680)	(0.705)	(0.756)	(0.924)	(0.746)	(0.800)	(0.726)	(0.721)
Industry_Trading and logistics	0.357	0.370	1.013	0.354	-0.400	1.119	-0.086	0.153
	(0.651)	(0.646)	(0.736)	(0.991)	(0.724)	(0.783)	(0.703)	(0.731)
Constant	-1.630*	-1.249	-1.871*	-3.165**	-2.427**	-1.619	-1.461	-2.218**
	(0.799)	(0.771)	(0.861)	(1.094)	(0.909)	(0.892)	(0.819)	(0.855)
N	139	139	139	139	139	139	139	139
ll	-115	-120	-111	-88	-100	-112	-110	-113
chi2	13.3	10.1	12.1	24.4	35.4	19.8	10.8	11.0

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Our analysis revealed that the age of the company has a positive and statistically significant effect on the likelihood of SMEs outsourcing their R&D functions (Coef. =

0.350, $p < 0.05$). In other words, all else being equal, as the age of the company increases, there is a higher probability of SMEs choosing to outsource their R&D activities.

Furthermore, it was found that the size of a company has a positive and significant impact on the likelihood of SMEs engaging in technology in-licensing (Coef. = 0.252, $p < 0.05$). This suggested that larger companies are more likely to pursue technology in-licensing compared to smaller companies when other factors are held constant.

Regarding the role of industry, I observed that SMEs operating in the financial services industry exhibit a higher probability of pursuing technology spin-offs (Coef. = 1.927, $p < 0.05$). This finding indicates that the financial services sector is more inclined towards creating new ventures based on developed technologies. Moreover, SMEs in the financial services industry also demonstrate a significantly higher likelihood of engaging in merger or acquisition activities (Coef. = 2.569, $p < 0.001$). This suggests that firms in this industry adopt a strategic approach to acquiring external resources and capabilities.

Lastly, I found that SMEs in the innovation and technology sector are more likely to outsource their R&D functions (Coef. = 1.547, $p < 0.05$) compared to SMEs in other industries. All reported coefficients are statistically significant at their respective significance levels. These results provide valuable insights into the factors influencing SMEs' involvement in specific types of inbound OI. The findings highlighted the importance of company age, size, and industry in shaping SMEs' innovation strategies.

Table 4.8 Factors influencing forms of outbound OI

	m1	m2	m3	m4	m5
	Selling innovative products / services	Revealing innovation to third party	Brand out-licensing	Technology out-licensing	Collaboration with other third party
Age of company	0.046	0.323*	0.214	0.314	0.230
	(0.144)	(0.157)	(0.154)	(0.206)	(0.145)
Size of company	0.001	-0.009	0.097	0.081	0.045
	(0.106)	(0.107)	(0.107)	(0.130)	(0.105)
R&D proportion	0.184	0.122	0.097	0.124	0.074
	(0.096)	(0.090)	(0.090)	(0.108)	(0.090)
Industry_Culture and sports related (as reference)	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)
Industry_Financial services	0.161	0.370	-0.194	1.665*	0.179
	(0.628)	(0.628)	(0.633)	(0.773)	(0.655)
Industry_Innovation and technology	0.608	0.746	-0.064	0.669	-0.882
	(0.597)	(0.578)	(0.574)	(0.736)	(0.583)
Industry_Professional and producer services	-0.333	-0.554	-1.108	-1.532	-1.193*
	(0.555)	(0.576)	(0.600)	(0.978)	(0.572)
Industry_Tourism & Retails	0.262	-0.199	0.285	0.217	-1.019
	(0.691)	(0.699)	(0.680)	(0.910)	(0.692)
Industry_Trading and logistics	-0.137	-0.791	-0.141	-0.566	-1.198
	(0.652)	(0.713)	(0.667)	(1.002)	(0.674)
Constant	-0.461	-2.099*	-1.746*	-3.621**	-0.581
	(0.767)	(0.835)	(0.822)	(1.160)	(0.774)
N	139	139	139	139	139
ll	-115	-112	-110	-74	-117
chi2	13.1	20.6	13.9	33.1	15.9

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

To examine the influence of various factors on the likelihood of SMEs' participation in outbound OI, I conducted a logit regression analysis. The independent variables included in the model were Age of company, Size of company, R&D proportion, and Industry. As shown in Table 4.8, three significant relationships were observed, while the remaining relationships were found to be insignificant.

Firstly, the analysis revealed that age of company had a positive and statistically significant effect on the probability of SMEs revealing innovation to third parties (Coef. = 0.323, $p < 0.05$). This suggested that all else being equal, as the age of the company increases, the likelihood of SMEs being willing to disclose their innovation to external parties also increases.

Furthermore, the results indicated that Industry played a significant role in determining the collaboration patterns of SMEs. Specifically, SMEs operating in the financial services industry showed a higher probability of engaging in technology out-licensing compared to SMEs in other industries (Coef. = 1.665, $p < 0.05$). This suggested that the financial services sector is more open to technology commercialization and licensing agreements.

Conversely, SMEs in the professional and producer services industry exhibited a lower likelihood of collaborating with other third parties (Coef. = -1.193, $p < 0.05$) compared with those in the cultural and sports related industries. This may be due to the fact that SMEs in professional and producer services often sell intangible services (such as accounting, legal advice, and insurance services) instead of tangible products, resulting in shorter industry chains and more conflicts of interests. Additionally, these industries are often expected to provide one-stop services, which makes it difficult for these SMEs to establish partnerships with external entities.

It is worth noting that the reported coefficients are all statistically significant at the 5% level, indicating robustness of the findings. These regression results shed light on the factors influencing SMEs' collaboration choices and highlight the significance of company age and industry in shaping partnership probabilities.

4.3.4 A multidimensional OI support mesh for OI development

The analysis of roles played by each OI player addresses Research Question 4—What are the roles of each participant in facilitating (or hindering) OI activities in Hong Kong? The findings showed that a multifaceted OI support network for OI development is beginning to emerge in Hong Kong.

Figure 4.6 presents the perceived roles played by facilitators as reported by SMEs. The findings indicated that facilitators were perceived to have a significant role in inter-organizational networks (39%) and providing capital/funding support (23%). This suggested that SMEs recognize the value of facilitators in establishing and maintaining connections with other organisations, as well as in obtaining financial resources to support their innovation endeavours. Interestingly, a large percentage of SMEs (39%) did not perceive a role for facilitators, indicating potential gaps in understanding or utilisation of facilitator services. Additionally, a notable proportion of respondents (27%) believed that office space provided by facilitators played a role in supporting their business activities. This finding suggests that some SMEs may find value in physical spaces provided by facilitators, potentially indicating the need for shared workspace or incubation environments.

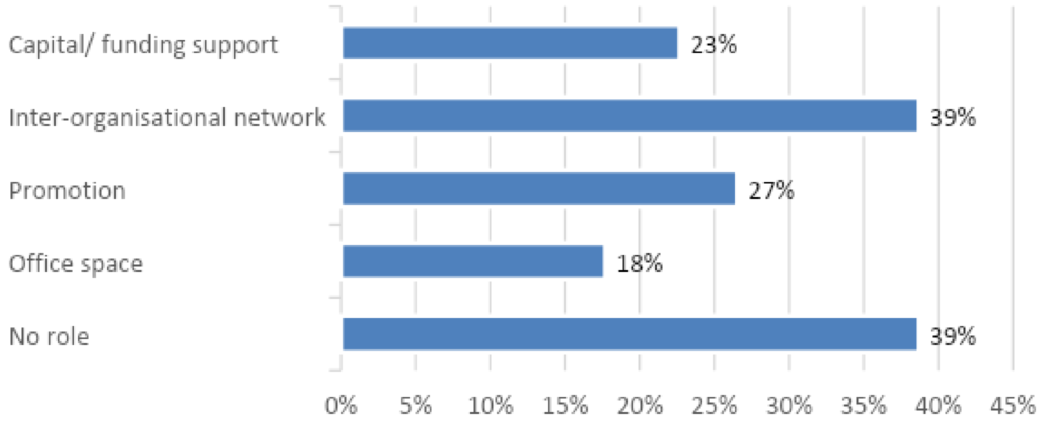

Figure 4.6 Role played by facilitators

Figure 4.7 focuses on the perceived roles played by financial institutions in supporting SMEs. The results indicated that financial institutions were believed to have a strong role in providing financing (60%), thereby highlighting the importance of access to financial resources for SMEs' growth and innovation. However, a considerable percentage of SMEs (27%) did not perceive any role for financial institutions in their business activities, indicating potential gaps in understanding or utilisation of financial institution services. Notably, only a small percentage of respondents (16%) perceived a role for financial institutions in mentoring, suggesting a potential area for enhancement in financial institution services to provide valuable guidance and support to SMEs beyond mere financing. Additionally, a quarter of SMEs recognized the importance of financial institutions in facilitating inter-organizational network support, indicating an acknowledgement of the networking opportunities provided by these institutions.

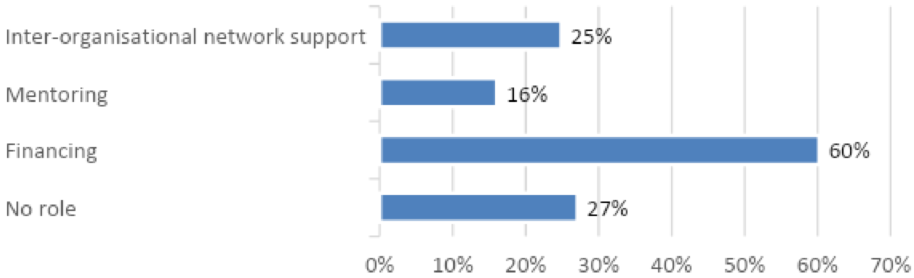

Figure 4.7 Role played by financial institutions

Figure 4.8 presented the perceived roles played by the media in supporting SMEs. The findings revealed that media play a significant role in promoting and branding SMEs' products or services (68%). This highlighted the recognition among SMEs of the value of media exposure for business growth and visibility. Furthermore, over half of the respondents (52%) believed that media could contribute to their sales and marketing efforts, indicating the perceived role of media in expanding market reach and customer engagement. However, the role of media in mentoring and inter-organizational networks had lower significance, with only a small percentage of SMEs attributing these roles to the media. This suggests that SMEs may not see media as potential mentors or facilitators of networking opportunities. Interestingly, a notable portion of SMEs (22%) did not perceive any role for media in their business activities, indicating potential gaps in understanding or utilisation of media resources.

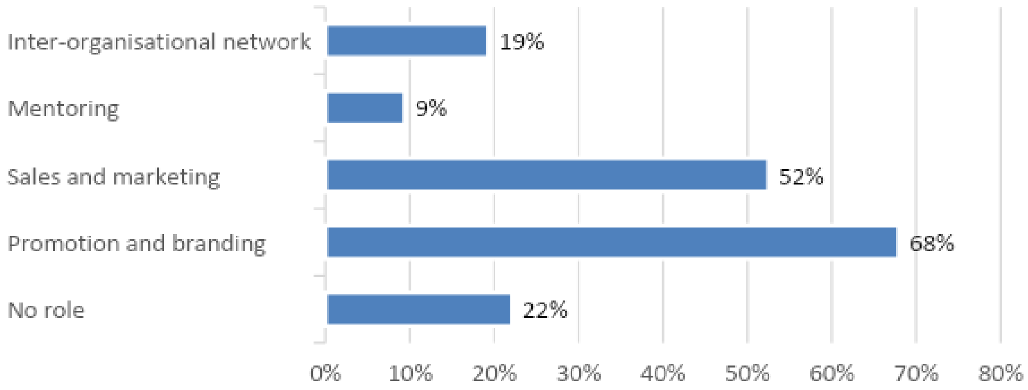

Figure 4.8 Role played by media

Overall, the results of Figure 4.6 to 4.8 shed light on SMEs' perceptions of the roles played by different stakeholders in supporting their businesses. The findings underscore the recognized importance of inter-organizational networks, capital/funding support, financing, promotion and branding, and sales and marketing for Hong Kong SMEs' growth and innovation. However, the results also suggested potential areas for improvement in the services provided by facilitators, financial institutions, and the media, such as enhancing awareness and understanding among Hong Kong SMEs of the available support and resources.

4.3.5 Push and pull factors of OI among Hong Kong SMEs

The analysis addressing Research Question 5 explores why SMEs would or wouldn't engage in OI activities with counterparts like government, universities, financial institutions, agencies, and media.

(1) Reasons why SMEs do not adopt OI

Two main sources of quantitative data were collected to investigate the reasons why SMEs do not adopt OI. The first was respondents' self-reported reasons for not participating in each form of OI, whereas the second was their perceived barrier for participating in OI as a whole.

Figure 4.9 illustrated the reasons why individuals did not participate in certain activities, categorised by three factors: 'Not participated because not interested,' 'Not participated because not related to my industry,' and 'Not participated due to objective constraints.'

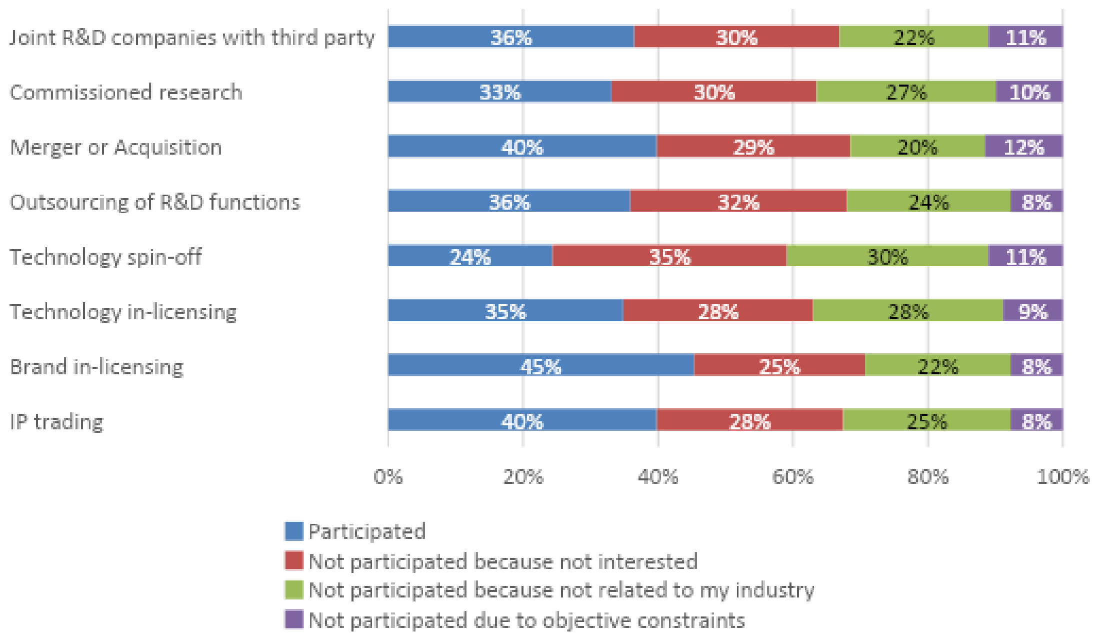

Figure 4.9 Reasons why SMEs do not adopt inbound OI (N=144)

Besides not being related to their field of industry, which is linked to industry-specific characteristics, the choice of the other two reasons deserves more attention. Approximately 10 percent of the SMEs surveyed rated their non-participation in all forms of inbound OI as 'due to objective constraints'. While the percentage seems equally small for each option, the discrepancy between each OI option becomes evident when compared to the percentage of choosing 'not interested'. The options of 'merger or acquisition' and 'joint R&D companies with third parties' were comparatively more frequently chosen than the other options. In contrast, for options of 'brand in-licensing', 'IP trading', and 'outsourcing of R&D functions', objective constraints were less frequently chosen as a reason for non-participation; instead, a higher number of SMEs chose being 'not interested' as a main reason, which is a subjective feeling that deserves attention.

Specifically, at the top of the list was 'technology spin-off,' with 35% of individuals stating that they did not participate because they were not interested. 'Outsourcing of R&D functions' follows closely with 32% of respondents indicating disinterest as the reason for non-participation. This implied a similar level of apathy towards outsourcing research and development tasks to external parties. The third highest reason for non-participation due to disinterest was 'commissioned research,' with 30% of respondents expressing a lack of interest in this activity. Both 'joint R&D companies with third parties' and 'merger or acquisition' shared a participation rate of 29%. This indicated that a significant number of individuals did not partake in these activities because they lacked interest. 'Technology in-licensing' corresponded to a disinterest rate of 28%. Similarly, 'IP trading' and 'Brand in-licensing' both had a participation rate of 25% among respondents who did not engage due to disinterest. These figures suggested a relatively high proportion of individuals who were not interested in participating in these specific activities.

Figure 4.10 provides an illustration of the factors influencing individuals' non-participation in outbound OI activities. These factors are categorised into four groups: 'Not participated because not interested,' 'Not participated because not related to my industry,' 'Not participated due to objective constraints,' and 'Not participated for some reasons (else)'.

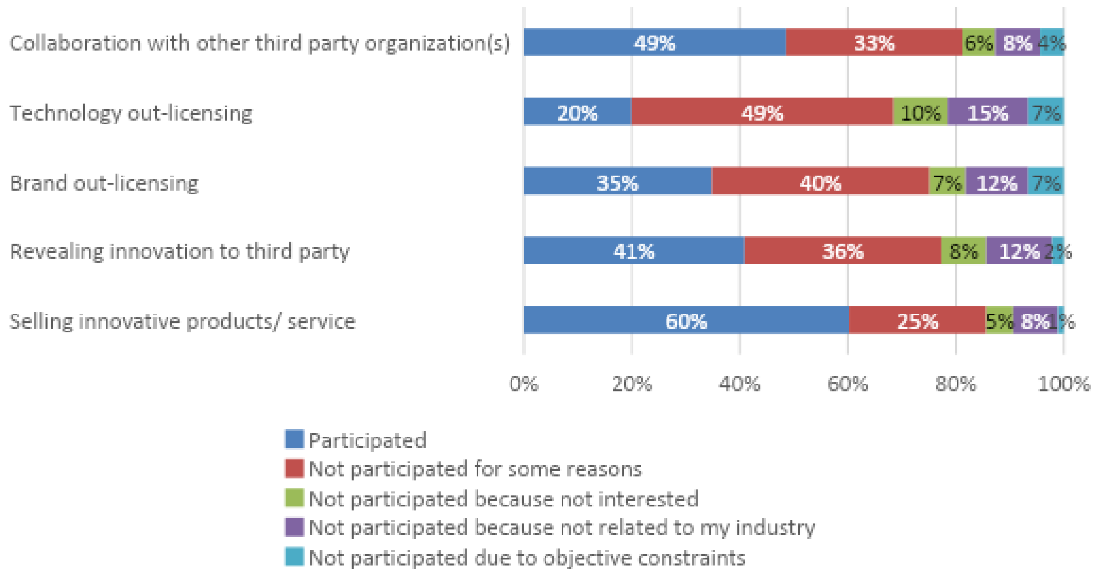

Figure 4.10 Reasons why SMEs do not adoption outbound OI

Although the reasons of 'for some other reasons' and 'not being related to their industry' were present, the focus should be directed towards the other two reasons. Approximately 5 percent of the surveyed SMEs cited 'objective constraints' as the cause for their non-participation in all forms of outbound OI. While there are slight variations in the percentages across the listed outbound OI options, the disparity between each option became more pronounced when compared to the percentage of those choosing 'not interested.' Among the options, 'brand out-licensing,' 'technology out-licensing,' and 'collaboration with other third-party organisations' were the more frequently chosen options. Conversely, for the options of 'selling innovative products/services' and 'revealing innovation to third parties,' objective constraints were less commonly selected as reasons for non-participation. Instead, a larger number of

SMEs cited ‘not interested’ as the primary reason, which is a subjective sentiment that warrants attention.

Figure 4.11 presents the perceived barriers to SMEs’ involvement in OI. The most significant barrier identified by SMEs is the inability to locate suitable partners, with 43% citing this challenge. Additionally, 37% of SMEs stated a lack of necessary talent, while 33% reported a shortage of capital. A notable proportion (26%) mentioned that required technology is unavailable in the market. Furthermore, 24% expressed uncertainty about finding partners, and 15% didn’t perceive any barriers. Finally, 11% wished for more control over company-owned IP, and 9% cited fear as a barrier.

The results emphasised that the major obstacles faced by Hong Kong SMEs in engaging in OI are the challenges of finding suitable partners, accessing the required talent, and securing adequate capital. To promote SME participation in OI initiatives and stimulate economic growth, it is crucial to address these barriers effectively. Providing guidance and support in partner identification and IP protection would be key strategies in overcoming these challenges.

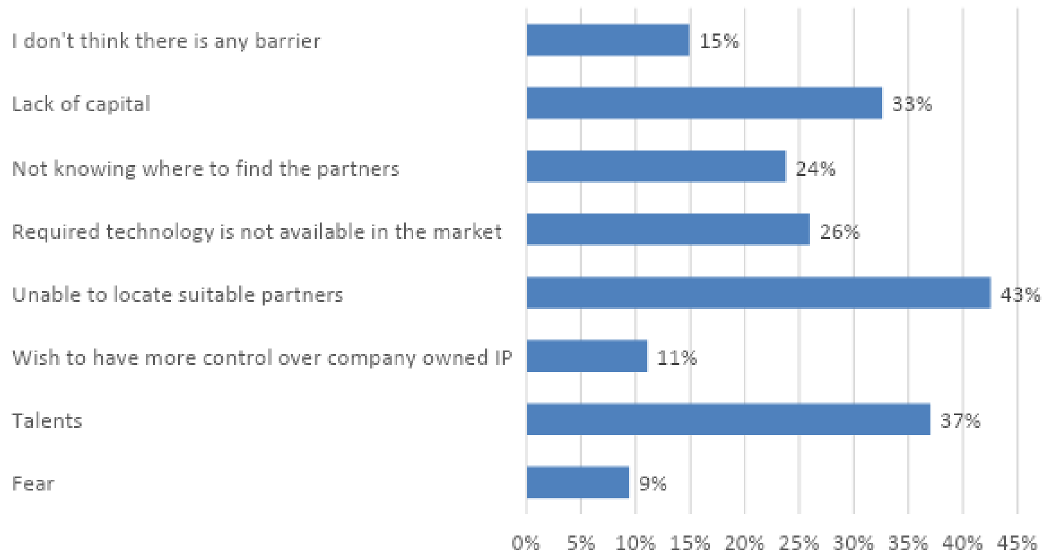

Figure 4.11 Barriers of OI

In order to examine the factors that influence SMEs' perceived barriers to participating in OI, a logit regression model was employed for a regression analysis. The variables considered in the analysis included the Age of the company, Size of the company, R&D proportion, and Industry of the SMEs.

The results presented in Table 4.9 indicate that only the relationship between the Size of the company and the lack of capital as a barrier was found to be statistically significant (Coef. = -0.369, $p < 0.05$). This finding suggests that larger companies, due to their greater available resources, encounter fewer obstacles related to limited capital when considering involvement in OI activities; this explanation has been partially substantiated by the qualitative data (see Chapter 6). Conversely, the relationships between the other variables, namely Age of the company, R&D proportion, and Industry of the SMEs, and the perceived barriers to participating in OI were not found to be statistically significant. This implied that there is no significant variation in SMEs' perceived barriers to engaging in OI based on these characteristics. Alternatively, it suggested that these barriers remain relatively consistent across SMEs regardless of their company age, R&D proportion, or industry.

