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Fuelling Further Growth of Biotech and Healthcare Industries: Leveraging Hong Kong's Financial Infrastructure

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Contents

Executive Summary

In recent years, governments around the world are putting increasing emphasis on healthcare- and biotechnology-related sectors, as longer life expectancy and better health conditions of citizens would not only mean a larger work force, but also enhanced overall social well-being. Serving as a reminder of the importance of such sectors, the recent global pandemic is seemingly urging the society to invest further into research and development (R&D) of relevant work. With the United Nations estimating that the population aged 65 or above will reach 1.5 billion by 2050, nearly doubling that in 2020,[1] both public and private sectors have been stepping up allocation of resources, including financial resources, to healthcare and biotechnology sectors.

In this respect, Hong Kong as a capital formation centre has played an indispensable role in mobilising capital to support research and innovation in these sectors. The establishment of a financing hub, however, requires a comprehensive ecosystem consisting of, among others, sound infrastructure, ample business opportunities, transparent flow of information and a cluster of entrepreneurs as well as experienced analysts and investors. In this paper, the Financial Services Development Council (FSDC) aims to take a holistic view in examining the role of Hong Kong's financial market in facilitating the overall development of the ecosystem for the healthcare and biotechnology sectors.

To achieve this goal, the FSDC has set up a dedicated Working Group comprising leading industry experts to formulate policy recommendations on strengthening Hong Kong's capabilities as a financing hub for healthcare and biotech industries, for the HKSAR Government's and regulators consideration.

Taking a longer-term view, it is believed that Hong Kong should strengthen its value proposition as a financing hub for healthcare and biotech sectors riding on its unparalleled proximity to the Mainland, access to international capital markets and the abundance of academic and business talents.

- **A talent pool**: Priority should be placed in terms of creating a talent ecosystem. This can be done by exploring closer collaborations between the public and private sectors in providing mentorships while encouraging capacity building among the financial industry with respect to the science, technology, valuation models as well as business realities around the healthcare and biotech sectors.

- **A financing hub:** Continuously review and renew the rules and practices of the financial markets to ensure they reflect global trends, regional competition as well as technological development, so as to seamlessly bridge capital to innovation through active M&A, IPO, private investment and other fundraising activities.

- **A commercialisation launchpad**: Seek to introduce business-friendly policies and other support to facilitate businesses entering and commercialising in the expanded international, as well as Mainland Chinese, markets. Pursue mutual recognition of standards with key markets in relation to service and product offerings.

[1] The United Nations, Department of Economic and Social Affairs, World Population Ageing 2020 Highlights https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Sep/un_pop_2020_pf_ageing_10_key_messages.pdf

Meanwhile, some nearer terms measures have also been identified to address immediate challenges faced with the healthcare and biotech community, which are believed to be conducive for Hong Kong to achieving the aforementioned longer-term vision as a healthcare and biotech financing hub. **These near-term recommendations include:**

- **Nurturing, attracting and retaining talents with distinguished research capabilities and business acumen:**

  - University professorship assessments may consider covering commercial-related contributions that will, in turn, keep risk averse but knowledgeable research professors to stay put in Hong Kong;

  - Existence and benefits of the city's Talent List, which currently includes pharmaceutical and life science/biotechnology talent, should be promoted and administrative burdens on employers should be minimised;

  - Universities should consider increasing allocation of endowment funding for health and biotech related research, and consider investing in projects led by affiliated professors/ researchers/students.

- **Supporting financing needs through Government programmes and mobilising private capital and attracting venture capital and equity firms specialising in healthcare and biotech sectors through strengthened public-private partnerships:**

  - More generous, less risk-averse government-led incubation programmes / grant schemes with streamlined administrative procedures;

  - Public sector to convene a group of asset owners to co-invest in winners of certain competitions or, preferably, projects meeting certain standards;

  - The Future Fund, and especially the newly established "Hong Kong Growth Portfolio", should, within the capacity of its own governance, consider to continue investing in relevant strategically important industries, and put greater emphasis on the healthcare and biotech sectors.

- **Facilitating commercialisation of products and services in local, Mainland and international markets throughout the business cycle:**

    - As a continuation and extension of the Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA), the Hong Kong SAR Government to lead discussion with relevant Mainland and overseas counterparts to facilitate mutual recognition of industry standards;

    - Provide access to coworking space/ laboratories at discounted prices;

    - Research universities should set up a dedicated commercialisation work stream/department with an aim of strengthening relevant aspects of their researching results;

    - Targeted promotional opportunities for homegrown start-ups, with promotion scope extended to all start-ups in addition to commonly featured successful firms;

    - Facilitate cross-boundary Merger and Acquisition (M&A) activities through creating and nurturing B2B and business-to-investor events and relationships.

These recommendations are proposed with an aim of riding on Hong Kong's established advantages to grasp relevant opportunities by boosting investment in healthcare and biotech sectors, while bearing in mind the longer-term objectives of building a welcoming and dynamic ecosystem to encourage entrepreneurship and innovations.

Background and Overview

COVID-19 has brought about tremendous disruption to almost every aspect of society, one of the most directly hit being the healthcare system. Luckily for Hong Kong, the healthcare system has shown resilience in times of the pandemic, providing medical services to those in need in an orderly and efficient manner.

In a nutshell, the city's healthcare system is broadly divided into public and private sectors, with the former offering low-price medical services to Hong Kong residents and the latter being supported by a mature insurance market. For the public sector, the Hospital Authority and the Department of Health, led by the Food and Health Bureau, oversees the provision of various medical services. As of July 2021, the Hospital Authority oversees the operation of 43 public hospitals and institutions, 49 specialist out-patient publics and 73 general out-patient clinics[2]. The Department of Health oversees public health institutions, including but not limited to school dental clinics, elderly health centres, and clinical genetic service centres. Meanwhile, the private sector mainly comprises of 13 private hospitals, according to The Hong Kong Private Hospitals Association, and over 3,700 Western Private practice clinics, according to Hong Kong's Food and Health Bureau.[3] While there may also be room for improvement in any healthcare system, there is no doubt that the Government has laid a solid foundation, as reflected by the city's No.2 ranking in Bloomberg's Bloomberg Health-Care Efficiency Index 2020.[4]

Figure 1. Bloomberg Health-Efficiency Index 2020

Rank		Efficiency	Covid-19 Counts		2020 GDP	Life	Healthcare Cost	
Chg	Economy	Score	Mortality	New Cases	Chg %	Expectancy	As % GDP	per capita $
+1	Singapore	67.79	4.96	246.67	-6.00	83.30	4.4%	$2,619
-1	Hong Kong	64.89	14.94	265.71	-7.47	84.17	6.2%	$2,849
+12	Taiwan	51.69	0.29	8.65	0.05	80.19	6.4%	$1,550
+2	South Korea	50.79	10.63	338.68	-1.88	82.44	7.6%	$2,283
-2	Isreal	46.44	335.72	26,349.82	-5.89	82.74	7.4%	$3,145
+1	Ireland	45.22	425.07	9,140.75	-3.00	81.72	7.2%	$4,977
+3	Australia	42.77	35.61	86.67	-4.16	83.15	9.2%	$5,332
+10	New Zealand	41.74	5.18	66.57	-6.07	82.11	9.2%	$3,937
+5	Thailand	41.40	0.86	9.38	-7.15	75.58	3.7%	$247
-2	Japan	40.21	18.30	725.09	-5.27	83.99	10.9%	$4,169
+6	Norway	38.79	65.30	4,930.27	-2.83	82.40	10.4%	$7,936
+13	China	38.02	3.22	1.08	1.85	76.48	5.2%	$441

Source: Bloomberg

This worldwide recognition is, in part, a result of the Government's emphasis on growing its healthcare system in the past two decades. Health expenditure has been rising steadily over the past three decades, growing at an average annual rate of 5.6% from 1990 to 2020,[5] higher than the average GDP growth rate of 3.4% during the same time period. These trends highlight the fact that there has been a rising demand for healthcare services and products.

[2] Hospital Authority, available at https://www.ha.org.hk/visitor/ha_visitor_index.asp?Content_ID=10008&Lang=ENG&Dimension=100&Parent_ID=10004
[3] The Hong Kong Private Hospitals Association, available at http://www.privatehospitals.org.hk/en/hospitals.htm
[4] Bloomberg, Asia Trounces U.S. in Health-Efficiency Index Amid Pandemic, December 2020 https://www.bloomberg.com/news/articles/2020-12-18/asia-trounces-u-s-in-health-efficiency-index-amid-pandemic
[5] Food and Health Bureau, Hong Kong's Domestic Health Accounts (HKDHA) Estimates of Domestic Health Expenditure, 1989/90-2019/20 (SHA2011), June 2021 https://www.fhb.gov.hk/statistics/en/dha/dha_summary_report.htm