Table 4.9 Factors influencing perceived barriers for adopting OI

	m1	m2	m3	m4	m5	m6	m7	m8
	Fear	Lack of talents	For more control over company owned IP	Unable to locate suitable partners	Required technology is not available in the market	Not knowing where to find the partners	Lack of capital	No barrier
Age of company	-0.259	0.168	-0.118	0.158	-0.162	0.111	0.174	0.280
	(0.223)	(0.147)	(0.215)	(0.141)	(0.158)	(0.166)	(0.151)	(0.231)

Size of company	0.123	0.068	0.169	-0.206	0.067	-0.062	-0.369**	0.116
	(0.175)	(0.103)	(0.160)	(0.106)	(0.118)	(0.125)	(0.132)	(0.135)
R&D proportion	-0.196	-0.018	0.205	0.063	0.154	-0.096	-0.090	-0.041
	(0.170)	(0.088)	(0.126)	(0.086)	(0.099)	(0.106)	(0.097)	(0.122)
Industry_Culture and sports related (as reference)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)	(.)
Industry_Financial services	0.000	-0.540	-1.611	0.354	-0.310	-1.016	-1.150	1.473
	(.)	(0.636)	(1.237)	(0.621)	(0.744)	(0.754)	(0.702)	(0.870)
Industry_Innovation and technology	0.801	0.078	-0.046	0.179	-0.606	-0.353	-0.425	0.741
	(1.174)	(0.566)	(0.770)	(0.567)	(0.671)	(0.630)	(0.584)	(0.859)
Industry_Professional and producer services	0.837	-0.376	-0.519	0.073	0.707	-0.286	-0.239	-0.839
	(1.146)	(0.560)	(0.848)	(0.554)	(0.619)	(0.599)	(0.560)	(0.976)
Industry_Tourism & Retails	0.130	-0.247	-0.975	0.096	0.298	0.459	-0.393	0.000
	(1.464)	(0.689)	(1.218)	(0.678)	(0.751)	(0.698)	(0.694)	(.)
Industry_Trading and logistics	1.673	-0.228	0.122	0.440	0.401	-1.076	-0.999	0.155
	(1.176)	(0.659)	(0.923)	(0.651)	(0.732)	(0.810)	(0.715)	(0.997)
Constant	-1.506	-1.077	-2.417*	-0.928	-1.218	-0.807	0.042	-3.335**
	(1.356)	(0.782)	(1.139)	(0.761)	(0.849)	(0.864)	(0.791)	(1.279)
N	128	139	139	139	139	139	139	129
ll	-50	-118	-58	-121	-100	-95	-106	-64
chi2	7.3	3.4	9.7	5.1	7.9	7.5	16.8	18.0

* p<0.05, ** p<0.01, *** p<0.001

(2) Reasons why SMEs adopt OI

Two primary data sources were used to analyse the reasons why Hong Kong SMEs adopt OI: one was their self-reported motivation to participate in OI, and the other was push/ pull factors influencing their willingness to participate in OI.

Figure 4.12 displays the motives for OI among Hong Kong SMEs. Broaden sales and marketing channels took the lead with a substantial percentage of 55%. This indicated that a significant number of Hong Kong SMEs engage in OI to expand their sales and marketing reach. In second place, with a close percentage of 53%, was cost reduction. This suggests that many SMEs view OI as a means of cutting costs in their operations.

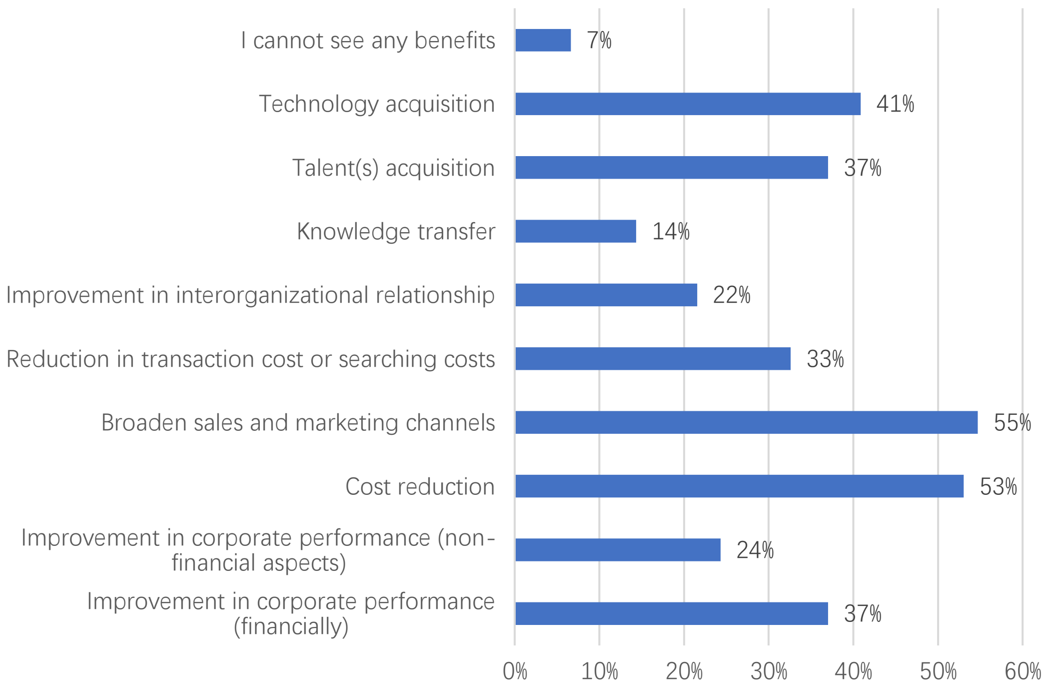

Figure 4.12 SMEs' motivation for participating in OI

Following closely was technology acquisition at 41%. This motive revealed that a considerable proportion of SMEs in Hong Kong aim to acquire new technologies through OI. In fourth and fifth place, both at 37%, we had improvement in corporate performance financially and talent acquisition. These findings implied that a significant number of SMEs seek OI opportunities to enhance their financial performance and acquire talented individuals. Moving down the list, we encountered reduction in transaction cost or searching costs at 33%. This motive highlighted the desire of many SMEs to streamline their operations and minimise costs associated with transactions.

Next, at 24%, we observed improvement in corporate performance in non-financial aspects. Further down the table, we have improvement in interorganizational relationship at 22% and knowledge transfer at 14%. The three motives for OI engagement significantly appeared lower than the previous motives, with all of them lower than 25%. The low percentages indicated that these three motives are less prevalent compared to the preceding ones, though they still indicate a consideration among certain Hong Kong SMEs.

Finally, at a relatively low percentage of 7%, we saw a minority of SMEs expressing that they cannot see any benefits from engaging in OI. While this motive represents the smallest proportion, it demands attention and further investigation.

Overall, the data reveals that among Hong Kong SMEs, broadening sales and marketing channels and cost reduction are the most prevalent motives for engaging in OI. This is followed by technology acquisition, improvement in corporate performance (financially), talent acquisition, reduction in transaction cost or searching costs, improvement in corporate performance (non-financial aspects), improvement in interorganizational relationship, knowledge transfer, and a small percentage of SMEs who cannot perceive any benefits from OI.

The survey also proposed some possible ways out for improving the participation rates of OI among Hong Kong SMEs. Figure 4.13 illustrates the factors that are believed to effectively encourage Hong Kong SMEs to participate in OI. A higher percentage indicated a greater consensus among SMEs regarding the effectiveness of each factor. At the top of the list was ‘Supportive government schemes’ with an overwhelming percentage of 62%. This factor suggested that a vast majority of Hong Kong SMEs perceive government initiatives and programs as influential in motivating their participation in OI.

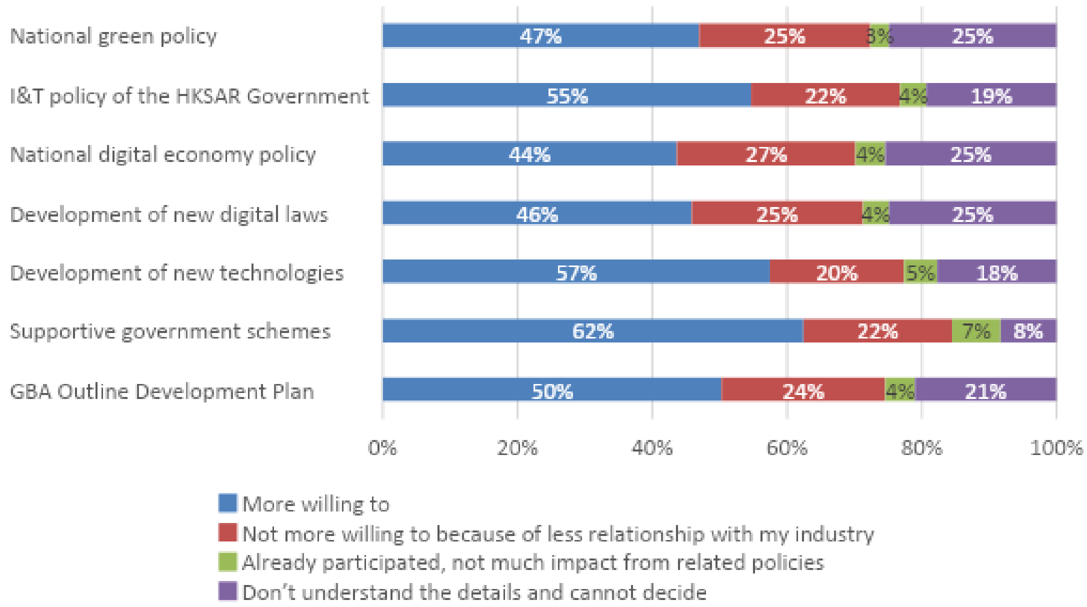

Figure 4.13 Pull factors for OI

Following closely was the ‘development of new technologies’ at 57%. It implied that SMEs believe that keeping pace with the latest technological developments is crucial for their competitiveness and growth, providing important context for their engagement in OI.

In third place, we had the ‘I&T policy of the HKSAR Government’ with a notable percentage of 55%. This suggested that Hong Kong SMEs consider the government’s policy framework as a key driver in fostering an environment conducive to OI.

The ‘GBA Outline Development Plan’ ranked fourth, with 50% of SMEs acknowledging its effectiveness in encouraging OI participation in Hong Kong. This factor underscores the relevance of regional cooperation and collaboration in promoting OI among Hong Kong SMEs.

Conversely, the ‘national green policy’ was at 47%, the ‘development of new digital laws’ at 46%, and the ‘national digital economy policy’ at 44%. These factors were less prevalent than the previous ones, and the data showed that the relatively low percentages can be attributed to SMEs’ lack of knowledge about the relevant laws and policies. This may require more efforts from the government to educate SMEs about the benefits these policies can bring to OI participation.

Overall, the data revealed that among Hong Kong SMEs, supportive government schemes, development of new technologies, and the I&T policy of the HKSAR Government were the most commonly believed factors to be effective in encouraging OI participation. In comparison, while the national green policy, development of new digital laws, and the national digital economy policy are believed to hold substantial importance in motivating SMEs to engage in OI, a significantly larger proportion of SMEs lack awareness of these policies, which discourages their participation.

Figure 4.14 presented factors contributing to SMEs’ willingness to engage in OI practices. The most influential push factor identified by SMEs is the change of company business models, with a significant 69% of respondents indicating they would be more willing to embrace OI due to this factor. This finding suggested that changes in company business models could be transformational and thus poses a demand for external resources to help SMEs to remain competitive in today's rapidly evolving market.

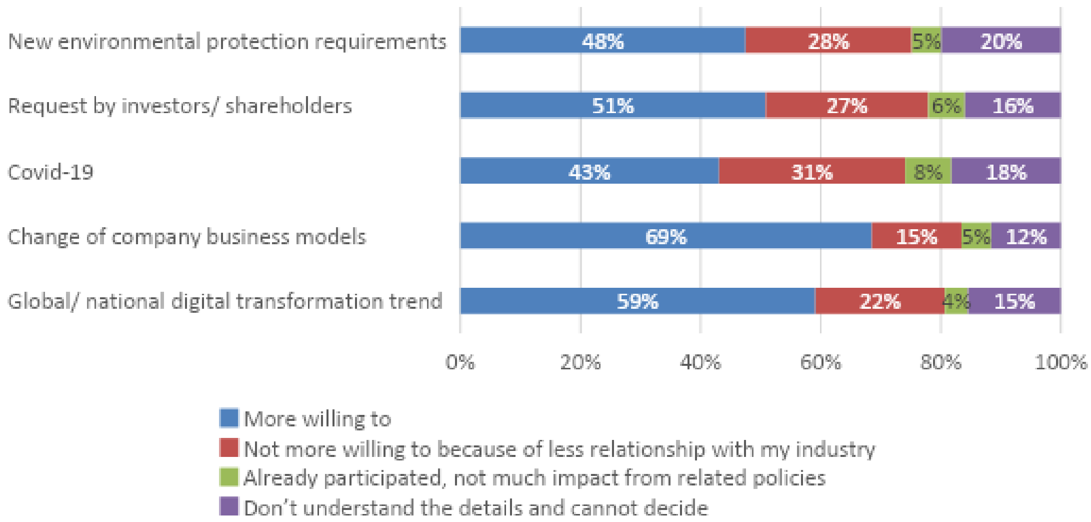

Figure 4.14 Push factors for OI

The global/national digital transformation trend emerged as another significant push factor, with 59% of participants expressing increased willingness towards OI. This result highlighted the growing recognition among SMEs of the transformative potential that digital technologies hold. OI provides SMEs with access to expertise and collaboration opportunities, facilitating their integration into the digital ecosystem and supporting their digital transformation journey.

Request by investors/shareholders was also a notable push factor, with 51% of respondents indicating that it would lead them to be more willing to adopt OI. This finding underscored that investors and shareholders are increasingly recognizing the value of OI in driving business growth and ensuring long-term sustainability. Their requests served as a catalyst for SMEs to seek innovative solutions through partnerships and collaborations, enhancing their ability to attract investment and meet stakeholder expectations.

New environmental protection requirements and the COVID-19 pandemic were also identified by nearly half of participants as a push factor towards embracing OI. This result reflected SMEs' increasing awareness of the importance of sustainable development and their responsibility to mitigate environmental impacts. The disruptive nature of the crisis had compelled SMEs to seek alternative approaches and innovative solutions to adapt their business operations. By engaging in OI, SMEs can access resources, knowledge, and technologies that aid them in developing eco-friendly innovations and meeting environmental standards. This recognition highlighted the potential synergy between sustainability objectives and collaborative innovation efforts. Also, OI offers opportunities for collaboration and knowledge exchange, allowing SMEs to navigate the uncertainties and build resilience in the face of ongoing and future disruptions.

Overall, the survey findings illustrated that several push factors influence SMEs' willingness to adopt OI. The most influential factors included the change of company business models, the global/national digital transformation trend, and requests by investors/shareholders. These findings emphasised the importance of adapting to market trends, embracing digital transformation, meeting stakeholder demands, addressing sustainability goals, and responding to external shocks. Understanding these push factors can inform policymakers, industry practitioners, and SMEs themselves in developing strategies to promote and facilitate the adoption of OI practices.

Using the ordered logistic regression model, I explored the relationship between motives for participating in OI and SMEs' relationships with OI partners. I examined whether these relationships are influenced by different motives. The results shown in Table 4.10 indicated that several motive variables were able to predict the relationship.

The analysis revealed that the relationship between SMEs and other OI partners was associated with their motives for participating in OI, particularly motives related to technology acquisition, cost reduction, knowledge transfer, and performance (both financial and nonfinancial). These motives exhibited significant associations with the aforementioned relationships. The motive for technology acquisition significantly and positively predicted SMEs' relationships with large companies in the same industry (Coef. = 1.233, $p < 0.001$), customers (Coef. = 0.916, $p < 0.01$), large companies in other industries (Coef. = 0.882, $p < 0.01$), financial institutions (Coef. = 0.800, $p < 0.01$), government organisations (Coef. = 0.711, $p < 0.05$), and SMEs in the same industry (Coef. = 0.624, $p < 0.05$). This indicated that, all else being equal, SMEs that are driven by technology acquisition when participating in OI tend to maintain closer relationships with these partners.

Similarly, the motive for cost reduction was also a significant factor that positively predicts SMEs' relationships with companies in the same industry (Coef. = 0.945, $p < 0.01$), suppliers (Coef. = 0.934, $p < 0.01$), SMEs in other industries (Coef. = 0.905, $p < 0.01$), customers (Coef. = 0.883, $p < 0.01$), large companies in the same industry (Coef. = 0.840, $p < 0.01$), government organisations (Coef. = 0.755, $p < 0.05$), financial institutions (Coef. = 0.709, $p < 0.05$), large companies in other industries (Coef. = 0.663, $p < 0.05$), and competitors (Coef. = 0.647, $p < 0.05$). These results indicated that, all else being equal, SMEs that are driven by cost saving when participating in OI tend to maintain closer relationships with these partners compared to their counterparts. The results were corroborated by the qualitative data and would be discussed in Chapter 6.

The motive for improving non-financial performance was also found to be a significant factor that positively predicts SMEs' partnership in OI, including their relationships with customers (Coef. = 0.920, $p < 0.05$), SMEs in other industries (Coef. = 0.842, $p < 0.05$), suppliers (Coef. = 0.798, $p < 0.05$), and industry consultants (Coef. = 0.779, $p < 0.05$).

Additionally, the motive to broaden sales and marketing channels was found to be positively associated with SMEs' relationships with suppliers (Coef. = 0.736, $p < 0.05$). However, the regression results also showed that some motives for participating in OI were negatively associated with SMEs' relationships with their partners. For instance, the results showed that SMEs with high motives for knowledge transfer tend to maintain a less close relationship with government organisations (Coef. = -0.870, $p < 0.05$) and large companies in other industries (Coef. = -0.865, $p < 0.05$). Additionally, SMEs with a higher motive for improving financial performance tended to maintain a weaker relationship with suppliers (Coef. = -0.741, $p < 0.05$). These negative correlations may arise because SMEs that place too much emphasis on financial goals, particularly when it becomes their sole goal for participating in OI, may adopt a pragmatic approach that weakens their relationship with stakeholders they perceive as irrelevant. These findings supported comments from survey respondents who noted that Hong Kong people tend to prioritise interests excessively, hindering their active participation in OI.

Table 4.10 Association of motivation for OI with SMEs' relationship with their partners

	m1	m2	m3	m4	m5	m6	m7	m8	m9	m10	m11	m12
	SMEs_ same industry	SMEs_ other industry	Large companies _same industry	Large companies _other industry	Universit ies/ Research Institutes	Government organisations	Suppliers	Customers	Competitors	Industry consultants	Media	Financial institutions
Motive_no_benefit	-0.519	-0.881	-0.526	-0.778	0.292	-0.267	-0.488	-0.622	-0.747	-0.676	-0.752	-1.158
	(0.631)	(0.670)	(0.628)	(0.667)	(0.648)	(0.633)	(0.609)	(0.620)	(0.638)	(0.638)	(0.646)	(0.660)
Motive_performance_ financial	-0.301	-0.325	-0.177	-0.130	0.455	0.185	-0.741*	-0.573	0.095	-0.139	-0.290	0.065
	(0.322)	(0.319)	(0.323)	(0.320)	(0.319)	(0.309)	(0.324)	(0.325)	(0.316)	(0.319)	(0.317)	(0.321)
Motive_performance_ nonfinancial	0.516	0.842*	0.574	0.667	0.684	0.660	0.798*	0.920*	0.654	0.779*	0.581	0.345
	(0.367)	(0.357)	(0.362)	(0.360)	(0.356)	(0.357)	(0.359)	(0.368)	(0.353)	(0.353)	(0.355)	(0.354)
Motive_cost_reduction	0.945**	0.905**	0.840**	0.663*	0.508	0.755*	0.934**	0.883**	0.647*	0.608	0.185	0.709*
	(0.320)	(0.324)	(0.322)	(0.319)	(0.324)	(0.316)	(0.316)	(0.314)	(0.310)	(0.313)	(0.308)	(0.317)
Motive_sales_ marketing_channels	0.521	0.346	0.290	0.453	0.462	0.472	0.736*	0.162	0.093	0.231	0.330	-0.319
	(0.308)	(0.299)	(0.303)	(0.306)	(0.309)	(0.305)	(0.300)	(0.306)	(0.305)	(0.301)	(0.305)	(0.308)
Motive_transaction_ cost_reduc	0.074	0.080	-0.224	-0.100	0.066	-0.310	0.142	0.058	-0.549	-0.396	0.185	-0.292
	(0.332)	(0.335)	(0.341)	(0.344)	(0.332)	(0.331)	(0.328)	(0.330)	(0.346)	(0.329)	(0.318)	(0.330)
Motive_interorg_ relationship	0.000	0.012	-0.226	0.072	0.258	0.439	0.002	-0.313	-0.041	0.056	0.070	0.299
	(0.373)	(0.380)	(0.370)	(0.374)	(0.374)	(0.365)	(0.372)	(0.373)	(0.367)	(0.360)	(0.361)	(0.363)
Motive_knowledge_ transfer	-0.298	-0.335	-0.439	-0.865*	-0.696	-0.870*	-0.212	-0.801	-0.253	-0.738	-0.068	-0.477
	(0.425)	(0.433)	(0.416)	(0.434)	(0.446)	(0.442)	(0.439)	(0.422)	(0.443)	(0.435)	(0.418)	(0.431)
Motive_talent_ acquisition	0.406	0.378	-0.201	-0.107	-0.312	-0.343	-0.055	-0.078	0.082	0.262	0.192	-0.443

	(0.310)	(0.315)	(0.316)	(0.315)	(0.325)	(0.316)	(0.307)	(0.317)	(0.311)	(0.308)	(0.308)	(0.319)
Motive_technology_ acquisition	0.624*	0.452	1.233***	0.882**	0.547	0.711*	0.449	0.916**	0.289	0.373	0.287	0.800**
	(0.296)	(0.297)	(0.308)	(0.304)	(0.303)	(0.299)	(0.297)	(0.310)	(0.301)	(0.298)	(0.295)	(0.310)
/												
cut1	-0.090	-0.200	-0.107	-0.082	0.579	0.169	-0.795*	-1.162***	-0.405	-0.323	-0.536	-0.336
	(0.311)	(0.307)	(0.300)	(0.301)	(0.314)	(0.310)	(0.317)	(0.324)	(0.304)	(0.303)	(0.307)	(0.304)
cut2	1.059**	0.985**	1.026**	1.024**	1.330***	1.058***	0.395	-0.206	0.803*	0.772*	0.596	0.611*
	(0.325)	(0.316)	(0.314)	(0.313)	(0.328)	(0.321)	(0.304)	(0.305)	(0.313)	(0.308)	(0.310)	(0.306)
cut3	1.673***	2.035***	1.944***	2.096***	2.175***	1.936***	1.384***	0.570	1.908***	1.675***	1.409***	1.607***
	(0.336)	(0.344)	(0.339)	(0.342)	(0.350)	(0.342)	(0.320)	(0.307)	(0.340)	(0.330)	(0.323)	(0.324)
cut4	2.923***	3.176***	2.959***	3.476***	3.306***	3.107***	2.623***	1.624***	3.341***	3.080***	2.789***	3.023***
	(0.372)	(0.391)	(0.374)	(0.411)	(0.400)	(0.389)	(0.361)	(0.325)	(0.426)	(0.399)	(0.377)	(0.401)
N	139	139	139	139	139	139	139	139	139	139	139	139
ll	-268	-267	-267	-263	-257	-266	-273	-267	-263	-269	-276	-260
chi2	38.5	38.0	35.3	30.9	24.6	28.7	35.0	32.2	16.8	19.9	15.7	22.3

* p<0.05, ** p<0.01, *** p<0.001

4.4 Summary of Qualitative Findings

The quantitative results presented in this chapter provides valuable insights into OI practices among Hong Kong SMEs. Through an analysis of the data, the following key findings have emerged.

(1) High OI Participation: The findings highlighted a high level of participation in both inbound and outbound OI activities among Hong Kong SMEs, with the former (79.2%) slightly higher than the latter form (72.2%). This indicates a proactive approach to innovation.

(2) Cross-Border Collaborations: The majority of OI partners originated from Hong Kong and Guangdong province, emphasising the significance of cross-border collaborations within the Guangdong-Hong Kong-Macao GBA. SMEs primarily tap into local resources but also engage with partners outside of Hong Kong.

(3) Top Three Most Frequent and Least Frequent Types of Inbound and Outbound OI Partners: In terms of inbound OI partnerships, SMEs most frequently collaborated with other companies in the industry (35%), suppliers (35%), and customers (26%). Similarly, for outbound OI partnerships, SMEs primarily engaged with suppliers (34%), other companies in the industry (31%), and customers (29%). Conversely, the least frequent partners for

SMEs in both inbound and outbound OI collaborations were competitors, government organisations, and online/offline media.

(4) Strong Customer and Supplier Relationships: Hong Kong SMEs had strong relationships with customers and suppliers, indicating the importance of these partnerships in driving innovation. However, there is room for improvement in relationships with large companies, government organisations, industry consultants, and other stakeholders.

(5) Barriers to OI: Finding suitable partners, accessing talent, and securing capital were the major obstacles faced by Hong Kong SMEs in engaging in OI. Addressing these barriers effectively through partner identification support, IP protection, and financial assistance is crucial for promoting SME participation in OI initiatives.

(6) Motives for OI: Broadening sales and marketing channels and cost reduction were the primary motives for Hong Kong SMEs to engage in OI. Technology acquisition, talent acquisition, and improving corporate performance are also significant motivations.

(7) Pull Factors for OI: Among Hong Kong SMEs, supportive government schemes, development of new technologies, and the I&T policy of the government were the most commonly believed factors to be effective in encouraging OI participation. In comparison, some seemingly effective push

factors were less known to the respondents, such as the national green policy, development of new digital laws, and the national digital economy policy.

(8) Push Factors for OI: The most influential factors included the change of company business models, the global/national digital transformation trend, and requests by investors/shareholders.

(9) Motives for OI and Relationship with OI Partners: The relationship between SMEs and OI partners was associated with their motives for participating in OI, particularly in technology acquisition, cost reduction, knowledge transfer, and performance improvement (financial and non-financial).

(10) Factors associated with OI participation: The age and size of the company, as well as the industry in which SMEs operate, influenced their OI activities. Older companies were more likely to outsource R&D functions, while larger companies engage in technology licensing. Financial services and innovation/technology sectors exhibited specific patterns in technology spin-offs, mergers/acquisitions, and collaboration with third parties.

4.5 Chapter Summary

In this chapter, the focus is on the quantitative data analysis and discussion of the research findings related to Hong Kong SMEs' participation in OI. The chapter begins with an introduction, followed by an overview of the sample characteristics.

Section 4.3 delves into the landscape of Hong Kong SMEs’ involvement in OI. The analysis reveals that there is high OI participation with a locally focused collaboration orientation (4.3.1), strong customer-supplier relationships among OI players (4.3.2), and key factors driving SMEs to engage in various types of OI (4.3.3). Furthermore, the study identified a multidimensional OI support mesh for OI development (4.3.4) and examines the push and pull factors of OI among Hong Kong SMEs (4.3.5).

Finally, the chapter concludes with a summary of the qualitative findings, synthesizing the key findings and insights gained from the quantitative analysis. This chapter provides valuable information on the current state of OI in Hong Kong’s SME landscape, offering a foundation for further research and potential strategies for fostering OI development in the region.

CHAPTER V
QUALITATIVE DATA ANALYSIS AND DISCUSSION

5.1 Introduction

This chapter focuses on the results and findings from the qualitative research. It addresses the following research questions: What are the relationships between SMEs and each of the other players? (RQ2), What are the roles of each actor in facilitating (or prohibiting) OI activities in Hong Kong? (RQ4), Why SMEs would/would not involve OI activities with their counterparts? (RQ5), and What kinds of support are offered by the 'players' to SMEs and vice versa? (RQ6). The chapter explores open innovation ecosystem in Hong Kong, analysing drivers and gaps, the roles of various entities such as universities, industries, financial institutions, agents, and media in the OI mechanism, interorganisational relationships, the impact of OI on SMEs and the development of the innovation & technology industry in Hong Kong.

5.2 Drivers for Open Innovation

The emphasis on technology development by the Hong Kong government since 1997 has created a favourable environment for open innovation. According to the summary provided by interviewee G4 from the Government sector (see Table 3.2 Interviewees' profile), the development of Hong Kong's technology industry has undergone three main stages: the start-up stage from 1997 to 2007, the removal of 'technology' from Commerce, Industry and Technology Bureau (CITB) from 2007 to

2015, and the reestablishment of the Innovation and Technology Bureau (ITB) from 2015 to present. Specifically, the Hong Kong government showed great determination to vigorously develop science and technology in Hong Kong after its return to China in 1997. This was seen as a means to address the developmental disadvantage caused by the previous British administration's strong emphasis on promoting the service industry, which resulted in a 'technology vacuum.' In 2007, the newly elected government under Donald Tsang restructured the CITB and removed 'technology' from CITB, effectively relegating it to a lower level within the government structure. It was not until the end of 2015 when the ITB was established that the government adjusted its relevant policies and stated that all technology policies should be driven by downstream initiatives. Accordingly, the first policy address in 2015 introduced many different programme packages. In 2022, Chief Executive John Lee renamed ITB to Innovation, Technology and Industry Bureau (ITIB) and the Secretary of ITIB is Professor Dong SUN who was a world-renowned scholar and scientist (ITIB, n.d.).

The Hong Kong technological Innovation ecosystem, according to interviewees U3 and G4, is composed of three types of organisations: upstream, midstream, and downstream. Upstream refers to universities, midstream refers to five research centres in Hong Kong as well as government organisations such as the Hong Kong Productivity Council, the Hong Kong Science and Technology Parks and the Hong Kong Cyberport, and downstream refers to industry, entrepreneurs and investors. In the aforementioned three stages of Hong Kong's technological development, the first stage was driven by the upstream, i.e. universities. At that time, the government had no experience in technology transfer and believed that universities, which specialise in scientific research, should know more about technology transfer. However, in reality, while universities hold IP and various resources, they lack knowledge of how to do business, resulting in a low rate of technology transfer. In the second stage, the government intended to promote technology transfer through economic development by encouraging downstream enterprises and investors, but this was also ineffective. Moreover, in the first two stages, applied research institutes, as midstream organisations, had no IP and often played a passive role. However, they wanted to engage in technology transfer, so they gradually established their own IP and became more independent. In the third stage, the government learnt from the experiences and lessons of the previous two stages and improved its strategic layout of innovative technology in government work, giving research institutes more autonomy and actively mobilising the demand for digital transformation of SMEs.

The specific drivers for the participation of SMEs in open innovation in Hong Kong can be categorised into four main aspects. Firstly, at the policy level, the government provides various funding schemes to support SMEs in their innovation efforts. For example, the Smart City Blueprint for Hong Kong was published by the Government in 2017, Smart City Blueprint for Hong Kong 2.0 in 2020, followed by the Innovation & Technology Blueprint in 2023, outlining a promising path towards a technology-enabled future for Hong Kong. The Innovation and Technology Fund has introduced three main types of programs: (1) Supporting Research & Development, which includes the Innovation and Technology Support Programme (ITSP) and the Enterprise Support Scheme (ESS); (2) Facilitating Technology Adoption, which includes the Public Sector Trial Scheme (PSTS) and the Technology Voucher Programme (TVP); and (3) Supporting Technology Start-ups, which includes the recently launched Research, Academic and Industry Sectors One-plus Scheme (RAISe+). Additionally, various government organisations have implemented a series of policies to support tech enterprises. For instance, Cyberport has launched the Digital Transformation Support Pilot Programme (DTSPP), while HKSTP has introduced the HKSTP Venture Fund and Incubation/ Acceleration Programme to harness the potential of local universities in transforming and commercialising R&D outcomes (HKSTP, n.d.a; n.d.b; n.d.c).

These various types of tangible innovation and technology support programmes facilitate SMEs to participate in OI. For example, the TVP has played a crucial role in promoting open innovation among local SMEs in Hong Kong. According to participant G2, 'the TVP allows any SMEs to apply and utilise equipment, software, and other resources to enhance their operational efficiency, which is highly beneficial for SMEs.' By providing financial support for the adoption of innovative technologies, the programme encourages SMEs to explore and implement new ideas, collaborate with technology providers, and engage in open innovation practices. Furthermore, interviewee G1 pointed out that the PSTS and the ESS also demonstrate the government's determination to promote open innovation. The former allows tech ventures to test new technologies in the public sector, thereby expanding their market opportunities. The latter, on the other hand, primarily serves as a research matching support fund, providing up to 50% funding matching for R&D projects. This helps to minimise the capital investment required by ventures, thus incentivizing the development of innovative technologies.

Secondly, government departments and government organisations actively engage with technology companies and provide references for their products. This endorsement from government bodies allows the technology companies to gain market recognition and credibility. Testimonies from respondents G2 and G3 have indicated the positive impact of such references on the market perception of these companies.

Thirdly, the government organises various innovation-related events, including Innovation Days and technology competitions. These events serve as platforms for showcasing innovative ideas and solutions. Winners of these competitions not only receive trophies but also gain media coverage. Armed with this recognition and exposure, they have a higher chance of engaging potential customers in the commercial market, which in turn increases their chances of success in market competition.

Lastly, the government is actively promoting open access to both open data and commercial data. Open data initiatives aim to facilitate the utilisation of publicly available data by enterprises to develop innovative applications. This accessibility benefits not only SMEs but also financial institutions, enabling them to explore new avenues for innovation.

In summary, the drivers for SMEs' participation in open innovation in Hong Kong encompass government funding schemes, endorsement of technology products by government bodies, innovation events and competitions, and the promotion of open data and commercial data access. These initiatives collectively create an ecosystem that encourages SMEs to engage in open innovation and increase their chances of success in the competitive market.

5.3 Gaps in Open Innovation

Despite the government's efforts to promote OI and establish a supportive ecosystem, there are still gaps in the OI ecosystem in Hong Kong. The qualitative data show that primary gaps that hinder the participation of Hong Kong SMEs in OI include (1) gaps in domain knowledge, (2) gaps in functional expectations in the value chain, (3) gaps in coordination, (4) gaps in factors of production, and (5) gaps in supply and demand.

5.3.1 Gaps in Domain Knowledge

As per the insights of interviewees U3 and G4, the open innovation ecosystem in Hong Kong encompasses three distinct categories of players, namely upstream, midstream, and downstream. Universities constitute the upstream players, while 5 applied research centres under Innovation and Technology Commission like ASTRI and Logistics and Supply Chain MultiTech R&D Centre (LSCM) represent the midstream players. The downstream players encompass users and investors (Innovation and Technology Commission, n.d.).

The qualitative data suggest that the most prominent gap within the open innovation ecosystem is the limited domain knowledge among upstream enterprises, impeding their capacity to fulfil the requirements of downstream participants. The interview data further highlights two prevailing gaps in domain knowledge.

Firstly, there is a dearth of understanding regarding industry needs among upstream players, including university professors and its technology transfer offices. The following quote reflects this issue.

> *It's not just about the quantity of PhDs or university professors. Because we see many university professors who are working in isolation, they come up with a technological concept without understanding the practicalities of the industry, and then casually propose how the government should act, without any real understanding of the industry's actual needs. (G2)*

Secondly, science and technology-oriented enterprises often lack insight into the practical demands of end-users. Interviewee G2 used the logistics industry as an example to analyse the difficulties in promoting collaboration between technology companies as suppliers and logistics companies as demand-side. He pointed out that, on the one hand, there are not many companies familiar with technology in the logistics field, and on the other hand, technology companies as suppliers do not know the specific needs of SMEs, and have not developed products that meet market demands. Therefore, despite the government's strong push for SMEs to use technology and the funding it provides, the lack of willingness from both the supply and demand sides to establish a partnership has resulted in many eligible SMEs not applying for the ESS, making it difficult for the relevant policies and schemes to achieve the desired effects.

> *In the innovation and technology market, there are two levels of companies. The first level is the 'end-users,' such as the logistics industry, construction industry, and services industry, which are the sectors where innovative technologies are applied. The upper level consists of the innovative technologies themselves, often represented by startups and similar ventures. However, there is rarely any overlap between these two levels. People within the industry often lack an understanding of innovative technologies, while those working in innovative technologies are usually young and passionate but lack industry-specific expertise. (G2)*

Both manifestations of these knowledge gaps hinder upstream organisations from meeting the expectations of downstream users and investors, leading to challenges in the commercialization of research outcomes and a restricted market reach.

5.3.2 Gap in Functional Expectations in the Value Chain

Significant disparities exist between each player's expectations within the value chain regarding the functionality of other players and their actual performance. These gaps are especially critical in their impacts on the participation of SMEs in OI and are primarily evident in three key areas: the market's expectations of the government, the government’s expectations of universities, and the industry’s expectations of universities.

(1) The market’s expectations of government

Firstly, the market expects the government/universities to lower patent usage fees to facilitate the adoption of advanced technologies and promote their own digital transformation. However, the government/universities believes it has an obligation to protect innovation from being stolen, thus implementing strict IP protection policies and setting high licensing fees. The high costs associated with intellectual property rights in Hong Kong make it financially burdensome for SMEs to afford patent applications and usage fees, thereby undermining the protection and promotion of innovative activities. As noted by interviewee U1, the fee for IP licensing is as high as HKD 500,000. Furthermore, these high costs associated with IP protection and enforcement severely deter companies from engaging in open collaboration, as they fear the risk of intellectual property infringement. The following quote from U3 also resonated with such an idea.

> *Currently, licensing an IP costs 500,000 (HKD). For an SME or startup, they would think, ‘I haven’t even started my business yet. I have to struggle and fight for a small profit, maybe a few million (HKD), and you want 500,000 (HKD) from me? No way!’ (U3)*

Secondly, the industry expects the government and its organisations to provide incubation services that effectively support the development of SMEs. However, in reality, some government agencies often consider their job done by merely providing space and funding to SMEs.

> *They feel that they are only providing a platform, and the most extreme example is that they see themselves as just an estate manager, such as the HKSTP or the Cyberport. Tenants come to rent my things, and that's it. Money is the same; I'm just someone who lends you money or pays you money. That's it. The money is here, go ahead and apply. That's how it is. (G4)*

(2) The government's expectations of universities

The government considers university professors as experts in their respective fields and expects them to promote open innovation. However, in reality, universities strongly believe that their primary mission is to foster the growth of talented individuals and drive advancements in the field of sciences, prioritising these objectives over engaging in commercial endeavours. Also, university professors prioritise academic excellence KPIs set by the university, rather than socio-economic benefits. Therefore, they are not inclined to invest significant effort into technology transfer.

> *The gap is inevitable, it does exist. For example, as a professor, he lacks a sense of time. He only needs to focus on research and publish his papers. In the industry, there are tight deadlines, and he is often unwilling or unable to compromise because of the tight deadlines. If you ask academia to meet the deadlines, the teachers will*

> *generally think, 'I know what my goals are, and I'm not short of money. Why should I help you?' So, let's not do it. Instead of this, I'd better focus on my own projects. That's the situation. (G4)*

> Every player has different performance indicators. UGC has its own performance indicators, and universities just do what they can. However, sometimes universities also feel that this is not their main job because they have to balance between research and teaching, and not just focus on commercialization. (U2)

In the past, the government held the belief that by pushing innovation from the upstream, a fertile environment for groundbreaking ideas would naturally emerge. However, the industry has frequently communicated to the government that this mindset is ineffective and requires re-evaluation. The data shows that an important reason why professors believe they should be loyal to academia rather than society is that they believe the government and the university pay them a yearly salary for 12 months to deepen their academic research. Therefore, they believe they should not get extra benefits from technology transfer, as noted by U3 in the following quote. Academics are hindered from participating in open innovation due to the lack of rights to connect with the industry at universities. This hinders collaboration, which is essential for innovative solutions that benefit society.

Prior to 2019, faculty members were generally not allowed to legally own shares in certain companies, and even if they did, the ownership was very limited. Why? Various media outlets repeatedly emphasised that this was seen as a transfer of interests, involving collusion between the government and businesses. Unlike in the United States, where faculty members only receive nine months of salary, academics in Hong Kong receive a full year's salary. It is believed that engaging in research and innovation is already enjoying double benefits. Therefore, since teachers receive a full year's salary, they should focus on their responsibility. (U3)

(3) The industry's expectations of universities

As mentioned earlier, Hong Kong universities primarily focus on outbound OI and have minimal inbound OI, resulting in a gap between upstream (universities) and downstream (users & investors). The industry, represented by SMEs, expects that university professors can conduct scientific research that addresses real-life societal issues. It holds the notion that universities are the ideal source for seeking technological solutions. Yet, they frequently encounter instances where universities fall short of meeting their lofty expectations. As academia values professors' pursuit of cutting-edge research ahead of societal demands, SMEs may feel somewhat disappointed with the solutions provided by professors. The following quote reflects the challenges faced by university technology transfer offices (KTOs) led by scholars lacking business experience in achieving the desired outcomes.

The KTOs I know are still not effective because the management is often driven by vice-chancellors or professors below them. They lack the concept of doing business. If the KTO functions as a business unit, they would lack this element. However, I often say it's a positioning issue. What is the role of a university? Everyone needs to first understand that it has always been involved in two things, nurturing talent and the advancement of sciences. How to promote science is the focus, so we do a lot of research. This has been our concept for over a century, so doing business is not something our university excels in. (G4)

5.3.3 Gaps in Coordination

The interview data also uncovers a crucial gap in coordination, in addition to the aforementioned gaps. This gap stems from the fact that in Hong Kong's open innovation ecosystem, each player tends to work independently, resulting in a lack of synergy. Despite the government's recognition of the differences in operational logic between the industry and universities, its establishment of Cyberport, Hong Kong Science & Technology Parks (HKSTP), and five applied research centres to bridge the gap has not resulted in effective coordination and collaboration among different players in open innovation.

The data suggest that a significant reason for this gap is that each player operates according to its own logic. For instance, while government departments are the primary promoters and advocates of the open innovation ecosystem, they are still bound by their own rules, such as bureaucratic procedures. In the field of technological innovation, where fast-paced progress is often necessary, the time-consuming approval processes imposed by the government can hinder innovation and slow down the efficiency of technological advancements. Cumbersome bureaucratic processes and lengthy approval timelines can discourage companies from pursuing collaborative projects or seeking external partnerships. The time-consuming nature of administrative procedures hampers the agility and responsiveness required for effective open innovation, limiting the ability to capitalise on time-sensitive opportunities. The Participant from U3 compared the administrative efficiency between Hong Kong and mainland China and expressed his complaint towards the former.

> *For all projects approved on the mainland, it takes only one month from submission to implementation. Everything is completed within two months, and within 18 or 24 months, they will review the project progress for further assessment. Therefore, in our cooperation with the mainland, the efficiency of government review is very high. On the other hand, why does Hong Kong take so long? It's because there are so many committees. For example, how many years did it take for Maker Hong Kong to go from idea to evaluation? Countless years. How many years did it take for the Hetao Development Zone? Countless years. From 2015 to now, eight years have passed. (U3)*

5.3.4 Gaps in Factors of Production

The constrained land area of Hong Kong poses significant disadvantages in terms of the production. High land prices and labour costs impose financial burdens on companies, increasing operational expenses. The city's soaring property prices and expensive labour force make it financially burdensome for companies, particularly startups and SMEs, to invest in R&D activities. The high cost of securing suitable premises for innovation centres or laboratories, coupled with the need to attract and retain skilled talent, creates financial constraints that impede the adoption of open innovation practices. These cost pressures often lead to a prioritisation of short-term gains over long-term innovative endeavours. Both SMEs and agencies expressed similar concerns, as shown in the quote below.

> *The biggest limiting factor is cost. Especially now, everyone is talking about how difficult it is to find a job and trying to save costs in every possible way. It's particularly challenging to hire people in the city centre. Now I realise it's really not easy to recruit people to work in Admiralty. (A1)*

These unfavourable conditions especially disadvantage technology enterprises. This is due to the fact that R&D activities necessitate sufficient space for testing and innovation, as well as a sizable market to validate and adopt new products. The limited land area in Hong Kong presents challenges in meeting these requirements. The scarcity of available land for R&D purposes hinders the expansion of innovative activities and restricts the potential for open collaboration among industry players. Both interviewees, U1 and U3, highlighted the primary challenge posed by limited space, which is the incomplete industry chain in Hong Kong and the lack of room for R&D experiments.

> *Without sufficient workspace and engineering technical support, it's difficult to turn good ideas into feasible plans. Research results need to go through many stages before they can be applicable to the industry. Hong Kong universities lack resources and struggle with certain stages. Although we have a little more workspace now, we still lack engineering support to turn our ideas into feasible plans. However, Shenzhen is a much more ideal place for implementation, so we can place some SMEs or research bases in Shenzhen. In addition, nowadays some Hong Kong universities are opening campuses in mainland China, and we can also utilise their workspaces and engineering support. Even if we solve the technical problems, there are still many intermediate stages that need to be overcome before the results can be applied to the industry. This is an issue of the entire value chain. We are aware of this, but we still have many challenges to overcome before we can establish connections with the industry. (U1)*

> *The institutions in Hong Kong lack proper facilities for medium-scale or small-scale trials. You see, we do have labs but they are very small. Today, even our clean room is tiny, and many of the prototypes can't be executed from our studies. Even though*

we have our industrial centre, we only have 3D printings. However, it is only capable of producing only small models instead of larger prototypes. *(U3)*

Capital is another critical factor in production. SMEs need capital to sustain or expand their businesses. There are different sources of capital in the market. For example, SMEs can borrow money from their friends or relatives in the early stages as the capital requirement is relatively tiny. They can also borrow money from the bank. After the SME has reached a specific scale, they can resort to capital investment from individual investors and even institution investors in the later stage. When the SME has grown to a certain level, it can go for an Initial Public Offering (IPO) and raise capital or funds from the financial market. As per the view from I4, Angel investors or start-up incubators may act as the financial advisors of the SMEs and give relevant advice to SMEs to match with the growing stages according to the SMEs' business plan.

We actually act as a typical intermediate while under the name financial advisors. On one hand we teach the startup how to prepare business plans to match the requirements of investors, especially the financials as usually the startups are either too conservative or totally unrealistic. On the other hand, institution investors actually entrust us to do initial scouting and filtering of deals so that they don't waste too much time reviewing a non-starter. Reputation is important in our industry. *(I4)*

5.3.5 Gaps in Supply and Demand

The interview data also highlights inherent disadvantages in Hong Kong's market environment, primarily evident in the small market size and presence of industry monopolies.

The relatively small market size limits profit potential. With a limited domestic consumer base, companies face difficulties in achieving economies of scale and justifying the investment required for collaborative innovation projects. The small market also restricts the diversity of potential partners and limits the range of expertise and resources available for open innovation initiatives. Consequently, as noted in the quote below, many companies with entrepreneurial intentions finally moved their companies to Shenzhen because they can have the whole mainland China as their experimental site and also reduce the costs.