The Government has been sparing no effort in developing its healthcare- and biotechnology-related sectors and deploying substantial resources in this regard. In 2016, the Government proposed the first 10-year Hospital Development Plan (HDP) with an aim of enhancing healthcare talent training, upgrading and acquiring new medical equipment and others, and earmarked $200 billion for the implementation.[6] As suggested by the Financial Secretary, the whole project would lead to over 6,000 additional beds and over 90 operating theatres. In its 2018-19 Budget,[7] the Government identified biotechnology as one of the four key areas to develop innovation and technology. Fiscal measures have been implemented to fund building research infrastructure and facilities, and establish a research cluster on healthcare technology innovation.[8]

Moreover, the Hong Kong Stock Exchange (HKEX) introduced new rules to update Hong Kong's listing regime in 2018, opening doors for pre-revenue biotech companies to be listed on its Main Board. Three new chapters were introduced to the Main Board Listing Rules, aimed at: 1) permitting listings of pre-revenue biotech issuers that do not meet the Main Board financial eligibility requirements; 2) permitting listings of innovative companies with weighted voting rights (WVR) structures; and 3) establishing a new concessionary secondary listing route for Greater China and international companies that wish to secondary list in Hong Kong[9]. These rules have brought Hong Kong's listing regime into a new era, making it one of the most sought-after listing venues, for global healthcare and biotech firms especially. Since then, Hong Kong has become the largest public financing hub for healthcare and biotechnology companies in Asia and the second largest in the globe, with 33 pre-revenue biotech company listings as of June 2021[10].

These actions and initiatives, among many others, show the Government's vision for the future and its determination to improve the livelihood of its people through an enhanced healthcare system.

As it is important to realise the strengths of Hong Kong's healthcare system, it is just as imperative to propose and establish methods in which the sector can improve. In order to do so, we must first identify characteristics that are unique to the Hong Kong market, of which can be utilised to improve its healthcare system. With the above in mind, our research framework starts with defining what the healthcare and biotech sectors are in the context of Hong Kong.

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[6] HKSAR Government, The 2020-21 Budget Speech, February 2020 https://www.info.gov.hk/gia/general/202002/26/P2020022600176.htm
[7] HKSAR Government, The 2018-19 Budget Speech, February 2018 https://www.budget.gov.hk/2018/eng/budget13.html
[8] Hong Kong Trade and Development Council, Hong Kong Leading the Way in Greater Bay Area Biomedical Services Cooperation, May 2019 https://research.hktdc.com/en/article/Mzc0NDM1MzYy
[9] HKEX, HKEX celebrates third anniversary of new listing regime, June 2021 https://www.hkex.com.hk/News/Media-Centre/Special/HKEX-Celebrates-Third-Anniversary-of-New-Listing-Regime?sc_lang=en
[10] HKEX, HKEX in Biotech Issue 6, July 2021 https://www.hkex.com.hk/-/media/HKEX-Market/Join-Our-Markets/IPO/Biotech-Newsletter/HKEX-Biotech-Newsletter-Issue-6-EN.pdf

Healthcare

A commonly accepted definition of healthcare is the organised effort to provide medical care to individuals and communities, by trained and licensed professionals. The healthcare industry includes a wide range of sectors that involve medical-related devices manufacturing and services.

According to the Hong Kong Trade Development Council,[11] Hong Kong's healthcare industry is divided into two major sectors, namely the medical & healthcare equipment and devices sector, and the biotechnology, medical & healthcare services sector.

The medical & healthcare equipment and devices sector is further divided into household consumers' markets and professional or institutional buyers' markets. Currently, the majority of companies in this sector are original equipment manufacturers (OEMs), meaning that their products are often used as components in the products of other companies. To gain a competitive edge, many companies also provide engineering design services. Although many manufacturers have relocated to Mainland China in efforts to lower production costs over the past couple of decades, the quality control, research and development, and materials and equipment procurement continue to be executed in Hong Kong. The strategy to apportion part of its operations to the Mainland has allowed Hong Kong's healthcare sectors to maintain strong growth, with total exports from the sector increasing 17.5% in 2020.[12] Exports to the EU and the US accounted for a significant portion of this increase, with growth contributions of 38.5% and 18.5%, respectively.

The biotechnology, medical & healthcare services sectors provide a wide range of medical treatment and rehabilitation services from various perspectives. Hong Kong offers different medical treatment and rehabilitation services through the public hospitals and facilities under the Hospital Authority and private hospitals. For biotechnology, the Hong Kong Science and Technology Park (HKSTP) and Cyberport support the promotion of technological innovation, providing laboratories, tools and technical services to related start-ups. Appendix 1 outlines initiatives introduced by HKSTP and Cyberport in supporting the technological innovation of the healthcare and biotechnology sector.