> *In my opinion, most of the innovation in Hong Kong currently face a problem. You can see that universities usually collaborate with hundreds of companies. However, these companies typically only collaborate with 10% to 15% of the university research staff. Moreover, these collaborations often only last for one or two years, with only 50% able to continue, so in the end only 20-30 companies can persist for more than three years. And those that can persist and have been around for more than five years are what we now call 'unicorns'. However, most unicorns have gone to Shenzhen or other mainland cities because there isn't a big market like the mainland and therefore companies*

cannot develop sustainably. This means that because they did not initially find local support in Hong Kong, they naturally went to the mainland, and after entering the mainland, their R&D teams and manufacturing were all done there. So how can Hong Kong establish a system that is equivalent to the mainland? In fact, it is impossible. That's why I repeatedly emphasise to local industry leaders, especially the leaders in various industries, that they should provide some experimental scenarios for entrepreneurs in local universities. (U3)

Furthermore, the presence of industry oligopolies, which are difficult to eliminate, restricts the acceptance and market reach of emerging technology enterprises. Interviewee U3 noted that as there are a few dominant players holding significant market power in the business sector, startups usually find it hard to test their product in the real contexts. Failure to do so usually means that they cannot keep improving their product to a satisfactory level, which in turn makes it hard to profit. The interviewee noted that this was an important factor that pushed many companies unwilling to embrace open innovation practices and even relocate to Shenzhen.

Due to the fact that each small enterprise has its own unique set of issues, these solutions often cannot be scaled up to the industrial level. Monopolistic industries are much more likely to achieve significant and sustainable success. In Hong Kong, various industries are controlled by a few conglomerates. Only when they are open, SMEs can benefit from open innovation. However, even if there are various pilot *programs conducted in universities, it is difficult for the resulting applications to be widely adopted in Hong Kong. For instance, I can track many things, but if the conglomerate that controls the entire supply chain does not allow me to implement my innovations, it becomes impossible to promote them. This conglomerate also interfaces with dozens of small enterprises downstream. … If we develop something that can detect the quality of houses, and a property or real estate company says, 'We're not going to use this software because we don't believe in it.' Why don't they believe in it? Because they say it's not accurate, but without this application scenario, how can I calibrate it? (U1)*

According to SME4 (see Table 3.2 Interviewee' profiles), the majority of entrepreneurial endeavours present lucrative business opportunities. However, it is imperative to acknowledge that embarking on such ventures also entails inherent potential challenges, as noted by participant SME4.

Our innovations may also bring some negative aspects, such as others being hesitant to collaborate with you. This is because you are being innovative. In reality, many so-called innovations nowadays are often focused on changing market structures or addressing efficiency issues. For example, in the past, the efficiency of medical physicians' work may not have been very high, but now AI or other innovative technologies may be introduced, resulting in *breakthrough progress. However, this also brings problems. Just like Tesla's autopilot function now, some issues may arise later on. (SME4)*

As a result of the market conditions, a local saying become well-known among manufacturers in Hong Kong, 'High tech wipes out profits, while low tech makes profits' (High Tech 揩野，Low Tech 捞野), which was mentioned by both interviewees G1 and SME3. This saying conveys the idea that engaging in high-tech product development carries a high risk of financial loss, while low-tech product development is less likely to result in losses. Influenced by such a mindset, traditional industries, such as manufacturing and retail, may exhibit resistances to change and a reluctance to embrace open innovation practices. As noted by Participant I1 in the following quote, this conservative mindset is especially prevalent among SMEs. While this mentality is natural, it should be noted that OI cannot occur without some negotiation and necessary loss.

During this period's time they also tried to create it or with what we call the week creative, or new product. This is what we call open innovation. And they ask for extra funding. And of course, like this particular, because those new innovations actually tap in with the existing product or existing solution they have. So that's why we add extra investment for that. (I1)

5.4 The Open Innovation Mechanism

This section delves into the role of each stakeholder in the open innovation ecosystem in Hong Kong. The findings are primarily based on the interview data from corresponding sectors, including industries, universities, government, investors, agencies and media who are the key six stakeholders in my proposed Open Innovation Mechanism model.

5.4.1 The role of universities

The first kind of stakeholders in the Open Innovation Mechanism are the universities. Knowledge transfer and broader engagement represent one of the five activity domains in university accountability in Hong Kong (University Grants Committee, 2023). The Technology Transfer Offices in the six local universities in Hong Kong are dedicated to transferring technology from academia to society. These offices include the Knowledge Transfer Office at City University of Hong Kong, the Knowledge Transfer Office at Hong Kong Baptist University, the Office of Research and Knowledge Transfer Services at The Chinese University of Hong Kong, the Institute for Entrepreneurship and the Innovation and Technology Development Office at The Hong Kong Polytechnic University, the Office of Knowledge Transfer at The Hong Kong University of Science and Technology, and the Technology Transfer Office at The University of Hong Kong.

According to the interview data, universities in Hong Kong play a critical role in the OI ecosystem. Firstly, they are essential in knowledge creation, which serves as the foundation for innovation. By conducting research activities, universities generate new ideas, theories, and technological advancements that contribute to the overall knowledge base. Interviewee G4 emphasised that successful university-industry collaboration is always based on competitive technology, which is a clear strength of universities compared to other players in the OI ecosystem. While echoing interviewees U1, U2, and U3, G4 also cautioned that universities should not lose sight of their core mission of fostering innovation. He stressed the importance of universities avoiding the temptation to prioritise marketing skills training over innovation, especially when cultivating students. The following quote illustrates his viewpoint:

> *Promoting the concept of innovation and entrepreneurship at the undergraduate level actually has a significant counterproductive effect. What are current undergraduate students doing? Because they are being pushed to do entrepreneurship, I'm learning how to pitch and talk big. Just think about it, as an engineer, if you haven't mastered the basics, but instead you're learning how to talk, what will you do in the future? You should know that the probability of entrepreneurial failure is very high. After four or five years of trying and failing in business, will you still have the ability to stand up and find a job? It seems like in reality, universities are increasingly glamorising entrepreneurship, promoting it,*

almost like 'The Emperor's New Clothes.' Personally, I believe that undergraduates should not be involved in such things. If it really needs to be done, it should be facilitated for PhD students. (G4)

Similarly, interviewee U1 elucidated the role of universities in doing cutting-edge research and highlighted that the research must be forward-looking and can guide the industry development for the following decade.

In my opinion, there are two things that universities can do. First, they should continue to conduct cutting-edge research because without the cutting-edge research of universities, society won't progress. But remember, the university's cutting-edge research must be at least 20 years ahead of its application in society, otherwise, society won't advance. For example, people started researching 4G twenty years ago, so today we have 4G and 5G. Now some people are researching 8G, and maybe many years later, we will have 8G. Therefore, doing forward-looking research is the role that the government assigns to universities by providing resources. (U3)

Secondly, another important role of universities in the Hong Kong OI ecosystem is technology transfer and commercialization. Universities often possess valuable intellectual property and cutting-edge technologies that can be leveraged by industry partners. Theoretically, through collaborations and licensing agreements, universities can facilitate the transfer of technology from academia to the business sector, enabling the commercialization of innovative ideas. This process not only benefits companies by providing them with access to groundbreaking technologies but also generates revenue streams for universities. However, none of the four interviewees working in universities (U1, U2, U3, and G4) rated technology transfer offices or technology transfer performances at their respective universities high. According to the following quotes, the reason is largely that universities tend to prioritise academic research over technology transfer.

> *Even if the technological achievements are ready, there may not be someone to promote them to the users in society. The person promoting it could be the professor themselves, but they may not have the time, interest, or knowledge on how to do so. That's why they have to hand it over to the university's knowledge transfer office. However, you have to consider the direction of this office and whether their colleagues have a good understanding of the market and the technology. There are many processes and checkpoints involved in order to truly apply the technology to social production or application levels. It's a complex and lengthy process. (U2)*

> *We currently generate at least 20 to 40 of them per year. In the past 12 years, our university has produced approximately 500 companies like this. Around 200 of them can be found on our website. Professors' companies account for about 50 of them, while the rest are students' or postdocs(post doctorate students)'. … To be honest, Hong Kong's support for any kind of innovation is quite inadequate. (U1)*

As the only university startup in this study, the interview data from SME4 is highly valuable as it sheds light on the support provided by universities to foster student entrepreneurship. According to SME4, his university not only offers financial support for student startups – which is comparable to technology transfer for faculty – but also provides a wide range of services. These services include: (1) assisting high-performing cases among the funded projects in enhancing their media exposure and recommending networking opportunities with business alumni, (2) assigning dedicated account managers to oversee the application process for intellectual property rights, and (3) providing SMEs with recommendations for venture capitalists. Interviewees responded that technological start-ups spined off from the university will more likely to survive because of their unique technologies. According to the survey by U2, the survival rate of its university start-up was about 75% within its 4-year of establishment.

Thirdly, universities play a vital role in nurturing and developing talents and technology start-ups for open innovation. They provide education and training programmes that equip students and researchers with the necessary skills and knowledge to engage in innovative activities. Through academic programs, internships, and research opportunities, these institutions cultivate a culture of innovation and entrepreneurship. By fostering interdisciplinary collaboration and encouraging critical thinking, universities prepare individuals to become future innovators and leaders in various industries. The following quote reflects this issue.

In terms of talent development, we can facilitate startups, just like what we are currently doing in our university. Because universities have PhD, undergraduates, and masters, they can cultivate talent, which is the source of innovation. Some entrepreneurial talents establish their ideas mainly based on their industry work experiences, but many others do so when they are still on campus. Hong Kong universities have facilitated many technology-oriented SMEs or startups. These organisations are not the traditional SMEs that are established outside [of campus]. Universities use their own PhD students to facilitate this process, providing resources and funding to help them become technology-oriented SMEs. This is something that universities are currently doing. (U3)

Fourthly, the importance of ‘open access to research findings’ was also highlighted by one of the participants (U3) in my qualitative data analysis. However, U3 noted that although Hong Kong universities are making efforts to enhance the accessibility of their research findings to relevant stakeholders, they face challenges during the sharing process, particularly in terms of presenting the research in a more accessible and appealing manner to target companies. U3 identified a gap between the original objectives of universities and the actual outcomes, and called for a more systematic dissemination of research findings within the context of open innovation. The finding suggests that there is a need for universities to explore effective strategies for disseminating research findings in a more accessible and comprehensible manner, especially to industry partners.

> *Many people are interested in certain intellectual property rights, but to understand how to use them, they must interact with professors. However, this process requires holding many meetings, and even with online conferences, language barriers may still exist, making it time-consuming and less effective. Professors only understand their own research and may not know how to describe the usage. Therefore, I believe universities should continue generating patents and conducting cutting-edge research, and then make all the patents available online for everyone to view. This way, people can understand that for example, maybe 15 years ago, we told others that we were researching 6G, and at least people in the telecommunications industry would know that, even if they were currently using 3G, 'Oh, so there will be 6G in a few years.' (U3)*

Lastly, the qualitative data reveal that Hong Kong universities also show endeavour in drawing collaborative research partnerships. Interviewee U2 reflected that we need a cross-universities platform for the OI ecosystem. During the interviews, participants U1, U2, and U3 provided examples from their respective universities where academics successfully attracted industry investments based on their research achievements. Some of these cases even led to the establishment of internationally renowned brands, which indicates that Hong Kong universities have indeed achieved some success in collaborative research and development. However, it should be noted that three out of the four SME participants mentioned that they did not receive any assistance from universities in their open innovation activities. For instance, in the following quote, Participant U1 frankly expressed that SMEs seem to doubt the actual role played by universities in doing feasible industry research and complained that the universities generally cannot help solve the pressing R&D issues for SMEs.

> *We once paid two hundred thousand (HKD) to a university for some R&D. They promised they could do everything before signing the contract, but when we handed over the materials and started the R&D with them, they said, 'This is completely unfeasible, it cannot be done. It's impossible.' We thought, 'What's going on here?' They took the money, but in the end, we had to cancel the project because they simply weren't capable. It was a waste of money and time. If we still have to rely on these funds for R&D, it's just absurd. (SME3)*

In comparison, SME4, as a university startup, acknowledged that their success was indeed attributed to the support received from the university. These findings suggest that while universities are committed to engaging in collaborative research with industry partners and continuously improving relevant institutional processes, their reach appears to be limited in terms of engaging SMEs. As mentioned by interviewees U1 and U2, universities tend to target larger enterprises rather than SMEs for technology transfer initiatives. Consequently, many specific regulations and policies may not be SMEfriendly. For example, SME4 revealed that their startup could not afford the university's IP because it is too expensive for SMEs. One of the main reasons for such policy settings is that university regulations and policies for university-industry collaborations primarily serve and protect the interests of the academics and the universities rather than that of companies. Since academic research is expected to be as forward-looking as possible, they often have high technological barriers for industry partners. As a result, university initiatives related to IP and technology transfer tend to benefit technology-driven enterprises and those that maintain close relationships with academia.

5.4.2 The role of government

The government is the second stakeholder in the Open Innovation Mechanism. According to the interview data, the Hong Kong SAR government is aware of the gap that exists between the upstream, midstream, and downstream in open innovation. As a result, their primary function is to act as a 'matchmaker,' as described by interviewee G4, in order to fill this gap.

> *In the upstream, there is a gap between the upper-middle and upper stream. In the downstream, there is also a gap between the lower-middle and lower stream. This gap is quite wide. How can we solve or alleviate this problem? In terms of business, if a software company wants to sell software, it's not enough to just have engineers. There must be a sales team involved, even a sales engineer. Their job is to create a*

liaison between the two and bridge the gap, answering the users' questions. In fact, we need a 'matchmaker' to bring these two parties together. We need someone who understands the problems of both sides. (G4)

To achieve this goal, the government has made efforts in three main areas. Firstly, since the establishment of the Hong Kong Special Administrative Region government, various policies and regulations have been put in place to explore the best policy tools and combinations that can be used to promote open innovation. As discussed in Section 5.1, the government has undergone a change in its policy dynamic mechanism from being completely upstream-driven to downstream-pulled and, subsequently, to a collaborative effort between upstream and downstream. Throughout this process, a series of regulations have been established, many of which serve as drivers of open innovation. These regulations have been discussed in Section 5.1. The following two quotes provide insight into the government's considerations when formulating relevant policies.

The establishment of the Innovation and Technology Bureau in November 2015 brought significant changes to the government's technology policies. The changes were driven by downstream demand, with programmes created for the industry, SMEs, and public services. For example, the Technology Venture Programme (TVP) was created to stimulate demand for innovative products that could be put to use. The Enterprise Support Scheme (ESS) is also different from previous ones as it is driven entirely by downstream demand. (G4; ITF, n.d.b; n.d.c)

Recently, Research, Academic and Industry Sectors One-plus Scheme (RAISe+) has been introduced. It is designed in two phases. In the first phase, for the first three years, selected projects from universities are applied for, and they involve collaboration with the business sector. During these three years, prototype evaluation is conducted, continuing the research but aligning with the requirements of the business and industrial sectors. The last two years are led by the business/industrial sector, focusing on productization and commercialization, including selling and technology diffusion processes. This is a significant change. Overall, in the past 25 years, our entire IT policy positioning has been focused on upstream promotion as the first priority, followed by downstream stimulation. During this period, collaboration in the middle stream has gradually increased. (G4; ITF, n.d.d)

In addition to the schemes that drive the OI initiative in Hong Kong, there are also specialised programmes available for SMEs in specific industries. For example, interviewee G2 mentioned the Transport and Logistics Bureau's Third Party Logistics Service Providers Pilot Programme (TPLSP) for 3PL logistics companies and various support policies for technology companies launched by multiple government departments, as shown in the following quote (HKPC, n.d.).

3PL logistics companies can apply for TPLSP funding to purchase robots, software, etc., while there are even more levels of support available for technology companies.

The Innovation and Technology Fund has many funding programmes specifically designed to support R&D for these companies. They can partner with universities and research institutions, and there are also funds available to support them. Currently, the government is actively seeking talent from universities to form technology companies. (G2)

Secondly, the government has been actively promoting open data in recent years (OGCIO, n.d.). From the perspective of the government, open data is expected to eliminate information asymmetry and promote the digital transformation of various innovative entities. Given that there is still a considerable amount of public and commercial data that has not been opened, promoting open data is imperative to unlock Hong Kong's innovation potential in the future. This initiative also aimed at addressing the current situation of knowledge gaps in industry and technology among Hong Kong's technology companies and SMEs. For instance, OGCIO is hoping that the DTSPP programme at Cyberport can narrow the gap (DTSPP, n.d.). However, the future effectiveness of this programme remains to be seen, and it will be expanded to other industries.

By making data sets accessible, the government fosters transparency and supports innovation. Researchers, entrepreneurs, and policymakers in Hong Kong can leverage open data to gain insights, develop new applications, and make informed decisions. The government's efforts in promoting open data contribute to the accessibility and utilisation of information, thereby enhancing the effectiveness and efficiency of the innovation ecosystem. The following quote made by Participant G3 provides evidence in support of this assertion.

> *Our main role is to make data available for free, and we measure the effectiveness of the open data by how many SMEs use it. Currently, over 70 apps use our open data, and they come in all kinds. This data can help businesses develop their own applications. (G3)*

Thirdly, the government has established government organisations related to science and technology innovation, such as HKSTP and Cyberport. In 2023, the State Council issued the ‘Development Plan for Shenzhen Park of Hetao Shenzhen-Hong Kong Science and Technology Innovation Co-operation Zone (河套深港科技創新合作區深圳園區發展規劃), which proposed the construction of an internationally competitive industry pilot transformation base (中試轉化基地) (China SCIO, n.d.; China Gov, 2023). Currently, the construction of the pilot transformation based in the HeTao Shenzhen Park is progressing rapidly, which means that Hong Kong universities will be able to conduct pilot testing (中試) in this industry park in the near future. Pilot testing is a critical stage in the process of technology transfer, which must be completed after the conceptualization and laboratory research of technology transfer and before industrial development. The construction of the pilot transformation base will further promote the development of open innovation in Hong Kong.

While the government acknowledges that it should play a matchmaking and intermediary role in promoting open innovation, it also realises that promoting technological innovation is a complex matter that requires the involvement of many professionals with knowledge of scientific research, business operations, and government policies. Therefore, the government has established government organisations related to science and technology innovation to collaborate with the government and facilitate OI. The establishment of HKSTP and Cyberport has created dedicated spaces and support systems for startups and technology companies. These hubs foster an ecosystem of open innovation by providing infrastructure, funding, and networking opportunities that facilitate collaboration, idea sharing, and the exchange of knowledge and expertise.

Overall, the interview data demonstrates that government organisations play the role of knowledge brokers in promoting Hong Kong's OI ecosystem in two ways. Firstly, government organisations take more concrete measures to minimise information asymmetry. While information asymmetry has a negative impact on all companies, it affects SMEs more severely due to their limited capital, which makes the costs of using brand suppliers too high for SMEs. Based on G2's interpretation of their organisational mission, as shown in the following quote, government organisations primarily aim to support competitive and promising enterprises in the market, particularly those that do not hold a monopoly.

Our current focus is on companies ranging from B- to A- level. As for C-level companies, we no longer provide assistance as their return to investment would benefit the entire industry. However, within the B- to A- range, there are four levels: B-, B, B+, and A-. Who will assist them?... For a unicorn to reach a market value of 1 billion USD, approximately tens of billions of HKD, and even if a few unicorns appear each year, it would not be able to help too many SMEs. Therefore, we need two approaches. For one thing, we need to assist those genius-level A++ companies that have the potential to become unicorns and may even receive Nobel Prizes. For another, we need to help those moderate companies. For these companies, the government provides numerous programs, hoping that they can continue to play a role and expand on a large scale. (G2)

When evaluating the role of universities in promoting open innovation, interviewee G2 provided a negative assessment of university professors, stating, 'We see many university professors who work in isolation, coming up with a technological concept without understanding the practicalities of the industry, and then arbitrarily proposing how the government should act. They have no understanding of the industry's actual needs.' He further pointed out that many SMEs not only failed to proactively understand government policies promoting innovation development but also casted doubts about whether the government is truly assisting them or if the majority of the innovative technology projects are being handed over to large enterprises. He expressed frustration with this perception and firmly stated that many projects are specifically targeted towards SMEs, as the funding in the range of millions provided by these projects is not significant for companies with billions or hundreds of billions in revenue.

SMEs often lack awareness of the funding programmes available to them. G2 drew attention to his government organisation's specialised one-stop centre, which efficiently oversees relevant information about various government funding programs. This centre offers some preliminary recommendations on which programmes and schemes are suitable for the companies to apply for. Essentially, this service serves as a vital link between the government and SMEs. Without it, most SMEs would be unable to access the funding programmes specifically designed for their benefit.

Secondly, government organisations play a crucial role in educating and demonstrating to both the supply and demand sides. Information asymmetry is a fundamental obstacle that hinders the participation of all players in OI. However, solely providing information support is inadequate to foster collaboration or transactions between technology ventures or universities as suppliers and potential customers. As previously mentioned, a significant challenge lies in the high technological threshold within the innovation and technology market, making it challenging for suppliers to balance R&D with promotion and marketing, while demand-side players often struggle to keep up with the latest technological trends. Therefore, the interviews reveal that government organisations undertake the responsibility of educating and demonstrating to both the supply and demand sides of the technology market. As knowledge brokers, members of these organisations typically possess experience in both R&D and the commercial sectors, equipping them with scientific research backgrounds and industry insights.

For SMEs as demand-side players, these government organisations frequently showcase technologies directly, demonstrating their effectiveness and encouraging independent demand generation. They promote the use of innovative products and services across different sectors of society. This includes encouraging businesses to adopt new technologies to improve productivity and competitiveness, supporting the development and adoption of digital solutions in government services, and fostering a culture of innovation among the general public. By actively promoting the benefits and value of technological innovations, the government organisations contribute to creating an environment conducive to their adoption, ensuring that society embraces and benefits from these advancements. This is reflected by Participant G4 in the following:

> *For example, the Smart Common Innovation Lab can serve as a bridge to the industry. It uses the government as an application scenario to develop new things, and then it can be packaged and promoted to the industry. In this way, the government becomes not only a user but also responsible for digital transformation and building a digital government. For example, as I mentioned earlier, there is a lot of data exchange within the government. On one hand, I can do something about it. If the government provides many digital services, citizens will gradually get used to*

using them. Then the industry and business sectors will also invest more in digital transformation because citizens are their audience. When citizens get used to using their smartphones for many things, the industry will also join this trend. (G4)

Meanwhile, the government organisations effectively leverage their accumulated networks and industry information to provide direct market demand information to technology ventures as suppliers. This facilitates the alignment of technology development with market demand, ultimately enabling the transformation of promising ideas into high sales. Interviewee G2 exemplifies in the following quote how their government organisation assisted a professor engaged in remote sensing technology research to identify a profitable technology application scenario.