Another component that contributes to the buoyancy of Hong Kong's healthcare sector is the special administrative region's focus on technological developments. The "Smart Hospital Project" is an example of the said technology-based developments and solutions. The project features a Queue Management System to streamline outpatient hospital appointments, with the mobile app "HA Go'' launched in 2019, to allow patients to organise appointments on their mobile phones. Another project launched in 2021 was The CUHK Medical Centre (CUHKMC), which is the first fully digitalised smart hospital in Hong Kong. Since the start of its operations, CUHKMC has introduced various innovative healthcare procedures, such as an entirely electronic medical record system, and real-time data mechanism to increase efficiency of patient treatment.

[11] Hong Kong Trade and Development Council, Biotechnology, Medical & Healthcare Industry in Hong Kong, May 2021, https://research.hktdc.com/en/article/MzEzOTQ1MjMz

[12] Ibid

Biotechnology

According to the Organisation for Economic Co-operation and Development (OECD), biotechnology is defined as the technology applied to living organisms to alter "living or non-living materials for the production of knowledge, goods and services."

Under the Main Board Listing Rules, HKEX states in Chapter 18A[13] that biotech is "the application of science and technology to produce commercial products with a medical or other biological application." The Exchange also sets out that "a biotech company" should primarily engage in business activities such as "research and development, application and commercialisation of Biotech Products." Similarly, Hong Kong Biotechnology Organization defines biotechnology as the integration of biochemistry, microbiology and chemical engineering to provide alternative solutions to individual therapies, industrial processes and global climate changes, in its paper[14] presented to the Legislative Council.

While the exact definition of healthcare and biotechnology industries may differ among organisations and stakeholders, in this Paper, the FSDC will primarily refer to the definition set out by HKEX in order to explore what role Hong Kong's financial services industry can play to better support the development of our home-grown companies/start-ups and, thereby, better position Hong Kong as a healthcare and biotechnology financing hub.

Hong Kong is home to over 250 biotech-related companies, with pharmaceuticals, traditional Chinese medicine, and medical devices constituting the majority of industries.[15] One of the key players in promoting technological developments in the city is the HKSTP, which acts as the research and development hub for 150 biomedical technology companies, some of which are world class.

The rapid expansion in Hong Kong's biotech industry is closely tied to the Government's support and investment in this sector. Starting two decades ago, the Government has consistently been increasing investments and R&D expenditures through various funds[16]. From 1999 to 2010, the Government increased total R&D expenditure from US$761 million to US$1.7 billion, with full time employees also doubling from 10,000 to 24,100. Several public funds have also provided financial support to this effort, including Innovation and Technology Fund (ITF), General Research Fund (GRF), and Medical Research Fund (HMRF).[17]

Notwithstanding the steady growth of the community, a cross-comparison between Hong Kong's healthcare landscape and markets with such of more developed systems will be helpful. Such comparison allows for Hong Kong's healthcare and biotech ecosystem to be taken into a global context, and make reference to methodologies or practices that were successful in other jurisdictions.

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[13] HKEX, Listing Rule and Guidance, Chapter 18A: Biotech Companies https://www.hkex.com.hk/-/media/HKEX-Market/Listing/Rules-and-Guidance/Listing-Rules-Contingency/Main-Board-Listing-Rules/Equity-Securities/chapter_18a.pdf?la=en

[14] Legislative Council Paper on Discussing the Innovation and Technology Development and RE-Industrialization Policy in Hong Kong (LC Paper No. CB(1)738/19-20(17), Hong Kong Biotechnology Organization (June 2020)

[15] HKTDC, Biotechnology, Medical & Healthcare Industry in Hong Kong, https://research.hktdc.com/en/article/MzEzOTQ1MjMz

[16] Flanders Investment & Trade, Biotechnology in Hong Kong, June 2017 https://www.flandersinvestmentandtrade.com/export/sites/trade/files/market_studies/BiotechHK.pdf

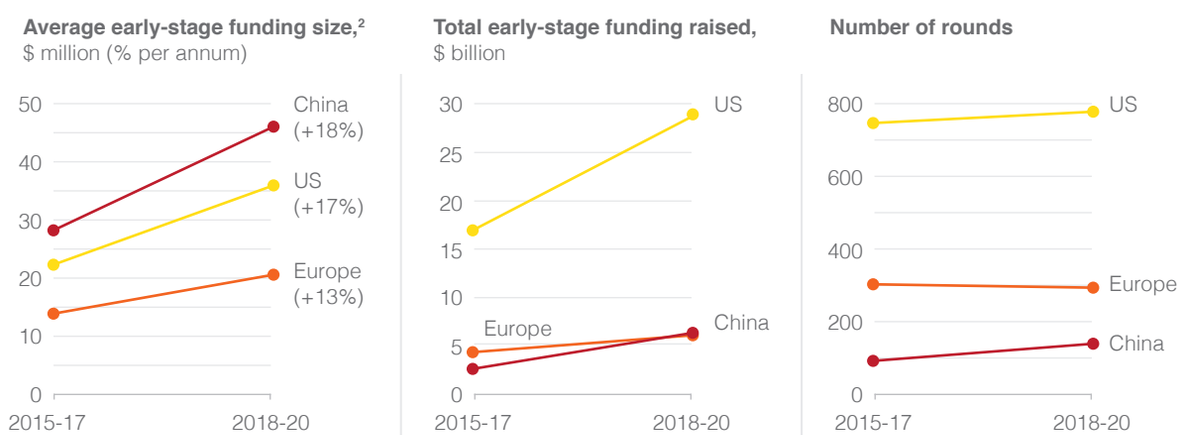
[17] ibid

Global Landscape of Healthcare and Biotech Sectors

The global spending on healthcare was already increasing even before the pandemic. In a report published by the World Health Organisation (WHO) in 2020, the global spending on health in 2018 reached US$8.3 trillion, or 10% of global GDP.[18] Zooming in to the US, its national health expenditure increased 4.6% to US$3.8 trillion in 2019, accounting for 17.7% of its GDP while the projected figure from 2019 to 2028 will grow at an average annual rate of 5.4% and projected to reach US$6.2 trillion by 2028, or 19.7% of its GDP in 2028.[19] Meanwhile, healthcare spending has also taken up a larger portion in the GDP of EU states. For instance, the estimated average spending on healthcare as a share of GDP of EU states in 2019 was 8.3%, while Germany and France healthcare expenditure-to-GDP reached 11.7% and 11.2%, respectively. The Mainland's spending on healthcare also recorded an gradual upward trend, with health-related expenditure to GDP reaching 7.12% in 2020 compared to the 6.64% in 2019.[20]

Besides increase in government dedications in the healthcare sector, more early stage fundings, including venture funding, Series A and Series B, were seen into biotech companies in the US, Europe and Mainland China. For average early-stage funding size, double-digit growth was seen in those jurisdictions from the period of 2015-2017 to 2018-2020. A milder growth in terms of total early stage fundings raised in Europe while China showed a stronger growth to close the gap against Europe. (See Figure 2 below)

Figure 2. Early-stage biotech funding by region, 2015-17 compared with 2018-20



Note: Intended to provide insight based on currently available information for consideration and not specific advice.
[1] Early-stage funding defined as Venture seeds, Series A and Series B.
[2] 3-year CAGRs shown between periods 2015-17 and 2018-20.
Source:BCIO (Feburary 2021)

Source: McKinsey

[18] World Health Organization, Global spending on health: Weathering the storm, December 2020 https://www.who.int/publications-detail-redirect/9789240017788#:~:text=The%20report%20shows%20that%20global,total%20health%20spending%20in%202018.
Centers for Medicine & Medicaid Services, NHE Fact Sheet, December 2020
[19] https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NHE-Fact-Sheet
National Health Commission of the Mainland China, Healthcare Development Statistics 202, July 2021, available at http://www.nhc.gov.cn/guihuaxx-
[20] s/s10743/202107/af8a9c98453c4d9593e07895ae0493c8.shtml (Chinese only)

Biotech companies around the globe have experienced accelerated growth in fundraising activities amidst the pandemic, including through venture capital investments, acquisitions, partnerships and initial public offerings (IPO). According to an analysis by McKinsey[21], the global biotech industry raised US$36.6 billion in venture capital activity in 2020, recording a 45% increase from that in 2019; while companies raised US$34.3 billion in public markets in 2020, reflecting a growth of 186% on the US$12 billion raised in 2019. Similar estimates were made by Goldman Sachs[22], BDO[23]and S&P Global[24].