That professor approached us, expressing their high capabilities in utilising remote sensing technology to accurately observe whether a location experiences rapid subsidence or abnormal conditions. However, they were uncertain about the applicable fields, so they asked us about the potential applications of this technology in Hong Kong. As a result, we introduced them to Company A and Government Organisation B. They have now begun collaborating in research, industry, and academia, and there is a possibility of establishing a new company or startup in the future. This has been a tremendous help for them. These efforts require our dedication, but we do not charge them any fees because professors usually have limited funding. We have numerous similar examples where we have facilitated *collaborations between research institutions and government departments, with at least dozens of projects being facilitated in this manner. (G2)*

In conclusion, the interview data highlight the government's recognition of the gaps in open innovation between upstream, midstream, and downstream. Their primary role is to bridge these gaps. The government has taken significant steps in addressing this issue through the establishment of policies and regulations that promote open innovation. Additionally, their emphasis on promoting open data aims to eliminate information asymmetry and drive digital transformation. Furthermore, the establishment of government organisations related to science and technology innovation demonstrates the government's commitment to fostering collaboration and development in the industry. By actively addressing these challenges, the government is paving the way for a more vibrant and inclusive innovation ecosystem in Hong Kong.

5.4.3 The role of industries

The third stakeholder in the Open Innovation Mechanism is the industry. The interview data suggest that industry associations and cross-industry partnerships play a critical role in facilitating knowledge sharing, collaboration, and innovation among SMEs.

Industry associations serve as an important platform for SMEs to connect with other businesses in their respective industries, share information on best practices, and collaborate on joint projects. Through industry associations, SMEs can gain access to valuable resources, such as market intelligence and regulatory updates, which can help them stay competitive and innovative. During the interview, participant SME3 emphasised that the SME Association in Hong Kong always strives to seek development opportunities for SMEs. He mentioned three development suggestions recently proposed for SMEs: First, SMEs need to enhance self-reliance and undergo innovative upgrades and transformations, particularly by leveraging artificial intelligence to reduce labour costs. Second, given the high unemployment rate in mainland China, Hong Kong SMEs can establish offshore offices in the mainland to lower labour costs and improve the efficiency of fund utilisation. Third, the SME Association plans to collaborate with government agencies to assist SMEs in obtaining ESG (environmental, social, and governance) certification, thereby facilitating market expansion for SMEs.

> *The first thing is about self-reliance. What does self-reliance mean? How can we innovate and upgrade ourselves? I often tell them that. So, you have to figure out how to innovate and upgrade your traditional business. You need to reduce your costs. By doing so, you can create a new realm. You must act quickly to do this... For example, we can't hire enough people right now, right? Every company needs to have an account and customer service, right? We can use AI as a substitute. I have consulted with companies like Sensetime, Alibaba, and Tencent, and found that these models can indeed be implemented. (SME3)*

In addition to industry associations, the interview data suggest that cross-industry partnerships are another effective way to foster open innovation ecosystems among SMEs. Cross-industry partnerships involve collaboration across different industries or sectors, where companies work together to exchange knowledge, expertise, and resources. By collaborating with companies in other industries, SMEs can leverage their complementary strengths and expertise to develop new products and services, enter new markets, and tackle common challenges. The interview data reveal that although SMEs are small in scale, their daily operations often rely on collaborations with other industries, as mentioned by SME2 and SME4 in the following quotes found on the next page. However, qualitative data shows that the establishment of partnerships between SMEs and other industries are influenced by their business models. B2B models, such as SME2, tend to have more collaborations with other industries compared to B2C models, which is a requirement for their business operations. Nonetheless, irrespective of the model, partnerships with other industries in the four cases we interviewed all demonstrate their role in facilitating SMEs' involvement in open innovation, as indicated by the following quotes:

> *Our industry is B2B, and our previous collaborations have been very close. You could say that because we specialise in the gift and promotional products industry, we have frequent interactions with SMEs. We have daily contacts, and if we were to quantify it, we have already partnered with over 500*

companies in Hong Kong and 200 companies on the mainland. Therefore, we have a deep understanding of their procurement needs, what kind of products they require, what innovative products they need, and the latest trends in the gift market. For example, due to the pandemic, travel restrictions have prevented people from going on trips, so after the pandemic, there has been a high demand for camping and barbecue-related products. Even before the official reopening after the pandemic, we had customers actively requesting travel products. Why? Because they believed that after the pandemic, there would be a rebound in large-scale travel demand, and they wanted to be prepared. So, they did their homework in advance, and we made sure to provide travel products. As you can see, our relationship with SMEs is very close, and it's a strong partnership. (SME2)

Because our industry is in pharmaceuticals, environment, and insurance, the entire medical field is interconnected. We cooperate with insurance companies in two aspects. Firstly, it's about claims. Essentially, for certain insurance policies like group medical plans, they may require follow-up visits, doctor consultations, medication purchases, etc. We collaborate with insurance companies to expedite these claims. Secondly, under our innovation, insurance companies are interested in purchasing more insurance plans. Therefore, we provide support, such as nutritional consultations in the

Greater Bay Area, and have become an online platform called Online Thomas. This has led to the possibility of insurance companies advertising and perhaps being more inclined to collaborate with us to expand the insurance market. (SME4)

Moreover, cross-industry partnerships can provide SMEs with exposure to new technologies and emerging trends, which can help them stay ahead of the curve and innovate more effectively. For instance, a partnership between a technology company and a manufacturing firm might result in the development of a new product that combines cutting-edge technology with traditional manufacturing processes.

Overall, industry associations and cross-industry partnerships serve as key drivers of open innovation ecosystems among SMEs in Hong Kong. These collaborative initiatives help SMEs access valuable resources, share knowledge, and collaborate on joint projects, ultimately leading to increased innovation and competitiveness in the marketplace.

5.4.4 The role financial institutions

The fourth kind of stakeholder in the Open Innovation Mechanism are the financial institution. Various financial institutions catering to SMEs at different stages of development were interviewed, namely the startup, acceleration, and scaling phases. These financial institutions play a crucial role in providing funding support for SMEs during these stages. During the startup phase, SMEs typically seek funding from their own savings or from angel investors. These angel investors may have their own working spaces, such as I3 or I4, or they may solely function as angel investors, like I2. In the acceleration phase, some angel investors, such as I4, continue to provide funding for the SMEs. However, in the scaling phase, SMEs must approach specialised financiers or investors, such as I1, to secure funding. In addition, financial institutions such as banks can serve functions like credit financing, trade transactions or even cross-selling as mentioned by SME1, SME2 and SME4.

Although different types of financial institutions may have varying functionalities, their core mission is to facilitate SMEs' access to financing. They evaluate the market prospects of relevant enterprises during the selection process and assist them in risk management. The qualitative findings indicated that financial institutions have the expertise and experience to assess the feasibility and market potential of new ideas. Financial institutions can make informed decisions regarding the allocation of resources generally based on a series of rigorous procedures, including conducting market research, analysing consumer trends, and evaluating technological risks. Thus, SMEs can estimate their chances of becoming successful in the end if they get the investment; or they may reflect on how they can improve their proposal to ensure a high success rate. Put it differently, financial institutions can provide hints to startups and SMEs, helping them navigate the challenges and uncertainties that arise during the innovation process.

But if you go for the IC, Investment Committee, in the institution, they will make those calculations with a more rational approach, whereas individuals might be more intrusive. So, for easier decision-making, it's better if the project matches the institution's existing projects because there will be synergy. (I1)

For the enterprises they decide to fund, financial institutions are active investors in innovative projects and startups, either through direct investments or venture capital funds. These institutions provide the necessary financial resources to transform ideas into commercially viable products or services. By providing funding and investment, financial institutions in essence provide incubation and acceleration programs, which are essential for supporting the growth of startups and entrepreneurial activities. The funding provides SMEs with access to mentorship and networks, which can help them develop their ideas and transform them into successful businesses.

These financial institutions also provide guidance in two main aspects. Firstly, they assist in promoting the investees to attract industry funding.

In the early stages of entrepreneurship, we may offer guidance on fundraising because it's challenging to gather funds or secure loans at that time. We teach them how to seek loans from friends and family through networking or find angel investors. We also assist them in selecting investors, formulating *fundraising agreements and equity agreements to secure their first round of funding. (I2)*

Secondly, they offer guidance to help SMEs understand the public organisations' funding schemes and projects they can tap into for financial support.

At the same time, we also teach them how to apply for funding from the government because the Hong Kong government provides many funding programs, and universities also offer funding opportunities. For example, both University A and University B have funding programs. Although the names may differ, they both provide financial support. Some entrepreneurs are not familiar with these programmes and may even need to make specific requests to obtain funding. (I2)

Additionally, these financial institutions also provide networking support to the funded enterprises, helping them expand their industry connections and secure more collaborations. The qualitative data suggest that financial institutions can sometimes act as intermediaries, connecting researchers, startups, and other industry players. By fostering collaborations, financial institutions create opportunities for knowledge exchange, technology transfer, and joint research initiatives. These partnerships enable the sharing of resources, expertise, and networks, which can accelerate the pace of innovation.

We aim to facilitate their collaboration with different companies, such as the company I mentioned earlier. I will promote its cooperation with a company in Thailand, negotiate mergers, and acquisitions, and so on. Then, one of the investors is Japanese, and he will introduce another logistics company in Taiwan. This creates a network of cooperation among investors. They can invest in each other and manage their companies better to promote their collaboration. (I2)

Furthermore, some angel investors who focus on funding startups in the SME sector often double up as incubators or accelerators. Therefore, their functions overlap with agencies. These organisations provide services such as legal advisory, client introductions, market expansion, marketing guidance, operation advice, and fund management, which will be discussed in the next section. Overall, these institutions enhance the development of promising SMEs by providing them with additional resources. For instance, such financial institutions can also play a role in providing market insights for SMEs. These insights can inform decision-making, identify market opportunities, and drive innovation. As the interviewee I2 mentioned that Hong Kong investors are interested in projects with international potential and a long-term strategy, as well as strong intellectual property protection and an exit plan.

In conclusion, financial institutions play a critical role in providing funding support for SMEs in Hong Kong's open innovation ecosystem. From angel investors to specialised financiers and investors, these institutions facilitate SMEs' access to financing at different stages of development. Their core mission is to evaluate the market prospects of relevant startups and SMEs, assist them in risk management, and provide guidance in promoting and packaging their enterprises to attract industry funding and tap into government projects. With networking support and overlapping functions with agencies, these institutions provide additional resources to enhance the development of promising SMEs.

5.4.5 The role of agencies

The fifth kind of stakeholder are the agencies. The open innovation ecosystem in Hong Kong encompasses two main types of agencies that play different roles and complement each other to facilitate the participation of SMEs in open innovation. The two distinct types of agencies are incubators or accelerators. Sometimes, the incubators / accelerators will act as facilitators and financial advisors. The former supports SMEs by providing space, resources, and networking opportunities, while the latter by acting as intermediaries to facilitate collaborations with industries and government departments.

(1) Incubators/Accelerators:

Incubators and accelerators are crucial agencies in the open innovation ecosystem as they assist SMEs in scaling up their operations. These agencies fulfil three primary functions: providing space, resources, and networking opportunities.

First, incubators, co-working spaces, and accelerators offer physical spaces where SMEs can establish their operations. These spaces provide a conducive environment for collaboration, knowledge sharing, and innovation. By creating such a space, incubators and accelerators create an environment that fosters the exchange of ideas and expertise. As participant A1 noted in the quote below, providing space is the most fundamental role for their institution.

> *As we are not a tech-oriented workplace, we are actually a small to medium-sized centre located in the city centre. We don't have extensive networks per se, but if any company has just established itself in Hong Kong and needs assistance with company registration, setting up trademarks, and other related matters, we provide some support in that regard. Moreover, if they require our venue for press conferences or for intellectual property rights purposes, we offer corresponding support to help them. Additionally, our centre itself promotes companies that hold events here on various social media platforms, regardless of whether they are engaged in inbound or outbound innovative activities. Essentially, we cater to the local market and ensure that we fulfil those needs. (A1)*

Second, in addition to providing physical spaces, incubators and accelerators provide resources or access to resources such as equipment, channel partners or professional networks, which are essential for SMEs. These resources can include financial support, technologies, operation process improvement and mentorship programs.

By providing such resources, incubators and accelerators empower SMEs to overcome resource constraints and enhance their capabilities in innovation and market development. The qualitative data reveal that agencies in Hong Kong offer various resources, such as funding, mentorship, and networks, to support the growth of startups and SMEs. These resources are essential for SMEs to develop their ideas and transform them into successful businesses. For example, interviewee A2 mentioned that their agency provides financial and legal advice services so as to help their incubated companies to overcome problems in fund-raising and patent protection.

Third, incubators and accelerators also facilitate networking opportunities for SMEs. Through organising events, workshops, and conferences, they create platforms for SMEs to connect with potential collaborators, investors, and mentors. These networking opportunities enable SMEs to expand their professional networks, gain industry insights, and explore potential partnerships, which are crucial for their growth and success. In the quote below, interviewee A2 noted that they had been active in creating opportunities for their member organisations to network with each other.

> We regularly organise gatherings and happy hours for everyone to chat, exchange experiences, and introduce each other. We even share which venture capital funds to make it better. Additionally, we conduct training to teach them how to present themselves, package their companies, and how to create PowerPoint presentations and write proposals, etc. We also organised competitions to encourage tenants and startup teams outside to participate. We would

invite judges who are familiar with technology or the investment industry. Firstly, they can point out any business problems to prevent participants from further going down the wrong path in future, and secondly, they may also invest in some teams themselves. (A2)

The interviewee A1 echoed that they also endeavour to engage more external organisations to their social activities so that SMEs can expand their networks:

> *We also introduce different companies to organise some events and provide more interaction for our members. Sometimes, we take the initiative to help them with their social gatherings, to allow everyone to get to know each other. We also have some networking activities for them, and we have an internal network where they can introduce their own businesses to us. Our centre's goal is to facilitate the members in networking and getting to know each other, so that they can decide if some of our member organisations can be of use to them. (A1)*

The interviewee A2 further supplemented that some financial institutions would offer personnel to fill the job positions of their startup teams so as to facilitate the start-up team's growth further. It is because startup companies usually lack talents with financial backgrounds to support their operations and link up with other financial institutions such as banks or venture capital. It is because it is easy to burn up their money during the B or C or even pre-IPO rounds of the fundraising cycle. Investor I4 further supplemented that they will sometimes sit in the Board of Directors of their incubated firms in order to support the growth and operation of their start-up team.

> *Some large venture capital firms even have a pool of reserve personnel who can fill certain roles for them, such as CEO, CTO or CFO. If the company co-founder can fulfil its CTO for technical matters, we will dispatch a CEO to assist the start-up team temporarily. If it's a matter of finance, we'll send a CFO to sit in the company for about 6 months and handle their problems temporarily. (A2)*

(2) Facilitators:

The second category of agency in the open innovation ecosystem comprises facilitators such as the LSCM, HKSTP, and Hong Kong Productivity Council (HKPC). These agencies primarily act as intermediaries, bridging the gap between SMEs, industries, and government departments, and facilitating joint programs.

Facilitators play a vital role in connecting SMEs with established industries. By leveraging their expertise and networks, facilitators identify potential collaboration opportunities between SMEs and industries. They facilitate the formation of partnerships, joint research projects, and technology transfer initiatives. Through these collaborations, SMEs can access industry-specific knowledge, resources, and market insights, which are essential for their innovation and competitiveness.

On the other hand, facilitators also act as intermediaries between SMEs and government departments. They assist SMEs in understanding government policies, regulations, and funding opportunities. By providing guidance and support, facilitators enable SMEs to navigate the complex bureaucratic processes and maximise their chances of securing government support. Furthermore, facilitators help SMEs develop joint programmes with government departments, fostering innovation and addressing societal challenges through collaborative initiatives.

> *We have a centre called XYZ that is responsible for managing all the relevant information regarding these government funding programs. If companies are interested in seeking support from government programs, they can obtain the initial recommendations and information through the XYZ centre. This allows tech startups to understand relatively easily how to obtain support from these programmes because often just by looking at the application forms, they will realise that there are actually many different programmes to choose from. (G1)*

> *For example, if a professor at University X has done a lot of research on indoor positioning, we will help him to liaise with the government. Maybe he can hold a demonstration in public shopping malls or airports to introduce his services to organisations such as the Airport Authority. In this process, we can introduce them and give them the opportunity to demonstrate their technology at the airport. If their*

technology performs well, they may even establish two or three tech companies as a result. This is just an example of indoor positioning. (G2)

In summary, in the open innovation ecosystem for Hong Kong SMEs, agencies, including incubators/accelerators and facilitators, play distinct yet complementary roles. Incubators/accelerators provide physical spaces, resources, and networking opportunities to support SMEs in scaling up their operations. Facilitators act as intermediaries, facilitating collaborations between SMEs, industries, and government departments. By understanding the roles of these agencies, SMEs can leverage their support to enhance their innovation capabilities, foster partnerships, and drive their growth in the open innovation ecosystem.

5.4.6 The role of media

Finally, media has its role to play in the Open Innovation Mechanism. According to the qualitative data, the role of media in Hong Kong OI ecosystem is embodied in several aspects.

Firstly, the media play a crucial role in enhancing the visibility and awareness of innovative projects and initiatives. Through news coverage, interviews, and feature articles, media outlets bring attention to innovative ideas and showcase the work of startups and entrepreneurs. This increased visibility not only attracts potential investors and partners but also inspires others to engage in open innovation. As the participant from

I1 stated in the quote below, media coverage facilitates the open innovation in Hong Kong by helping SMEs gain exposure and reach a wider audience.

> *So, on the media side, yes, it’s beneficial for the entire scenario, the whole phenomenon of open innovation in Hong Kong. The more people talk about it and become aware, and the more startups that emerge, the greater the potential for open innovation. And that always helps. (I1)*

Secondly, media act as a catalyst for collaboration and networking in the open innovation context. Through news articles, event coverage, and online platforms, media outlets connect researchers, startups, industry players, and investors. These networking opportunities facilitate knowledge exchange, technology transfer, and partnership formation. In the following quote, the participant M2 shared a story that one SMEs successfully attracted the external collaborator due to his coverage.

> *Our media covered a Hong Kong-based company that specialises in manufacturing face masks and highlighted their efforts in R&D. Shortly after the report, an SME in the business of producing flower gelatine contacted us, expressing their interest in obtaining the contact information of the aforementioned company. Through our facilitation, these two companies drew a business collaboration and successfully developed the first-ever face mask infused with flower gelatine components. (M2)*

Journalists themselves need to have a vast network of contacts in order to find suitable interviewees, which is why journalists often possess strong social skills. In many cases, their relationships with interviewees are mutually beneficial, and interviewees may even recommend other familiar individuals to be interviewed. As a result, by maintaining continuous attention to a particular topic, journalists can connect with many people relevant to that topic, which often fosters mutual acquaintance and the formation of a community. As mentioned by M2 in the quote below, they discuss their search for interview subjects:

> *There are several channels. First, I read newspapers and listen to the news, then I make calls to business associations. Second, I leverage the relationships of hosts and guest hosts who are more well-known and have social status. They can provide referrals for me. Third, I will meet different business friends through business gatherings. After exchanging ideas, if I feel there would something with news angle or news value, we will invite them for a media interview. We may also seek my business friends for referrals and assist in finding related spokespersons for particular popular topics. Alternatively, SME friends will call us actively and introduce their products or services to us in order to gain publicity and being interviewed. (M2)*

Media also plays a role in advocacy and policy dissemination in the context of open innovation. Through policy-related coverage, media outlets raise awareness of policy issues and advocate for supportive measures. This media advocacy helps shape the regulatory environment for open innovation. However, according to participant M2, the role of media in influencing the policy agenda in Hong Kong has diminished. Nowadays, media in Hong Kong rarely engage in investigative journalism or opinion pieces due to the significant time commitment required, the risk of being left behind by other media outlets, and a potential loss of readership. The traditional media cannot afford to employ too many reporters. In business related section, they tend to ask the organizers to send them media release instead. As a result, they often collaborate with their 'clients', allowing the clients to provide the initial draft of the report while the media only performs necessary editing. Or in other occasion, the media would only send reporter to report for an event with additional charge. M1 urged industry people to allocate more monetary resources on media in order to keep the relationship active. Otherwise, the media cannot sustain its own businesses. It is found that the media has been reduced to acting as intermediaries, with a limited ability to hold stakeholders accountable or encourage policymakers to create a conducive ecosystem.

In addition, media contributes to community building within the open innovation ecosystem. By featuring success stories, organising events, and providing platforms for knowledge sharing, media foster a sense of community among startups, entrepreneurs, researchers, and investors. This community-building aspect creates opportunities for collaboration, mentorship, and peer learning. As expressed by SME4, 'media events and forums allowed us to connect with like-minded individuals, share experiences, and build a supportive network within the open innovation community.'

Media plays a crucial role in knowledge dissemination. Through articles, interviews, and reports, media outlets disseminate information about emerging technologies, market trends, and best practices in open innovation. This knowledge-sharing function helps startups and entrepreneurs stay informed, learn from others' experiences, and adapt their strategies accordingly. As per M2, he quoted the case of the flower jelly mask. M2 matched a manufacturer of facial masks and gelatine trader together and created a new product of flower jelly mask. Media events can perform a function for business matching and generating new business ideas.

While the role of media in education and training, as mentioned in the literature, was not explicitly highlighted in this study, it is worth noting that media can also contribute to the education and training aspect of open innovation. By featuring educational content, organising workshops, and showcasing innovative projects, media outlets can provide valuable learning opportunities for aspiring entrepreneurs and researchers. Although the media has a role in disseminating knowledge, this kind of dissemination is usually driven by the desire to attract attention rather than for educational or training purposes. Unlike surveys conducted in Europe and America (Lee et al., 2010; Maulina et al., 2020; Shin et al., 2017), the educational and training functions of Hong Kong media in the construction of the social innovation system are relatively weak. Based on the news value judgement logic mentioned by M2 above, when an event is not expected to generate further attention, the media will not continue to follow it because it will not gain any readers' attention. This is actually the fundamental difference between the media and educational institutions. The media can briefly attract readers who are interested in the topic of open innovation, but if readers want to gain a deeper and more systematic understanding of the operational mechanisms and collaborative models of open innovation, they must search more in-depth information online, read more books or even take relative courses themselves. Readers should not expect local media will give them very in-depth reports.

Furthermore, contrary to what is argued in the literature, the qualitative data do not seem to support the idea that media in Hong Kong facilitates communication and feedback within the open innovation ecosystem. Since a facilitating network has not yet been established, media in Hong Kong have a reduced role in providing platforms for interviews and opinion pieces where stakeholders can exchange ideas, share experiences, and provide feedback on innovative projects. As a result, there is no feedback loop that can help SMEs refine their business ideas, identify potential challenges, and seek solutions.

Notably, the interview data indicates that various types of media outlets adopt distinct approaches to promoting an OI atmosphere in Hong Kong. Video media emphasises using a more visual and accessible approach to enhance the impact of communication. Specifically, interviewee M3 summarised that his media organisation aims to help small business owners showcase themselves fully and understand how to sell themselves. The company primarily achieves this by featuring successful case studies through special reports, instilling confidence in SME owners. Additionally, they invite experts to provide analysis and insights into industry trends and market opportunities. Furthermore, M3's media company closely follows up on each reported project, assisting the featured subjects in finding more collaboration partners.

Radio media employs programmes as a means of promotion, ensuring a certain consistency in length and style to attract a loyal audience. Moreover, radio programmes are expected to be entertaining, which leads radio media to prefer reporting on SMEs in unique and interesting industries. For instance, M2 mentions a previous programme that focused on introducing, testing, and experiencing novel and niche products, many of which were from SMEs. Radio programmes are relatively low-cost channels for SMEs for mass promotion with their famous anchors or celebrities as they are able to reach the mature groups.

Print media differs significantly from online media. People need to deliberately purchase a physical paper in order to read it. Therefore, the readers of printed media tend to be the more mature group and maybe from traditional industries. However, as interviewee M1 points out, print media has faced a survival crisis in recent years due to declining readership and rise of social media. Many traditional media would go online. Consequently, media may request the interviewees to pay a certain fee for coverage after their media reports.