Recent developments of the healthcare and biotech sectors

Digitalisation of provision of healthcare services

Every cloud has a silver-lining; for the healthcare services sector, the silver-lining of the ongoing pandemic is likely the accelerated adoption of technology. Behner, Spence, Ural, and Mathews (2021) argued that COVID-19 has had a complex impact on companies in healthcare- and biotech- related companies, with an overwhelming majority of them having seen erosion of profitability as a result of the pandemic.[25] Specifically, it was highlighted that while some established pharmaceutical firms have been driving the development and delivery of vaccines and other treatments, other companies in the sector were adversely affected. Moreover, noting that patients have been less willing to or incapable of visiting physicians, newly written prescriptions and administered treatments – cancer drugs, for example – have seen noticeable declines. Medical technology companies, big and small, were also negatively affected, as hospitals have been delaying or pausing non-essential procedures temporarily.

Sanagan (2020) suggested that virtual care would be here to stay, noting that investments in relevant solutions as a result of COVID-19 would have huge and lasting impact on the delivery of healthcare services in Canada, as well as countries seen as early adopters, while further investments would be needed to keep the momentum going.[26] Behner et al.'s findings were very much in-line with such directives, calling for an increase in digital investments by life sciences companies and it was towards the same direction of surveyed executives in the fields of life sciences in their study (i.e. 67% expect to increase that investment).

[21] McKinsey, What's ahead for biotech: Another wave or low tide?, April 2020 https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/whats-ahead-for-biotech-another-wave-or-low-tide
[22] Goldman Sachs, The Surge in Global Biotech Innovation, December 2020 https://www.goldmansachs.com/insights/pages/the-surge-in-global-biotech-innovation.html
[23] BDO, The Biotech IPO Boom, February 2021 https://www.bdo.com/insights/industries/life-sciences/the-biotech-ipo-boomm
[24] S&P Global, Healthcare tech sees robust investment in Q3; biotech draws $20.2B in 2020, December 2020 https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/healthcare-tech-sees-robust-investment-in-q3-biotech-draws-20-2b-in-2020-61555668
[25] Ernst & Young, Life sciences executives taking longer-view look at M&A strategy, April 2021 https://www.ey.com/en_gl/ccb/life-sciences-mergers-acquisitions
[26] Deloitte, COVID-19: Digital health & virtual care, 2020 https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/life-sciences-health-care/ca-covid-19-digital-health-and-virtual-care-aoda-en.pdf

Among others, *telemedicine* has gained popularity across the world, but its adoption has picked up tremendously over the past one and a half years.[27] According to the World Medical Association, *telemedicine*

> is the practice of medicine over a distance, in which interventions, diagnoses, therapeutic decisions, and subsequent treatment recommendations are based on patient data, documents and other information transmitted through telecommunication systems… Telemedicine is used for patients who cannot see an appropriate physician timeously because of inaccessibility due to distance, physical disability, employment, family commitments (including caring for others), patients' cost and physician schedules. It has capacity to reach patients with limited access to medical assistance and have potential to improve health care.[28]

Of all emerging technologies, Levy (2021) suggested that various markets have seen increased adoption of telemedicine. Noting that the US, Canada, and Mainland China are some of the market leaders in this area, the report highlighted that eased regulations in the past two years have boosted its adoption in many countries, while policies around reimbursement and regulations would have much implication to the permanent adoption and growth potentials.[29]

Intellectual property financing

Although still in the early stage of market development, intellectual property (IP) financing, as defined by the World Intellectual Property Organization (WIPO) as "the use of IP assets (trademarks, design rights, patents and copyright) to gain access to credit",[30] has been gradually gaining prominence as an alternative financial solution utilised by the biotech sector. Amidst a shift in investment appetites towards the booming healthcare and biotech sectors, especially as a result of the demonstrated resilient performance during the COVID-19 pandemic, IP financing is increasingly being explored in mature markets as a funding source to support the research and development of biotech companies. As highlighted in "Enquiries into Intellectual Property's Economic Impact" published by the OECD, IP financing can take a variety of forms including as direct collateral for a loan, or through securitisation, sale-and-lease-back and venture debt.[31]

IP refers to the "creation of mind" ranging from inventions, literary and artistic work, designs and other commercial signs, according to the WIPO.[32] At the time of writing, there are 26 WIPO-administered treaties, requiring member countries to recognise rights of persons from the other member countries.[33] As innovation is borderless and the world being more interconnected than ever, it is often suggested for start-ups and other small and medium enterprises to apply for IP rights over their inventions, which could later turn into business opportunities and generate value. Furthermore, an IP right also needs to obtain a valuation to be later leveraged for gaining access to credit.