In conclusion, the findings demonstrate the significant role of media in OI in Hong Kong. Media in Hong Kong can more or less enhance visibility and awareness, foster collaboration and networking, advocate for supportive policies, build a sense of community, and disseminate knowledge. Yet, the data also suggest that Hong Kong media do not function very well in facilitating communication and feedback in the open innovation ecosystem in Hong Kong. These findings emphasise the importance of media in driving open innovation and supporting the growth of startups and entrepreneurial activities in Hong Kong's innovation ecosystem.

5.5 Interorganisational Relationship

The data indicate that the government and government organisations engage in a funding relationship with technology enterprises. They specifically operate funds such as the TVP Fund and ESS mentioned earlier. Additionally, they collaborate on infrastructure-related initiatives. For instance, the government funds the establishment of institutions like the HKSTP and Cyberport, which serve as government agents to provide high-quality services to technology SMEs. However, interviews revealed that relationships between the government and OI stakeholders such as SMEs, media and agencies are not very close. The government and government organisations are reluctant to establish close relationships with industries and SMEs.

Universities maintain close relationships with their spin-offs and startups, but they have little interaction with other SMEs. They focus on developing their technology-based startup teams and do not maintain relationships with other SMEs. The media and agencies act as facilitators. However, while they have a significant impact on SME operations and participation in OI, they do not maintain close relationships with SMEs. Taking the media as an example, in the literature, the media is considered to be the channel for communication among governmental, industrial, educational, and research institutions. After all, there is a symbiotic relationship between the media and the organisations being reported on, as participant M1 suggested, and this relationship should be intimate. However, with the development of communication technology, the media outlet, as a company, also needs to pursue economic efficiency. As a result, the media has gradually become a temporary employee of the organisations being reported on, diminishing the role of relationship factors. Consequently, this marginalised status makes it challenging for the media to act as a catalyst for open innovation.

> *Nowadays, the media is really all about KPIs. There used to be an interactive and mutually beneficial relationship between media outlets and businesses or corporations, right? You needed coverage to gain recognition. Your work needed to be made public. But you can't just use people when you need them. Back in our younger days, we got used to have very closed relationship with PR agencies. For example, the PR executives will call us and asked for help They would say, 'hi, I have a bit of a connection with the CEO or the editor-in-chief. Can you help me with some coverage?' We would rely on such personal touch to get things done. But today, we are unable put in the effort to*

maintain those relationships because media professionals change their jobs frequently. Everything has become depersonalised gradually. Today, media coverage in both printed media and online media are precious resources. We are unable to give special treatment to people all the time. Business friends should understand that we can only publish those high-quality media release and relationship could not help much. We still need to account for our readers even the article is just an online piece. However, we still suggest those people who want to promote their products or events to show their sincerity to us even the sponsorship is minimal. (M1)

Some key characteristics of interorganisational relationships in OI are observed. First, there is interaction among OI players, but the relationships are not very close. Interviewee G4 explicitly pointed out that this phenomenon is prevalent in all social contexts because they have their own distinct operating rules and objectives.

In reality, there is a significant gap between industry and academia. Who can bridge this gap? Don't tell me it can be filled spontaneously by individual stakeholders. That's impossible because everyone has their own vested interests and it's very difficult to achieve this. But after all these years of trial and error, we've encountered these issues. Many times, industry, academia, and research institutions each do their own thing. Everyone considers their own interests, resulting in a big gap. So just waiting for money to come in is not enough, and simply creating a science park is not sufficient either. There needs to be some action to vigorously drive this forward. (G4)

Second, OI players are reserved in their assistance to other players, resulting in a distant relationship. An important reason for their unwillingness to help, according to the interview data, is that each player operates within its own set of rules within their respective systems, such as the industrial, political, educational, and research systems. These distinct sets of rules create boundaries when players attempt to cross them, which hamper the flow of ideas, resources, and expertise between different sectors. As demonstrated by the aforementioned quote, the media industry must adhere to the rule of attractiveness in order to survive in the face of fierce competition. However, an inevitable consequence of this reality is that they will rarely prioritise the open innovation agenda. Similarly, investors, despite playing an essential role in the open innovation ecosystem, have their own business logic, as highlighted by the statement from I1 below. Due to potential conflicts between their operational logic and the principles of open innovation, many projects initiated by SMEs fail to secure investment. While reportage contributes to fostering an open innovation atmosphere, it does not interfere with investors' decision-making processes.

> *However, if we only concentrate on Hong Kong, it becomes like '塘水滚塘魚' (meaning 'inner loop'), where there are just so many similar projects in the same market. Therefore, all those focused projects are essentially the same, and the smaller ones probably don't care. They only focus on the big and reputable ones. (I1)*

Third, OI players do not have a deep understanding of each other’s functions, leading to a distance between them. Many interviewees deliberately avoided answering questions about close collaborations with other OI players, indicating a hesitancy to establish close relationships. An important reason is that OI partners often maintain limited communication exclusively with each other, resulting in a failure to generate synergies. This lack of collaboration hinders the potential for joint innovation and knowledge sharing among organisations. Without open and frequent communication channels, it is quite normal for OI players to perform their functions in isolation from other OI players, let alone realising the full benefits of interorganisational relationships. Consequently, the existing infrastructure in Hong Kong, including investors, agencies, and media, often falls short as a catalyst for fostering collaborative relationships among partners, as proposed by the literature (e.g., Cepeda-Carrion et al., 2023)

In conclusion, the characteristics of interorganisational relationships in Hong Kong present challenges that hinder the realisation of their full potential. The government and government organisations have a funding relationship and collaborate on infrastructure-related projects. However, interviews have indicated that the relationships between the government and OI players are not particularly strong. The government and government organisations are hesitant to establish close ties with industries and SMEs.

5.6 Open Innovation of SME and the Development of Innovation & Technology Industry in Hong Kong

It is important to note that it is the overall OI environment, rather than any specific OI partner, that plays a crucial role in fostering this transformation.

One key factor contributing to this success is the opportunity for SMEs to expand their collaborative networks through OI, allowing them to tap into the digital advancements occurring across various industries. These exposures not only increase their awareness but also ignite their motivation for digital transformation. As a result, SMEs actively seek out affordable solutions that can propel their businesses forward, often finding support from government initiatives.

For example, during the interview, SME1 highlighted the pivotal role of data-driven market intelligence in securing a competitive edge for her company. Recognizing the high costs associated with information services, she was delighted to come across the government's 'Digital DIY' (DDIY) initiative. Leveraging the data provided through this program, she seamlessly integrated it into her company's operations, yielding positive outcomes:

> *When you bid, you get to know suppliers and prices from different countries. So, you know whether they are buying at a low price or not, and then when it is a good time to purchase. It is something to think about. ... Usually, those called resource supporters often share information with you. Just like yesterday when I got to know*

about the DDIY portal (DDIY, n.d.), they gave me all the suppliers' data, which is a really affordable resource that will help us. (SME1)

As per the response from SME1, it is worth highlighting that the DDIY portal was specifically launched by the Hong Kong Productivity Council with the aim of facilitating digital transformation for local businesses in Hong Kong. Its primary objective is to connect them with suitable service providers, thereby enhancing operational efficiency and exploring new business opportunities. The government-led initiatives and related service programmes offered in this context are typically available for free or at reduced rates. The aim of the DDIY portal was to ease the financial burden of digital transformation for SMEs.

Among the policies discussed in the interviews, two notable ones that aim to facilitate technological upgrading and transformation of SMEs are the Distance Business (D-Biz) Programme and the TVP. The D-Biz Programme was specifically introduced to provide support to enterprises in adopting IT solutions, enabling them to sustain their operations even during the challenging times brought about by the pandemic. As per the media release from Legislative Council about Distance Business Programme (GovHK, 2022), 'During the application period from May 18 to October 31, 2020, over 38 000 applications were received. All the vetting work on funding applications was completed in January 2021. Of about 35 000 applications approved, over 25,740 approved applications have proceeded to implementation, involving total funding of around 1.7 billion. As at

February 14, 2022, about 20 000 applications have completed the projects.’ This indicated that the results of D-Biz were quite successful.

On the other hand, the TVP focuses on enhancing productivity and facilitating the upgrade or transformation of business processes through the utilisation of technological services and solutions. According to the website of TVP (ITF, n.d.), the number of approved projects was 29,388 on 7 March 2024. Legislative Council approved the $500 million funding for the new 3-year ‘Digital Transformation Support Pilot Programme’ on 14 July 2023 (Business Facilitation Advisory Committee Food Business and Related Services Task Force, 2023), to support the digital transformation process of SMEs in Hong Kong (Finance Committee, 2023) and the programme is targeted to launch in early 2024. In addition, New Industrialisation and Technology Training Programme (NITTP) was launched in August 2018 to subsidise Hong Kong enterprises to train their staff related to New Industrialization advanced technologies on a 2:1 matching basis. That means the government will be responsible for two-third of the expenses and the enterprise will be responsible for the remaining one-third. According to the report from The Audit Commission (Audit Commission, 2024), ‘up to 31 March 2023, 8 936 training grant applications for 3 937 companies had been approved. The total amount of training grant disbursed was $282.7 million’.

Furthermore, for technology-based SMEs, their products inherently aim to have a significant impact on their target audience, with many of them operating within a B2B model. For instance, during the interviews, SME4, a technology-based SME, emphasised their involvement in IP projects that aim to assist various healthcare stakeholders in their digital transformation efforts. The technology products developed by this company play a transformative role by shifting the traditional doctor-led approach to a user-led approach. Moreover, these products enable them to engage with different medical institutions, thereby driving their digital transformation.

The interviewees, including G1, G2, and SME4, all recognised the government's proactive implementation of various policies aimed at promoting the growth and fostering innovation among technology-based SMEs. These policies not only offer support and resources but also serve as catalysts for their overall development. By expanding their market presence and establishing a strong foothold, these initiatives provide technology-based SMEs with additional motivation to drive the digital transformation of SMEs in Hong Kong in a market-oriented manner.

Overall, the findings suggest that open innovation, by expanding collaborative networks and providing access to government-led initiatives, plays a crucial role in facilitating the digital transformation of SMEs.

5.7 Chapter Summary

Throughout this chapter, I have explored the Hong Kong Open Innovation Mechanism in the open innovation ecosystem and its various components. I began by analysing the drivers and gaps in OI and then proceeded to examine the roles played by different shareholders in the OI ecosystem. I explored how interorganisational relationships can facilitate OI and how SMEs' participation can impact the development of the innovation and technology industry in Hong Kong. In this concluding section, I summarised the key points discussed in this chapter, providing a comprehensive understanding of the importance of OI and its implications for organisations.

Firstly, the analysis reveals that the factors driving SMEs' involvement in OI in Hong Kong comprise various government funding schemes, support from government bodies in endorsing technological products, innovation events and competitions, as well as initiatives promoting open data and access to commercial data. Together, these efforts establish an ecosystem that fosters SMEs' engagement in OI, boosting their chances of success in the highly competitive market.

Secondly, there are several key gaps that hinder the participation of Hong Kong SMEs in OI. These include gaps in domain knowledge, gaps in functional expectations within the value chain, gaps in coordination, gaps in factors of production, and gaps in supply and demand. Addressing these gaps is crucial to enhance the involvement and achievements of Hong Kong SMEs in OI.

Thirdly, in the context of facilitating OI activities in Hong Kong, each actor plays a crucial role. According to qualitative studies, universities have five primary functions in OI: knowledge creation, technology transfer and commercialization, talent development, open access to research, and collaborative research partnerships. Some respondents proposed that the cultivation of technology start-ups may be added as a new function of universities. The government promotes OI through policies, various funding schemes and programs, open data, and dedicated organisations. Industry associations and partnerships help SMEs access valuable resources, share knowledge, and collaborate on joint projects. With respect to financial institutions, incubators/accelerators offer physical spaces, resources, and networking opportunities, while facilitators facilitate collaborations between SMEs and other OI players (especially industries and government departments). Media can help SMEs enhance visibility, foster collaboration, advocate for policies, build community, and disseminate knowledge. Understanding the role of each player can help us understand the OI atmosphere or even OI ecosystem in a systemic approach.

Fourthly, the interorganisational relationships among players in the OI ecosystem in Hong Kong possess certain characteristics that create obstacles to fully realising their potential. While the government and government organisations have a funding relationship and work together on infrastructure-related projects, the relationships between the government and OI players are not very strong. Specifically, the government and government organisations are somewhat reluctant to establish close connections with industries and SMEs. Nevertheless, OI plays a vital role in enabling the digital transformation of SMEs by expanding their collaborative networks and granting them access to government-led initiatives. The interorganisational relationship among players enriched the discussion of OI in SMEs.

From the qualitative research, the respondents viewed that university and SMEs are two ends of the open innovation value chain. In between, there are different players such as the government, industries, financial institutions, media, intermediaries like agencies and so on. Figure 5.1 provides a schematic diagram illustrating the major relationships between SMEs and other OI players.

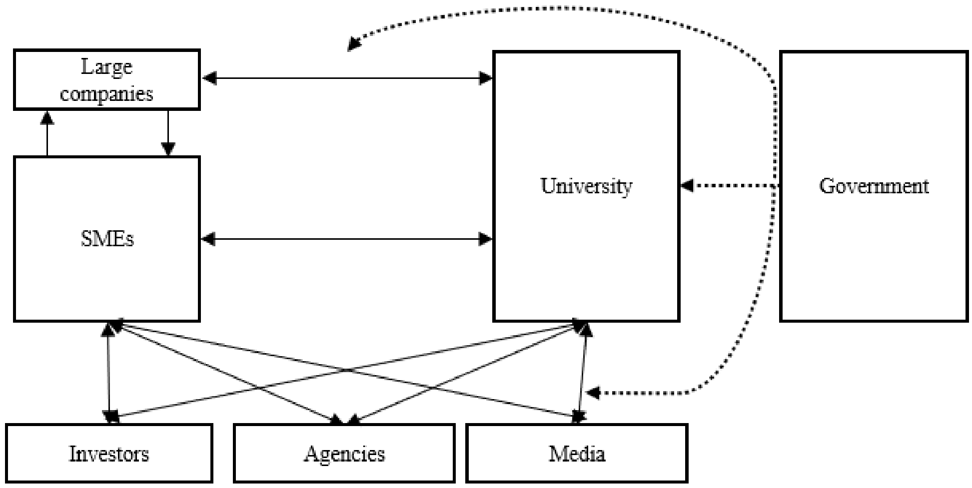

Figure 5.1 The OI (open innovation) ecosystem faced by Hong Kong SMEs

Built on Arnold et al. (2012).

In previous discussion of quadruple helix model (Yun & Liu, 2019), only Government-Industry-University-Society were taken into consideration. These studies further enhance the understanding towards the role of players such as financial institutions, media, agencies contributing to the OI ecosystem. Such discussion contributed to the collaborative framework of OI. I would propose to use 'Universities' instead of 'University' and 'Industries' instead of 'Industry' because it ignores the internal dynamics and interactions among universities and among industries in the ecosystem. In fact, we need to view the value chain of the complex organic Open

Innovation ecosystem in a systematic way and so that we can deeply look into detailed and dynamic interactions of each player. According to the interviews, an entity is required to possess the domain knowledge of other players in the ecosystem in order to achieve successful collaborations in OI activities. Otherwise, both players cannot effectively interact. Better interaction can facilitate resources and knowledge sharing. From a resource-based point of view, the OI ecosystem is important to SMEs in the sense of facilitating the transfer and allocation of OI resources in the ecosystem which is a scarce resource in the market.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The primary aim of this study was to investigate the OI ecosystem of SMEs in Hong Kong. To achieve this aim, several specific objectives were set forth, including identifying the key ‘players’ and their roles in Hong Kong’s OI ecosystem, collecting and analysing data on Hong Kong SMEs’ participation in OI activities and their relationships with other players, examining the push and pull factors that encourage SMEs in Hong Kong to engage in OI activities, and providing recommendations for establishing a support mesh to facilitate Hong Kong SMEs’ participation in OI activities.

In this concluding chapter, I present a comprehensive analysis of the research findings and their implications for OI and SMEs. The chapter begins with an examination of data triangulation and its role in drawing conclusions from the research. Subsequently, the discussion delves into the nuanced aspects of the findings, shedding light on their significance and potential impact. Building on these insights, the chapter then puts forth targeted recommendations aimed at enhancing the practice of OI within the context of SMEs in Hong Kong. Finally, the research’s limitations were discussed and a roadmap for future inquiries in this domain was provided.

6.2 A Comprehensive Understanding of OI Engagement among Hong Kong SMEs

With the aims and objectives of this study in mind, this section will address each research question in turn, synthesizing the findings and insights gained in both the quantitative and qualitative segments of the study.

Research Question 1. What kind of 'players' can be found in Hong Kong's OI process?

Both quantitative and qualitative data suggest that all the OI 'players' proposed in the literature exist in Hong Kong's OI process. The players included the Government, industry, universities, financial institutions, agencies and media. The quantitative analysis shows that the OI activities of SMEs are influenced by factors such as the company's age, size, and industry. Older companies are more inclined to outsource R&D functions. Larger SMEs tend to participate in technology licensing. In specific industries like financial services and innovation/technology sectors, there are distinct patterns observed in terms of technology spin-offs, mergers/acquisitions, and collaboration with third parties. These results are well explained by the qualitative data, which suggests that these predetermined actors more or less play a role in the OI system in Hong Kong and that no other new actors have emerged.

The influence of a company's age, size, and industry on the OI activities of SMEs can be attributed to several factors. Firstly, older companies may have established networks and relationships with external partners, making it easier for them to outsource

R&D functions. These companies might prioritize cost-efficiency and risk mitigation by leveraging the expertise and resources of external entities. On the other hand, younger companies might be more focused on building internal capabilities and opt for in-house R&D activities.

The tendency of larger SMEs to participate in technology licensing can be explained by their greater resources and capabilities. These organizations may have stronger financial backing, enabling them to negotiate and obtain licenses for innovative technologies. Additionally, larger SMEs may have a broader customer base and distribution channels, making technology licensing an attractive strategy for expanding their product or service offerings.

The distinct patterns observed in specific industries, such as financial services and innovation/technology sectors, indicate the unique characteristics and dynamics of these sectors. In financial services, technology spin-offs may arise from the need to develop specialized solutions for fintech applications. Mergers/acquisitions are common as companies seek to consolidate resources, gain market share, or access new technologies. Collaboration with third parties is prevalent in these sectors due to the rapid pace of technological advancements and the recognition that partnerships can enhance innovation and competitiveness. These findings suggest that different industries have specific OI strategies tailored to their sector-specific needs and opportunities.

Research Question 2. What are the relationships between SMEs and each of the other players?

The quantitative data show that Hong Kong SMEs have strong relationships with customers and suppliers, indicating the importance of these partnerships in driving innovation. However, there is room for improvement in relationships with large enterprises, government organisations, industry consultants, and other stakeholders. The qualitative analysis provides an explanation for SMEs' loose relationship with large enterprises. It demonstrates that SMEs' decision to engage in OI activities and the related motives were related to their gaps in technology knowledge and the overall gap in coordination in the OI ecosystem as a whole.

The relationships between SMEs and OI partners are associated with their motives for participating in OI, particularly in technology acquisition, cost reduction, knowledge transfer, and performance improvement (financial and non-financial). The connections between Hong Kong SMEs and their customers and suppliers are robust, highlighting the significance of these partnerships in fostering innovation. Nevertheless, the qualitative research confirms that SMEs tend to focus on OI players with whom they have business relationships, and their direct motivations to collaborate with these players are often unrelated to OI. The research further suggests that SMEs with relatively strong capital are less motivated to participate in OI, while those SMEs with various deficiencies and needs are more inclined to maintain connections with external organisations. In other words, the thesis highlights that the participation of Hong Kong SMEs in OI activities is primarily driven by demand.

The thesis also reveals that the nature of the relationship between SMEs and their OI partners is determined by their motivations for engaging in OI, particularly in areas such as technology acquisition, cost reduction, knowledge transfer, and overall performance improvement, both financially and non-financially. The qualitative part of the research primarily supports the results of the regression analysis. For instance, the interview data reveals that SMEs driven by the desire to acquire technology are more inclined to establish closer connections with various stakeholders, such as SMEs in the same industry, large companies, government organisations, customers, and financial institutions. This finding suggests that it is likely because these SMEs driven by technology acquisition often operate with limited capital and find themselves positioned towards the end of the industrial chain, bringing them closer to their customers. As a result, these SMEs recognise the importance of utilising technology to enhance their efficiency, leading them to seek knowledge and guidance from larger companies and other SMEs within their industry. Additionally, they are also eager to secure technology-specific funding from government organisations and financial institutions, such as the Innovation and Technology Fund.

The quantitative analysis also shows that SMEs with high motives for knowledge transfer tend to maintain a less close relationship with government organisations and large companies in other industries. The qualitative part provides some feasible explanations:

SMEs with a motivation for knowledge transfer are typically larger SMEs with a certain level of R&D capabilities rather than technology consumers. They act as 'business doctors' for smaller SMEs in open innovation, helping narrow the knowledge gap between industry and university research. Their unique roles result in closer relationships with smaller SMEs and more distant relationships with larger companies in other industries compared with other SMEs. These SMEs engaged in knowledge transfer often have relatively more capital, which means they do not need government funding like startups do. Therefore, it is possible that their relationships with government agencies are not as close as those of smaller SMEs.

Moreover, the qualitative data indicates that older SMEs are more inclined to collaborate with government organisations and large companies in the same industry for open innovation activities. This is because these institutions often partner with larger SMEs, which typically are the older ones among them.

Research Question 3. What kinds of inbound and outbound OI activities are between SMEs and other players?

The quantitative analysis shows that the three most commonly adopted forms of inbound OI are brand in-licensing, IP trading, and merger or acquisition. Over one-third of the surveyed companies also utilise outsourcing of R&D functions, joint R&D companies with third parties, and technology in-licensing. In contrast, the proportion of companies engaged in technology spin-offs is relatively low. Among outbound OI activities, the most widely used forms include selling innovative products/services and collaborating with other third-party organisations. Revealing innovation to third parties and brand out-licensing are also employed by over one-third of the respondents. By contrast, technology out-licensing is less common.

The qualitative analysis largely confirms this observation. On the one hand, a significant feature is that technology-oriented SMEs are scarce in Hong Kong. Therefore, more SMEs participate in inbound rather than outbound OI, and as a consequence, they are naturally less involved in technology spin-off and technology out-licensing but are more inclined to adopt rather than create new technologies. On the other hand, due to the presence of industry oligopolies and a traditional business mindset, many SMEs are reluctant to adopt new technologies.

Research Question 4. What are the roles of each player in facilitating (or prohibiting) OI activities in Hong Kong?

This research, primarily the qualitative part, reveals that, in the open innovation ecosystem of Hong Kong, universities serve as the foundation for innovation by creating knowledge, transferring technology, nurturing talent, providing open access to research findings, and forming collaborative research partnerships. The Government functions as ‘matchmakers’ and aims to minimise information asymmetry among various OI players in the value chain by formulating policies, promoting open data, and establishing organisations related to technology innovation. The relevant government organisations further supplement the Government’s role by educating and demonstrating to both the supply and demand sides. Industry associations and cross-industry partnerships help SMEs access resources, share knowledge, and collaborate on joint projects. With respect to agencies, incubators/accelerators provide physical spaces, resources, and networking opportunities to support SMEs in scaling up their operations. In contrast, facilitators facilitate collaborations between SMEs, industries, and government departments.

Financial institutions provide funding support and guidance to evaluate market prospects, manage risks, and promote and package enterprises. Interview data suggests that many SMEs do not need to borrow money from banks as they run small businesses. Yet, the interview material also increases our understanding of the functions of financial institutions - their role is more than just financing. They can introduce businesses to SMEs, which was not covered in the questionnaire.

Media can enhance visibility and awareness, foster collaboration and networking, advocate for supportive policies, build a sense of community, and disseminate knowledge. However, they need to function well in facilitating communication and feedback to drive open innovation and support the growth of startups and entrepreneurial activities. It should also be noted that both qualitative and quantitative research indicate that the extent to which media can help SMEs engage in open innovation varies depending on their industrial field. Culture and sports-related SMEs have a closer relationship with the media compared to other industries. In comparison, technology and innovation-focused enterprises have a significantly weaker relationship with the media. As suggested in interviews, this is because Hong Kong media tends to prioritise reporting on novel and engaging content that captures public interest, which is their survival strategy. This current situation may be unfavourable for developing technology and innovation-focused SMEs. Therefore, we should consider increasing media coverage and public recognition for these types of SMEs to enhance their visibility in Hong Kong.

Research Question 5. Why SMEs would/would not involve OI activities with their counterparts (i.e. Government, universities, financial institutions, agencies and media)

Regarding the reasons why SMEs would involve OI activities with their counterparts, the qualitative findings of the study had provided further evidence to support the quantitative findings. They showed that the Government's support through funding, endorsements, events, and open data initiatives encourages SMEs in Hong Kong to participate actively in open innovation and drive technological advancements in the ecosystem. Firstly, the Government's emphasis on technology development and innovation has created a favourable environment for open innovation. The Government has implemented various funding schemes and introduced policies to support tech enterprises, including the Innovation and Technology Fund and programs such as the TVP and ESS. These initiatives provide financial support and resources for both non-technology or technology SMEs to upgrade their businesses using innovation and technology.

Secondly, the Government and its organisations actively engage with technology companies and provide references for their products. This endorsement from government bodies enhances these companies' market recognition and credibility, increasing their chances of success.

Thirdly, the Government organises innovation-related events and competitions, providing platforms for SMEs to showcase innovative ideas and solutions. Winners of these competitions gain media coverage and recognition, which helps them attract potential customers in the commercial market.

Lastly, the Government promotes open access to both open data and commercial data. Open data initiatives facilitate the utilisation of publicly available data by enterprises, enabling them to develop innovative applications.

As for the specific motives for SMEs to engage in OI, quantitative results indicated that broadening sales and marketing channels and cost reduction are the primary motivations for Hong Kong SMEs. Additionally, technology acquisition, talent acquisition, and improving corporate performance are also significant drivers. The qualitative results corroborated these quantitative findings, as both self-descriptions of SMEs' motivations for participating in OI and descriptions of Hong Kong SMEs by other OI participants indirectly confirm the quantitative research results. It is evident that SMEs are more willing to choose OI when they are unable to be self-sufficient in their own development. This is also reflected in the push factors for OI identified in the quantitative research, such as changes in company business models, the global/national digital transformation trend, and requests from investors/shareholders.

In addition, the results of the quantitative study demonstrated that the participants do not widely recognise certain push factors that could potentially be effective, such as the national green policy, the development of new digital laws, and the national digital economy policy. Similarly, these factors were seldom discussed in the qualitative research, further supporting the conclusions drawn from the quantitative analysis.

Concerning why SMEs would not involve OI activities with their counterparts, quantitative research revealed that gaps in not participating in OI activities in Hong Kong include difficulties in finding suitable partners, accessing talents, and securing capital. The quantitative part also highlighted the fact that Hong Kong SMEs tend to prioritise short-term interests excessively as a factor hindering their active participation in OI. Moreover, the quantitative study indicates that all other conditions being equal, smaller SMEs are more likely to consider capital size as a barrier to OI.

Generally aligned with the quantitative part, the qualitative research further explained some institutional issues underlying these problems. The participation of SMEs in OI is crucial for enhancing innovation and competitiveness in the Hong Kong ecosystem. However, several gaps hinder their involvement in OI. These gaps include a lack of domain knowledge among upstream players, such as university professors and technology transfer offices, and a lack of insight into practical demands among science and technology-oriented enterprises. These gaps result in a mismatch between industry needs and research outcomes.

Furthermore, gaps in functional expectations within the value chain contribute to the challenges faced by SMEs. The market's expectations of the Government include the reduction of patent usage fees and the provision of effective incubation services. However, in reality, some government agencies often consider their job done by merely providing space and funding to SMEs. The Government, in turn, expects universities to promote OI, but universities prioritise the advancement of science and nurture future talents over commercial endeavours. This results in a gap between upstream and downstream players and limits the effectiveness of technology transfer.

Coordination gaps also exist among different players in the OI ecosystem, with each player tending to work independently. Despite the Government's recognition of the differences in operational logic between the industry and universities, its establishment of Cyberport, HKSTP, and five research centres to bridge the gap has not resulted in effective coordination and collaboration among different players in open innovation.

Additionally, high land prices and labour costs, as well as the relatively small market size and industry monopolies, pose challenges for SMEs. These gaps in the OI ecosystem contribute to the hesitation of SMEs to participate in OI, hindering the growth of the ecosystem. It can be argued that all of these gaps disadvantage smaller SMEs with limited capital. From the perspective of resource dependence theory, capital is a fundamental factor for the survival and development of businesses. The scarcity of capital for smaller SMEs prevents them from investing in addressing the aforementioned gaps, particularly in terms of collaboration with Government, universities, and larger enterprises. Consequently, smaller SMEs face greater challenges in participating in open innovation compared to larger SMEs.

Research Question 6. What kinds of support are offered by the government, universities, financial institutions, agencies and media to SMEs and vice versa?

Based on qualitative analysis, financial institutions, such as angel investors and specialised investors, play a crucial role in the open innovation ecosystem by providing various forms of support. This includes funding, evaluating market prospects, managing risks, facilitating networking opportunities, and offering guidance to attract industry or public funding. The survey results supported this, with 60% of respondents stating that financing is the most significant contribution financial institutions make towards promoting SMEs' participation in OI. Additionally, a quarter of respondents indicated that these institutions help SMEs establish inter-organisational relationships, i.e., facilitate partnerships. However, similar to the qualitative research findings, the quantitative analysis revealed that financial institutions offer relatively weak mentoring services. Besides their primary finance function, these financial institutions can provide more networks for SMEs, which does not require deliberate effort from them.

The qualitative analysis showed that agencies provide space, collaboration and networking opportunities, partnership formation, and resource sharing to facilitate OI. A number of interviewees opined that the ‘agency’ is an important intermediary and acts as a ‘translator’ or ‘business physician’ to translate the technology terms to SME end users. However, the survey results showed that almost 40% of respondents believe agencies play ‘no role’ in OI activities and that SMEs had weaker relationships with facilitators (i.e., agencies) than any other players. In other words, the quantitative data suggested that SMEs perceive the agencies’ role in their participation in OI activities to be less significant than what the agencies themselves believe. Based on a combination of qualitative and quantitative data, the contradiction may stem from SMEs perceiving the role of agencies in providing infrastructure for open innovation indirectly rather than directly, leading them to underestimate their impact. Other quantitative results generally aligned with the qualitative findings. Around 40% of respondents believed agencies play an inter-organisational network role, while nearly 30% thought agencies have a promotion role. Only about 20% of respondents believed agencies play a capital/funding support or office space role. These quantitative results and qualitative findings both indicated that the agencies’ most significant function in Hong Kong’s SMEs’ OI activities is the inter-organisational network role, which effectively meets SMEs’ networking needs and enables them to establish partnerships.

The qualitative part of this thesis indicated that, from the perspective of media professionals, the media play a role in enhancing visibility and awareness, promoting collaboration and networking, and facilitating community building. The survey of SMEs also highlighted the importance of promotion and branding. However, there were some misalignments between the survey results and the qualitative interview findings, suggesting that SMEs' views of the media differ somewhat from how the media perceives itself. Specifically, this study intentionally interviewed three distinct types of media: traditional news media, radio station, and emerging digital media. The qualitative results showed their differences in perceived mission and approaches to facilitating OI in Hong Kong. In fact, more than half of the survey respondents believed the media play such a role in sales and marketing. This further confirms the characteristic of Hong Kong SMEs, who prioritise benefits in almost all their actions and subconsciously see the media as an investment to increase sales. As the survey results showed, the most common type of partner in inbound OI was other companies in the industry and suppliers, both with a participation rate of 35%. Additionally, although media professionals believed they have helped SMEs establish inter-organisational networks, only a few (19%) SMEs share this view. This result likely suggested that the media's efforts to promote OI for Hong Kong SMEs had not achieved the expected effect, and more endeavours are needed to bridge the gap between their vision and reality.

Furthermore, the qualitative analysis suggested that universities or research institutions contribute through knowledge creation, technology transfer, and talent development and training. Industries collaborate with SMEs, scout and acquire technologies. Collectively, these actors provide crucial support to SMEs in their growth and development.

6.3 Discussion

In addressing the six research questions, this section systematically responds to the three research objectives one at a time, namely to (1) identify the key ‘players’ and their roles in Hong Kong’s OI ecosystem, (2) collect and analyse data on Hong Kong SMEs’ participation in OI activities and their relationships with other players, (3) examine the push and pull factors that encourage SMEs in Hong Kong to engage in OI activities, and (4) provide recommendations for establishing a support mesh to facilitate Hong Kong SMEs’ participation in OI activities.

This thesis highlights that SMEs in Hong Kong are somewhat passive in participating in OI activities. The main drivers for these SMEs to engage in OI activities are the change in company business models, the global/national digital transformation trend, and requests by investors/shareholders. In other words, SMEs often have no other choice but to engage in OI. Previous research has also indicated that a lack of resources may compel SMEs to adopt OI approaches, as this strategy can help them overcome their liabilities (Engelsberger et al., 2022; Urbinati et al., 2020).

This thesis also emphasises that although many SMEs in Hong Kong participate in OI activities, their motivation for participation is largely driven by the benefits they see for themselves rather than the positive impact of OI on overall socio-economic development. This point has been revealed in previous studies as well. For instance, according to Henttonen and Lehtimäki (2017), SMEs employ OI primarily for commercialisation rather than research and development purposes.

In the current thesis, it is found that among all OI players, Hong Kong SMEs have strong relationships predominantly with customers and suppliers. These SMEs tend to maintain loose relationships with large enterprises, government organisations, industry consultants, and other stakeholders. This finding is also reflected in the motivations of the interviewed participants in this study, where the dominant motivations are broadening sales and marketing channels and cost reduction. These findings corroborate previous research conclusions that SMEs are more interested in immediate benefits when participating in OI activities, and they may not be inherently interested in OI or technology itself. For example, according to Padilla-Meléndez et al. (2013), SMEs do not give sufficient attention to knowledge transfer and exchange, despite their critical importance for OI, as they involve the recognition of researchers, the development of intellectual property contracts, and the determination of project time scales.

Consistent with previous research findings, this thesis highlights the role of Government in driving OI. Unlike other governments, the local Government in Hong Kong does not own technology directly. The local Government would give back the IP ownership decision to its universities or its research arms, etc. Therefore, it seldom directly transfers its IP to the commercial sector i.e. SME. Consequently, it would support Open Innovation in Hong Kong mainly through monetary support, open data support and market environment support instead of technology support.

The analysis shows that supportive government schemes, the development of new technologies, and the Government’s innovation and technology policy are commonly believed to be effective pull factors in encouraging OI participation. This finding aligns with existing literature that justifies the necessity of government involvement in the transition from closed to open innovation (Acosta et al., 2015; Mardones & Zapata, 2019; Radas et al., 2015). Scholars advocated for government support in creating a favourable business environment and infrastructure, such as allocating more funds for technology commercialisation, establishing facilities for entrepreneurial use, providing tax breaks for new and emerging businesses, and offering subsidies for these organisations (Abereijo, 2015; Bandera et al., 2016). Similar to previous research, this study finds that the Hong Kong government has made significant efforts in creating the quadruple helix of government-industry-university-research, considering financial support for R&D activities, development through innovation, and support for sectoral programs as beneficial activities for social development, which cannot solely rely on enterprises (especially SMEs) to bear the cost (Jugend et al., 2020). However, the qualitative findings of this thesis suggested that the Government's efforts in establishing the quadruple helix have not been effective. Unlike previous research, which found that public funding supports R&D activities by facilitating corporations to establish R&D departments (Mardones & Zapata, 2019), this study found that the Government's support for SMEs is not sufficient to induce changes in their internal governance structures.

According to interview data, the Government's grasp of open data, which is crucial in current OI, is relatively lagging behind because different government departments tend to work in silos. Despite having a large amount of data, the Government is unable to fully utilise these data to formulate targeted measures that can truly help SMEs. It is because the Government lacks the support of experts and technicians in data analytics and data intelligence. The Government's data team often lacks the necessary expertise and skills to analyse accurately and mine massive amounts of data. Some useful government data are still missing in the open data platform. This would lead to the failure to unleash the potential value of government data fully. In addition, historical data are still missing in the open data platform. SMEs are unable to extract valuable insights and information for SMEs from government data. On the other hand, the Government lacks measures to force large public utilities or public services corporations to share their data such as transportation data, electricity, and communication data effectively. Such circumstances also hindered the development of the Open Innovation atmosphere in Hong Kong.

To adopt a broader view, the polygonal helix should also take players such as financial institutions, agencies and media into consideration in order to grasp a more systemic view of the Open Innovation ecosystem. Previous research on open innovation in the business domain has primarily been focused on open innovation systems, with less attention given to innovation ecosystems. Business research has emphasised interactions between key organisations. For example, the AMRC model (AMRC, 2023) highlighted partnership between university, industry, R&D centres, and financial institutions in promoting open innovation. Such models have not adequately considered the role of Government, media, and agencies in promoting open innovation or have assumed that these organisations are not directly involved in the open innovation system. On the other hand, models like the triple helix, quadruple helix, and quintuple helix (Carayannis & Campbell, 2009; Carayannis et al., 2012; Cai & Liu, 2015), which focus on the entire innovation ecosystem, have considered Government and media as players in the entrepreneurial ecosystem. However, these models often take a macroscopic view and lack practical guidance for enterprises. Currently, both types of open innovation (eco)system research are constrained by disciplinary perspectives, leading to a certain degree of disconnect between these models and reality. This thesis emphasises the significance of open innovation ecosystems (versus systems) because we have discovered that when making decisions about participating in open innovation, enterprises consider the assistance that each player can provide, not only those directly related to business interests. This is a valuable contribution of this thesis, calling for interdisciplinary perspectives to analyse enterprise participation in open innovation and comprehensively examine the roles of non-industry actors. This is aligned with the resource-based theory, which emphasises the relational nature of the organisation (Scott & Davis, 2015) and an open systems approach, as the resources obtained from or supplied to the external environment are critical to the system's operation.

This study's focus on SMEs and the unique circumstances of Hong Kong has allowed me to give more attention to open innovation players that were overlooked in previous open innovation models. Previous research on innovation (eco)systems has predominantly been concentrated on large enterprises. From the perspective of resource-based theory, large enterprises possess abundant capital, giving them a greater advantage in establishing partnerships compared to SMEs (e.g., Das & Teng, 2000). In contrast, SMEs require more external support to form partnerships with other players during their participation in open innovation. That is why, unlike previous research, this study highlights the importance of Government, media, and agencies in the open innovation ecosystem. Additionally, the Hong Kong context provides an excellent environment for studying open innovation ecosystems as it combines a free and open market with a government that is gradually strengthening its role in industry development through technological innovation. This is another crucial reason why the findings of this thesis emphasise the role of Government in open innovation.

This thesis resonates with previous findings (e.g., Lee et al., 2010; Spithoven et al., 2013) and confirms that capital size is a significant factor limiting SMEs' engagement in OI activities. Although this thesis also reveals that a shortage of resources can be a motivator for SMEs to engage in OI, the analysis shows that it also constraints SMEs from participating in OI activities, as highlighted in previous studies (Livieratos et al., 2022; Spithoven et al., 2013). On the one hand, while OI is critical, SMEs adopt it to a far lesser extent than multinational corporations due to resource restrictions and scale limits (e.g., Lee et al., 2010). The quantitative analysis in this thesis found that all else being equal, larger SMEs engage more in technology licensing, while older companies are more likely to outsource R&D functions. This finding contrasts with previous research, which found that despite a lack of resources, new entrants in a sector were more likely to use open systems than incumbents (Lecocq & Demil, 2006). This discrepancy may be due to industrial hollowness in Hong Kong, which prevents SMEs from finding corresponding users even if they adopt open systems. Additionally, this thesis finds significant variations in the extent of OI participation across different industries. The quantitative analysis indicates that the financial services and innovation/technology sectors exhibit specific patterns in technology spin-offs, mergers/acquisitions, and collaboration with third parties.

Previous research on OI players has primarily been focused on the roles of universities and governments in the OI ecosystem. This study reveals the roles played by other players that have been largely overlooked. Firstly, unlike previous literature that simplifies the role of financial agencies as funding providers (Gobble, 2016; Roijakkers et al., 2014), this thesis finds that financial institutions have many other roles in OI, such as risk management, partnership facilitation, offering incubation and acceleration programs, and providing data and analytics support.

Secondly, this study pays more detailed attention to the roles of agencies in the OI ecosystem. The thesis finds that agencies provide essential support by offering space for innovation, fostering collaboration and networking opportunities, facilitating partnership formation, and enabling resource sharing, which aligns with previous research findings (Bruneel et al., 2012). However, contrary to the emphasis on the roles of incubators and science parks in an OI system in previous studies (Mortara & Minshall, 2011), this study finds that agencies' contributions to education and training and business incubation are not as prominent. Qualitative research findings suggested that one important reason for their limited impact is that these agencies have not effectively played the role of ‘innovation intermediaries’ (Chesbrough et al., 2006), which involves enhancing trust relationships between stakeholders and prompting companies to innovate by matching ideas, talent, and technology (Winch & Courtney, 2007). The agencies should play a role in lining up the information or knowledge asymmetry between technology SMEs and non-technology SMEs.

This study innovatively examines the role of media in the OI ecosystem, an area that has rarely been studied before (Mount & Martinez, 2014). The study finds that the media has a significant impact on OI by enhancing visibility and awareness, promoting collaboration and networking, advocating for favourable policies, building communities, recognising best practices and disseminating knowledge. It is worth noting that the media’s involvement in education and training initiatives is currently insufficient.

Most importantly, this thesis reveals the challenges faced by SMEs in participating in OI activities in the context of Hong Kong, which is dominated by the service industry and lacks manufacturing elements. These challenges include limited communication, inadequate infrastructure, boundary constraints, and one-sided relationships with the Government. The research also finds that technology SMEs would stay in the frontier of the technological department. They would be able to grasp the latest trends such as Artificial intelligence, communication technologies, business information modelling, augmented or virtual reality etc. However, there is a significant technical knowledge gap between non-technological SME and technological SMEs in Hong Kong. It is a gap that needs to be filled in order to push the Open Innovation environment forward. We also need the "industries" perspective when studying the dynamics among industries.

This thesis also gives a new view on the role of universities. Other than the advancement of sciences (including technologies) and nurturing of talents, our universities should also consider playing a new or active role in cultivating technological startups and the technological capability of SMEs. Such startups can supply solutions and skills to help the advancement of technology across different industries in Hong Kong. In addition, the universities should change their mindset in commercialising their IP rights to the market. An IP without usage means zero value. The universities should think about the non-monetary value brought to the community by commercialising their IP rights. The universities should share the mission to improve the technological capability and capacity of enterprises. Furthermore, different universities should interact with each other in order to achieve OI.

6.4 Conclusion

In conclusion, as in most of the developed areas across the world (Theyel, 2013), Hong Kong has implemented OI practices, though they are not yet fully comprehensive and could be improved upon. Currently, we are still in the early stage of development, as Hong Kong has recently undergone a change in Government, and many measures have only been implemented for a short period of time, ranging from a few months to a few years. We have taken positive steps towards creating a more innovative and collaborative culture in the region. Both the government and industry associations are key players in fostering an OI environment and creating an ecosystem that is conducive to innovation.

However, although significant changes have taken place compared to two decades ago, there is still a need for continuous efforts in this area. By promoting OI, Hong Kong can shift towards a more innovation-driven economy. This will require continued efforts from all stakeholders to further develop and expand upon the current OI practices and develop the interdisciplinary or cross-disciplinary expertise or knowledge (e.g. IT + Retial, IT Finance). Furthermore, in this thesis, I have identified several gaps and shortcomings in Hong Kong's OI practices. To effectively promote the development of OI in Hong Kong, it is essential to address these gaps through targeted policy initiatives. Specifically, there is a need to enhance business policies, foster a more supportive business environment, and facilitate better networking opportunities. By focusing on these areas, we can cultivate an atmosphere conducive to OI, encourage collaboration among stakeholders, and establish a robust platform that will contribute to the creation of a thriving OI ecosystem in Hong Kong.

In order to understand the innovation systems in Hong Kong, questions about the OI ecosystem or atmosphere are asked. However, it was observed that the OI atmosphere in Hong Kong is still limited. A university or an industry park may be able to build its own open innovation ecosystem. However, a territory-side innovation system should consist of different small innovation ecosystems. Such ecosystems should not be limited to a particular entity or industry. A cross-player and cross-industries OI system should be built in order to create Hong Kong as an Open Innovation-driven economy. In addition, in order to fill in the technology knowledge gap between technological and non-technological SMEs, more cross-industry technology exchange is required. Also, more cost-effective solutions to help SMEs taste the benefits of technology adoption in their businesses should be introduced. Such solutions can reduce the reluctance of SMEs to invest in digital transformation and enhance non-technological SMEs' technology capabilities.

In terms of theoretical contributions, as discussed above, this thesis emphasises the self-interested nature of SMEs' participation in open innovation activities, highlighting the importance of understanding the motivations and drivers behind their engagement. The study also calls for adopting a dual perspective that integrates management and science and technology studies approaches in examining the OI ecosystem, as opposed to relying on a singular disciplinary lens. Additionally, the research uncovers the roles of previously overlooked OI players, such as financial institutions, agencies, and media, thereby enriching the existing literature on open innovation ecosystems.

In terms of practical contributions, this study reveals the challenges faced by Hong Kong SMEs in engaging with open innovation and provides insights into how to establish an OI support network to facilitate their participation. By identifying the barriers and opportunities within the OI ecosystem, policymakers, industry stakeholders, and SMEs themselves can develop targeted strategies to enhance open innovation adoption and collaboration among SMEs in the region.

6.5 Recommendations for OI and SMEs

In the post-pandemic era, the economy of Hong Kong is gradually rebounding. As indicated by the results of the '2023 Startup Survey,' the startup ecosystem in Hong Kong is thriving, with a remarkable surge in the number of startups reaching an all-time high of 4,257, representing an impressive increment of 272 compared to the previous year (InvestHK, 2023). This substantial growth vividly demonstrates the inherent attractiveness of Hong Kong as a favourable destination for ambitious startup founders. Vigorously developing 'new quality productive forces' has become the inevitable choice for Hong Kong in responding to the call of the central government and accelerating economic development (Li, 2024), further necessitating active promotion of OI by the Hong Kong government.