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[27] McKinsey, Telehealth: A quarter-trillion-dollar post-COVID-19 reality?, July 2021 https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/telehealth-a-quarter-trillion-dollar-post-covid-19-reality

[28] World Medical Association, WMA Statement on the ethics of telemedicine, September 2020 https://www.wma.net/policies-post/wma-statement-on-the-ethics-of-telemedicine/

[29] Deloitte, 2021 global life sciences outlook, 2021 https://www2.deloitte.com/global/en/pages/life-sciences-and-healthcare/articles/global-life-sciences-sector-outlook.html

[30] World Intellectual Property Organization, Intellectual Property Financing – An Introduction, September 2008 https://www.wipo.int/wipo_magazine/en/2008/05/article_0001.html

[31] OECD, Enquiries Into Intellectual Property's Economic Impact, https://www.oecd.org/sti/ieconomy/KBC2-IP.Final.pdf

[32] World Intellectual Property Organization, What is intellectual property?, 2020 https://www.wipo.int/portal/en/index.html

[33] World Intellectual Property Organization, Summary of the Convention Establishing the World Intellectual Property Organization (WIPO Convention), 1967 https://www.wipo.int/treaties/en/convention/summary_wipo_convention.html

Owning IP assets allows companies to showcase their quality of management and technological capabilities. This is due to the fact that the owner of the IP assets has an exclusive legal right to exploit the IP and to prevent others from doing so without the owner's consent. More significantly, IP assets fairly valued can serve as a key economic source for projected sales and profitability, which is essential for research-and-innovation-oriented companies to gain financing support from investors / creditors, not to mention in case of financial distress. This applies to biotech companies too, and start-ups in particular.

In spite of certain conceivable challenges facing the IP financing markets, some developed markets, the US in particular, have seen notable growth with strong support by the government in providing protection and enforcement with regards to IP rights.

Appendix 2 takes a deeper dive into the emerging trend of intellectual property financing which may provide useful reference for Hong Kong.

Global capital market activities

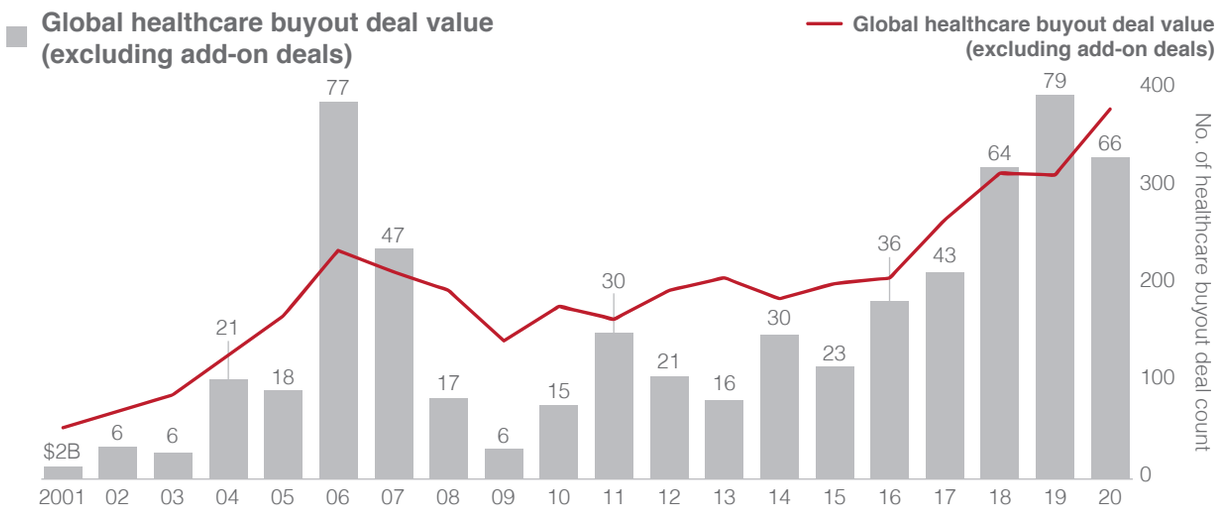
Amidst the pandemic, biotech companies around the globe have experienced accelerated growth in fundraising activities, including through venture capital investments, acquisitions, partnerships and initial public offerings (IPO). According to an analysis by McKinsey, the global biotech industry raised US$36.6 billion in venture capital activity in 2020, recording a 45% increase comparing to that in 2019, while companies raised US$34.3 billion in public markets in 2020, reflecting a growth of 186% on the US$12 billion raised in 2019.[34]