The findings of this study suggest that, while university spin-offs and startups have been successful in implementing OI through university-industry or cross-industries collaboration, SMEs have not yet been able to fully capitalise on the immense benefits of such collaboration. Instead, their experiences have been characterised by difficulties and failed investments, thereby indicating that university-industry collaboration in Hong Kong still faces several challenges and shortcomings. To further enhance the OI atmosphere in Hong Kong, efforts should be made to address the obstacles faced by SMEs in Hong

Kong, such as the limited market size, lack of experimental sites, and high operational costs. This can be achieved through measures such as providing subsidies or incentives to SMEs engaged in R&D as their primary business, as well as supporting incubators that meet specific criteria. By creating a favourable incubation environment, SMEs can overcome the challenges of the initial startup phase.

Equally importantly, universities and organisations that are involved in innovation and technology should have a deep understanding of the language, industry-specific terminology, and business mindset of SMEs. Only by doing so can SMEs be convinced of the value of investing in technology and be motivated to leverage it to improve their efficiency actively. By speaking their language and using terms they are familiar with, such organisations can establish a connection with SMEs and demonstrate how technology adoption can benefit their specific business goals. This understanding will encourage SMEs to embrace technology, leading to increased productivity and competitiveness. Ultimately, this will contribute to the overall growth and development of the innovation ecosystem in Hong Kong.

In addition, it is recommended that SMEs be offered more favourable patent licensing terms. This can be done by establishing policies that enable SMEs to access patents at preferential prices. By reducing the financial burden of patent licensing, SMEs can more easily incorporate innovative technologies into their operations, fostering a culture of OI.

Furthermore, we should review the anti-competition laws. It is essential to establish clear guidelines and restrictions on anti-competition. It is because we need to balance the importance of anti-competition to SMEs and the technological development of a particular industry. If each large company could only do their own industry-specific technology research and their own, it would handle the technology upgrade of the whole industry. Hong Kong is already a small market. We sometimes need large companies to take the lead for technology advancement together so that they can lead the SME in the same direction. We need a critical mass for technological success.

Lastly, streamlining administrative approval processes related to OI and entrepreneurship is essential. Reducing waiting periods and improving the efficiency of administrative procedures can significantly benefit SMEs. By minimising bureaucratic delays and facilitating faster approval for initiatives related to OI, SMEs can seize opportunities and bring their innovative ideas to market more quickly.

Overall, these policy recommendations aim to create an enabling environment for SMEs in Hong Kong, addressing various barriers and promoting OI as a key driver of economic growth and development.

6.6 Research Limitation and Future Research

This study relied heavily on qualitative data for certain research questions, such as the roles of each actor in facilitating (or prohibiting) OI activities in Hong Kong and the type of support offered by the Government, universities, financial institutions, agencies, and media to SMEs. These data are already triangulated with the findings from the quantitative data. Future research can collect more qualitative and quantitative data.

By exploring the current status of OI in Hong Kong and the barriers faced by SMEs in participating in OI, this study can provide some policy recommendations. To effectively enhance the participation of SMEs in OI activities, future research could employ action research. By advocating the concept of OI during the research process and promoting it to SME participants, this approach can help them overcome difficulties encountered in the OI participation process, thereby providing more direct value to the research.

In comparison to existing literature, there appear to be certain missing roles in Hong Kong's OI system. Further investigation is needed to understand the reasons behind this discrepancy and explore ways to enhance the involvement of universities and research institutions in supporting startups and entrepreneurial activities. Future research could explore deeper into the barriers and challenges that hinder the integration of data and analytics in OI practices.

As a final word, we need to think about what is open and what is innovation. Everyone has a different degree of openness. What is the largest extent of 'openness' that can be accepted by an individual company? Different people may give different answers. SMEs should understand that OI should not only be limited to open boundaries but also include an open mindset and open vision. We should have an open mindset and accept there are also other players in our community, in our industry and in our economy. SMEs should have an open vision to move forward in technology and adopt it in business practices. The definition of innovation also varies among people. Some people would only consider disruptive innovation as an innovation. Some people believe that minor improvements or creative thoughts are innovation. By any means, we should appreciate both breakthrough and small innovation because every improvement can bring our society forward.

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Appendix 1

Adoption of Open Innovation by SMEs in Hong Kong

香港中小企在香港應用開放創新的情況

請各位朋友，麻煩各位花約 10 分鐘時間填上以下問卷調查。所有資料均會匿名及保密，並於調查後銷毀。所有資料收集過程將會遵守個人資料（私隱）條例及 UWTSD 的大學研究資料管理政策。受訪者如感到不適合可以隨時停止回答本問卷。謝謝您的配合及支持。

All answers will be kept anonymous and confidential. The results will be discarded after the research is completed. The Personal Data (Privacy) Ordinance of Hong Kong and UWTSD's University's Research Data Management Policy will be fully observed in the data collection process. You can stop answering the questionnaire if you feel uncomfortable.

開放創新定義

開放創新與封閉式創新: 封閉式創新是企業依靠全內部資源去進行創新活動 (例如研發新產品、技術、服務等)，而「開放創新」與對外伙伴進行開放創新，合作對象包括: 使用者、供應鏈、政產學研等。 本問卷調查題目稍後會再作細分定義。

Definition of Open Innovation

Unlike Closed Innovation which totally depends on the company's own internal resources for innovation activities such as research and development of new products, technology or services etc.). Open Innovation would cooperate with different external parties including users, supply chain, government, industry, universities, research institutions etc. for innovation. Open Innovation will be further defined in the subsequent questions below.

1. 公司總部 Your company based: (單選 Choose the one most appropriate) *

○ 香港 Hong Kong

○ 澳門 Macau

○ 中國內地 Outside Hong Kong: Mainland China

○ 其他香港境外地區 Outside Hong Kong: Other countries

2. 公司規模 Company Size: (單選 Choose the one most appropriate) *

○ 0-20 人 people

○ 21-40 人 people

○ 41-60 人 people

○ 61-80 人 people

○ 81-100 人 people

○ 100 人或以上 people +

3. 公司性質 Company Nature (請選出一個最適合形容您公司業務的選項 please choose one that is the most appropriate one to describe your business) *

○ Financial services 金融服務

○ Tourism & Retails 旅遊及零售

○ Trading and logistics 貿易及物流

○ Professional and producer services 專業及工商業支援服務

○ Innovation and technology 創新及科技

○ Culture and sports related 文化及體育

○ Other: ☐

4. 公司研究及發展支出佔公司每年收入的百分比 Percentage of Research & Development expenses towards total annual company revenue: (單選 Choose the one most appropriate) *

○ 0%

○ 1-5%

○ 6-10%

○ 11-15%

○ 15-20%

○ 20%-25%

○ 25%-30%

○ 30%+

5. 你的最高學歷 Your Highest Qualification attained: (單選 Choose the one most appropriate) *

○ 小學或以下 Primary education or below

○ 中學或同等學歷 Secondary education or equivalent

○ 副學士／高級文憑或同等學歷 Associate Degree / High Diploma or equivalent

○ 大學學位 University Degree

○ 碩士或深造文憑 Master Degree / Postgraduate Diploma

○ 博士學位或以上 Doctor Degree or above

○ Other: ☐

6. 你的職位 Your Job Position: (單選 Choose the one most appropriate) *

◯ 非管理人員 Non-management

◯ 中層管理人員 Middle Management

◯ 高級管理人員 Senior Management or Above

◯ 專業人士 如: 會計師、工程師、醫生、教師等 Professionals e.g. accountants, engineers, medical doctors, teachers etc.

◯ Other:

7. 你在公司的角色 Your role in the company: (可複選 Click all when all apply) *

- ☐ 人力資源/行政 Human Resources / Administration
- ☐ 銷售/市場推廣/客戶服務 Sales/ Marketing/ Customer Services
- ☐ 會計或財務 Accounting / Finance
- ☐ 研發或技術相關 Research and Development / Technical Related
- ☐ 生產過程或營運 Manufacturing process / operation
- ☐ 其他支援角色 Others supporting Role
- ☐ Other:

8. 請問你是否公司主要決策者 Are you a major decision maker in your company? (單選 Single choice only)*

◯ 是 Yes

◯ 不是 No

◯ 可能是 Maybe

9. 請問您的公司參與以下流入式開放創新項目的情況如何: Types of inbound Open Innovation involved by your company: (單選 Choose the one most appropriate) ☑*

	參與過	不感興趣，故未參與	不適用本行業，故未參與	受制於客觀限制，故未參與（請備注限制因素）
知識產權貿易 IP trading				
品牌引進授權 Brand in-licensing				
科技引進授權 Technology in-licensing				
科技分拆 Technology spin-off				
把研發外判 Outsourcing of R&D functions				
收購或合併 Merger or Acquisition				
委託研究 Commissioned research				
與第三方機構進行聯合研發 Joint R&D companies with third parties				
其他________				

10. 請問您的公司參與以下流出式開放創新項目的情況如何: Types of outbound Open Innovation activities involved by your company: (單選 Choose the one most appropriate) ☑ *

☐

	參與過	不感興趣，故未參與	不適用本行業，故未參與	受制於客觀限制，故未參與（請備注限制因素）
銷售創新產品／服務 selling innovative products / services				
將創新向第三方披露 revealing innovation to third party				
品牌對外授權 Brand out-licensing				
科技對外授權 Technology out-licensing				
與其他第三方機構的協作 collaboration with other third party organization(s)				
Other:				

11. 請問您公司採用了哪些知識產權保護政策 What kinds of intellectual property protection strategies are involved by your company? (可複選 Click all when all apply) ☑

*

☐ 專利 patent

☐ 商標 trademark

☐ 版權 copyright

☐ 工業設計 industrial design

☐ 沒有任何相關策略 No related strategy

☐ Other: ____

12. 根據以上第 9 題，貴公司對內的合作夥伴單位包括: Based on Question 9, what kind(s) the partners of the Inbound Open Innovation activities involved by your company? (可複選 Click all when all apply) ☑

*

☐ 沒有任何合作夥伴 No partners are involved

☐ 大學或科研機構 Universities or research institutions

☐ 同行業其他公司 Other companies in the industry

☐ 政府機構 Government organizations

☐ 供應商 Suppliers

☐ 顧客 Customers

☐ 競爭對手 Competitors

☐ 行業顧問 Industry consultants

☐ 行業促成者 Facilitators (e.g. 科學園／工業邨 ／ 數碼港 /孵化器／加速器／共用工作間 等 Science Park / Industrial Estates/ Cyberport/ incubators or accelerators or co-working space etc.)

☐ 金融機構 Financial institutions (e.g., 銀行／投資者／風創投基金 等 banks, investors, venture capital firms etc.)

☐ 線上／線下媒體 Online/offline media

☐ Other: ____

	0 - 沒有任何關係 No relationship	1- 非常鬆散關係 Very Loose relationship	2 - 鬆散關係 Loose relationship	3 - 少許密切關係 A little bit close relationship	4- 密切關係 Very close relationship
其他非行內中小企 Other SMEs of other industry (with size 100 people or above)	○	○	○	○	○
行內大企業 (100 人或以上) Large companies of the same industry (with size 100 people or above)	○	○	○	○	○
非行內大企業 (100 人或以上) Large companies of other industry (with size 100 people or above)	○	○	○	○	○
大學或科研機構 Universities or Research Institutes	○	○	○	○	○

政府及相關機構 Government organizations	◯	◯	◯	◯	◯
供應商 Suppliers	◯	◯	◯	◯	◯
顧客 Customers	◯	◯	◯	◯	◯
競爭對手 Competitors	◯	◯	◯	◯	◯
行業顧問 Industry consultants	◯	◯	◯	◯	◯
線上／線下媒體 Online / offline media	◯	◯	◯	◯	◯
金融機構 Financial institutions (定義參考上題)	◯	◯	◯	◯	◯
行業促成者 Facilitators (定義參考上題)	◯	◯	◯	◯	◯

13. 根據 10 題，貴公司對外的合作夥伴單位包括 Based on Question 10, what kind(s) of external partners of the outbound Open Innovation activities involved by your company? (可複選 Click all when all apply) ☑

*

- ☐ 沒有任何合作夥伴 No partners are involved
- ☐ 大學或科研機構 Universities or research institutions
- ☐ 同行業其他公司 Other companies in the industry
- ☐ 政府機構 Government organizations
- ☐ 供應商 Suppliers
- ☐ 顧客 Customers
- ☐ 競爭對手 Competitors
- ☐ 行業顧問 Industry consultants
- ☐ 行業促成者 Facilitators (e.g. 科學園／工業邨 ／ 數碼港 /孵化器／加速器／共用工作間 等 Science Park / Industrial Estates/ Cyberport/ incubators or accelerators or co-working space)
- ☐ 金融機構 Financial institutions (e.g., 銀行／投資者／風創投基金 等 banks, investors, venture capital firms etc.)
- ☐ 線上／線下媒體 Online/offline media
- ☐ Other:

14. 請形容貴公司與不同夥伴的關係: Relationship between your company and with different players: (單選 Single choice only)*

14. 對你公司而言，行業促成者(如 科學園／創新園 ／ 數碼港 /孵化器／加速器／共用工作間 等 ）扮演什麼角色? What are the roles of facilitators (Science Park / NNOPARK / Cyberport/ incubators or accelerators or co-working space etc.) to your company? (可複選 Click all when all apply) ☑ *

- ☐ 沒有任何角色 No roles
- ☐ 辦公地方 office space

☐ 宣傳推廣 promotion

☐ 組織網絡 inter-organisational network

☐ 資金支援 capital / funding support

☐ Other:

15. 請問金融機構 （如銀行、投資者、風創投機構等）對貴公司扮演什麼角色? What are the roles of financial institutions (e.g., banks, investors, venture capital firms etc.) to your company? (可複選 Click all when all apply) ☑

*

☐ 沒有任何角色 no role

☐ 財務支援 financing

☐ 友師 mentoring

☐ 組織網絡 inter-organisational network support

☐ Other:

16. 請問線上或線下媒體如何促進貴公司的開放式創新? What are the roles of online/offline media in facilitating Open Innovation to your company? (可複選 Click all when all apply) ☑

*

☐ 沒有任何關係 no relationship

☐ 推廣及品牌 promotion and branding

☐ 銷售及推廣 sales and marketing

☐ 友師 mentoring

☐ 機構網絡 inter-organisational network e.g. helping you locate partners / mentors etc.

☐ Other:

17. 請選出您認爲阻礙貴公司參與開放式創新的因素 In your opinion, what are the barriers for not involving in any Open Innovation activities for most SMEs

* (可複選 Click all when all apply) ☑

- ☐ 害怕 fear
- ☐ 人才供應 talents
- ☐ 希望對公司的知識產權有更多控制 wish to have more control over company owned IP
- ☐ 未能找到適合的合作夥伴 unable to locate suitable partners
- ☐ 市場未能提供相關科技 required technology is not available in the market
- ☐ 不知道如何找合作夥伴 not knowing where to find the partners
- ☐ 資金不足 lack of capital
- ☐ 我不認為有任何障礙 I don’t think there is any barrier
- ☐ Other:

18. 請選出貴公司參與開放式創新的主要動機。In your opinion, what are the benefits of Open Innovation to the SMEs? (可複選 Click all when all apply) ☑

*

- ☐ 改善企業財務方面的表現 Improvement in corporate performance (financially)
- ☐ 改善企業非財務方面的表現 Improvement in corporate performance (non-financial aspects)
- ☐ 降低成本 cost reduction
- ☐ 開拓營銷渠道 broaden sales and marketing channels
- ☐ 降低交易成本或尋找成本 reduction in transaction cost or searching costs
- ☐ 改善與其他組織的關係 improvement in interorganizational relationship
- ☐ 知識轉移 knowledge transfer

☐ 獲得人才 talent(s) acquisition

☐ 獲得科技 / 技術 technology acquisition

☐ 我看不到任何得益 I cannot see any benefits

☐ Other:

19. 下列因素會吸引貴公司更加願意參加流入式開放創新項目嗎? What pull factors drive the company to go for Open Innovation? (單選 Single choice only) ☑

*

☐

	會更加願意	與本行業關聯少，故不會更加願意	暫時不瞭解相關政策，故無法判斷	已經參與流入式開放創新，故相關政策影響不大
粵港澳大灣區規劃綱要 Guangdong-Hong Kong-Macao Greater Bay Area Outline Development Plan				
特區政府的支援計劃 如科技券、「發展品牌、升級轉型及拓展內銷市場的專項基金」supportive government schemes e.g. TVP, BUD Fund etc.				

新科技/技術的發展 development of new technologies				
數碼法規的新發展 development of new digital laws				
國家數字經濟政策 national digital economy policy				
香港特區政府的創新及科技政策 Innovation and Technology policy of the HKSAR Government				
國家「綠色」政策 national green policy				

下列因素會吸引貴公司更加願意參加流出式開放創新項目嗎?（單選 Single choice only）

	會更加願意	與本行業關聯少，故不會更加願意	暫時不瞭解相關政策，故無法判斷	已經參與流出式開放創新，故相關政策影響不大
粵港澳大灣區規劃綱要 Guangdong-Hong Kong-Macao Greater Bay Area Outline Development Plan				

特區政府的支援計劃 如科技券、「發展品牌、升級轉型及拓展內銷市場的專項基金」supportive government schemes e.g. TVP, BUD Fund etc.				
新科技/技術的發展 development of new technologies				
數碼法規的新發展 development of new digital laws				
國家數字經濟政策 national digital economy policy				
香港特區政府的創新及科技政策 Innovation and Technology policy of the HKSAR Government				
國家「綠色」政策 national green policy				

20. 你認為下列因素是否會推動貴公司參加開放創新?What push factors drive the company to go for Open Innovation? (單選 Single choice only) ☑*

☐ 、

	會推動	與本行業關聯少，	暫時不瞭解相關因素，故無法判斷	已經參與開放創新，故相關因素影響不大

		故不會推 動		
全球/全國的數字化轉型趨勢 global / national digital transformation trend				
公司商業模式的轉變 change of company business models				
新冠肺炎的影響力 Covid-19				
股東或投資者的要求 request by investors / shareholders				
新的環保需要 new environmental protection requirements				

21.你公司的合作夥伴來自那些地區?(可複選) Origins of your company's partners listed above: (please click all if all applies) ☑:*

- ☐ 香港 Hong Kong
- ☐ 澳門 Macau
- ☐ 中國內地 (廣東省以內城市) Mainland Cities (Within Guangdong Province)
- ☐ 中國內地 (廣東省以外城市) Mainland Cities (Outside Guangdong Province)
- ☐ 其他國家 Other countries
- ☐ 不適用 Not Applicable
- ☐ Other:

22. 貴公司在香港成立多久? How many years has your company been established in Hong Kong? (單選 Single choice only) *

◯ 12 個月內 / Within 12 months

◯ 13 - 24 個月 / 13 - 24 months

◯ 2 - 5 年 / 2 - 5 years

◯ 6 - 10 年 /6 - 10 years

◯ 11 年或以上 / 11 years or above

◯ Other:

23. 其他對開放創新的意見 (如有，請填寫) Other views towards Open Innovation, please elaborate if any:

Your answer

Appendix 2

Interview questions for participants from SMEs

(1) Can you describe your experience with engaging in inbound and outbound Open Innovation activities with other SMEs, government, universities, financial institutions?

(2) What are the factors influencing your decision to involve or not involve the inbound/outbound Open Innovation activities? Did any organisation encourage or incentivize you to participate?

(3) What are the roles played by your organisation in the OI process?

(4) In what ways do you believe OI activities can benefit your organisation?

(5) Have you faced any challenges or barriers when participating in OI activities? If so, what were they and how did you overcome them?

(6) In your answers to the questionnaire, you noted that your organisation has a very loose relationship with XXXX (according to their answers), yet XXXX is believed to be a critical player in other parts of the world. Why didn’t you work with it/them? Any specific considerations?

(7) Are there any specific types of support or resources that you would like to receive from other players in the OI process?

Interview questions for participants from government

(1) What initiatives or policies has the government implemented to facilitate OI collaborations between SMEs and other players? (ask to detail the relevant policy only when it the researcher is unfamiliar with the relevant policy)

(2) What are the roles played by the Hong Kong SAR government / government organisation in the Open Innovation process? How do you evaluate the government’s performance in this area compared to other developed countries?

(3) Have you observed any successful cases where the government's involvement has significantly contributed to the SME OI process?

(4) What are the benefits of inbound and outbound Open Innovation activities to the government?

(5) How to improve the incentives in the Public Sector Trial Scheme to enhance the government to use the technologies from SMEs?

(6) Effect of agencies and media in facilitating inbound and outbound open innovation activities between government (public sector) and SMEs.

(7) How do you ensure fairness and equal opportunities for SMEs to engage in OI activities with the government?

Interview questions for participants from universities

(1) How does your university promote and support OI collaborations with SMEs?

(2) What roles do you think universities should play in the Open Innovation process?

(3) Can you share any examples of successful OI partnerships between your university and SMEs?

(4) Does your university management provide incentives for professors/lecturers to conduct inbound or outbound Open Innovation projects with SMEs? Why/ Why not? How common is it? Can you cite some examples to demonstrate how your university supports such behaviour (e.g., specific resources or expertise)?

(5) What are the benefits of inbound and outbound Open Innovation activities to Hong Kong universities?

(6) Do academics have any incentives to transfer their innovation to SMEs? Why / Why not? How does your university ensure the protection of intellectual property rights while academics engage in OI activities?

(7) What steps have been taken to bridge the gap between academic research and practical applications through OI?

Interview questions for participants from financial Institutions

(1) As an investor, what are your roles in facilitating Open Innovation activities between your invested companies with SMEs, universities, and the government?

(2) Can you provide examples of financial support or funding options available for SMEs engaged in OI activities?

(3) Can you share some stories of industry collaboration, whether successful or not, that your organisation participated in? In your opinion, why did some cases succeed while others did not?

(4) What criteria does your institution consider when selecting SMEs for OI-related investment or partnership opportunities?

(5) Other than monetary support, can you describe kinds of support from your organisation to your invested company (e.g., business referral, marketing, etc.)

Interview questions for participants from agencies (i.e., incubator / co-working space / accelerator)

(1) What kind of programmes/measures are conducted by your organisation in facilitating inbound and outbound Open Innovation activities?

(2) Can you elaborate on the types of assistance or services that your organisation provides to support SMEs in OI activities?

(3) Do you think your organisation should have a more active role in promoting the Open Innovation environment in Hong Kong? How? (e.g., promoting inter-organisational network, investment support, promotion support)

(4) Can you share some of the success stories of your incubatees / tenants? How do you think your organisation plays a role in these success stories (/in helping SMEs to overcome the challenges or barriers that they face)?

(5) Did you provide any incubation/acceleration services to your incubatees /tenants? Can you share the scope of the services? How much do you know about the services your international competitor organisations provide for their incubatees/ tenants?
(6) To what extent do you think you are playing a role in promoting the Open Innovation environment for your incubatees / tenants, and for all Hong Kong SMEs?
(7) Are there any challenges you face when providing services to SMEs?

Interview questions for participants from media

(1) What kind of industry events are more likely to be reported by your media? Why?
(2) Do you share the mission of promoting industry collaboration in Hong Kong?
(3) Has your media ever reported on any SMEs' collaboration stories or other Start-Up's stories? Where did you know about that event? Why did you decide to report on that?
(4) Do you think your media should have the mission and roles to promote a positive Start-Up atmosphere in Hong Kong? If so, how (e.g., raising awareness, showing about the benefits, and functioning as a mediator)?
(5) Do you think the media should play a more active role in promoting an Open Innovation environment in Hong Kong? How? (e.g., in promoting inter-organisational network, brand building)?
(6) Have you noticed any challenges or limitations in reporting or covering OI initiatives involving SMEs? If so, how were they addressed?