Despite a 14% decline in general private equity activities globally, Bain (2021) found that performance in the healthcare sector was robust in 2020, as private equity deal volume in the healthcare sector reached 380 deals during the year, representing a 21% year-on-year increase from 313 deals in 2019.[35] The healthcare provider and biopharma sectors also shared the 10 largest announced buyouts in 2020, which accounted for US$26.6 billion, or 40% of disclosed value, according to the Bain. Meanwhile, M&A activities dropped to US$339 billion last year, representing a 37.3% decline compared to that of US$541 billion in 2019, while deal count also fell 292 to 2,845. (See Table 1 below)

[34] Bain & Company, Global Healthcare Private Equity and M&A Report 2021, https://www.bain.com/globalassets/noindex/2021/bain_report_global_healthcare_private_equity_and_ma_2021.pdf

[35] Bain & Company, Global Healthcare Private Equity and M&A Report 2021, https://www.bain.com/globalassets/noindex/2021/bain_report_global_healthcare_private_equity_and_ma_2021.pdf

Table 1. Global healthcare private equity deal values and count in 2020

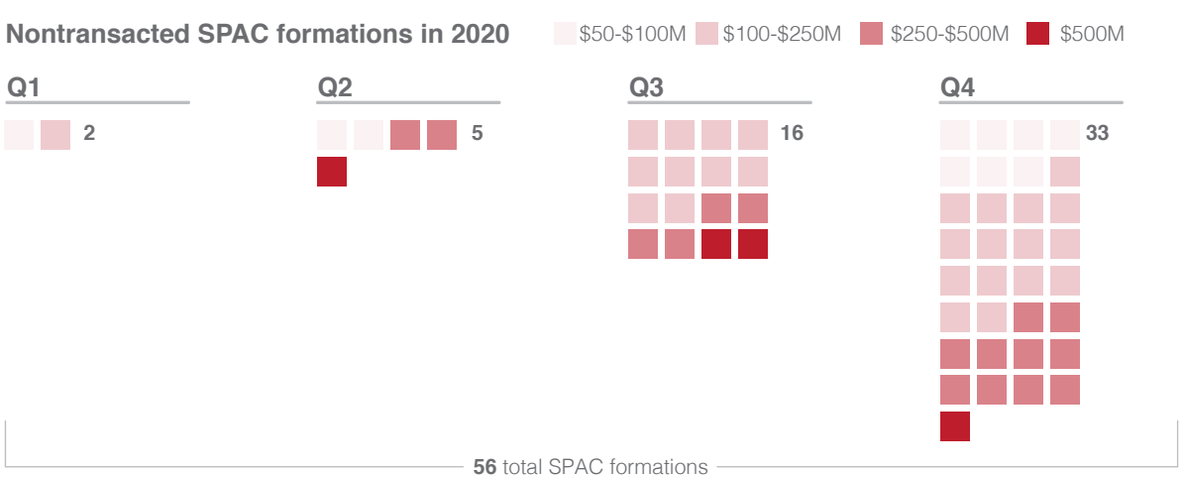


In 2020	Global healthcare buyout deal value (exclude add-on deals) (US billion)	Global healthcare buyout deal count
Private equity	66	380
M&A	339	2845

Source: Bain

Bain also highlighted that there was a notable global surge of IPO activities in the form of special purpose acquisition companies (SPACs) in 2020, perhaps because SPACs are more flexible in nature and can lower uncertainties around valuation of the companies. Specific to the healthcare-related sector, the number of exits increased from 126 in 2019 to 146 in 2020, with disclosed exit value rocketed from US$40.8 billion in 2019 to US$73.1 billion in 2020. As a result of the series of actions, in 2020, 248 SPACs were formed globally, among which 56 of them had a focus on healthcare. (See Figure 3 below)

Figure 3. SPAC formations on global healthcare sector in the second half of 2020



Note: Includes only nontransacted SPACs

Source: Bain

Comparison between the US, Mainland China and EU

Table 2. Overview of activities in the biotech sector in the US, Mainland China and Europe in 2020

	No. of patents registered (Medical Technology & Biotechnology) (as of 2020)	Universities ranked top 100 at QS World University Rankings by Subject 2021: Life Sciences & Medicine	IPO proceeds raised (USD billion) (biotechnology, healthcare products, healthcare services and pharmaceuticals) (for 1H21)
The US	7,796	38	42.12 billion
Europe	8,887	44	13.79 billion
Mainland China	777	2	19.09 billion

Sources: Bloomberg,
the European Patent Office,
QS World University Rankings by Subject 2021: Life Sciences & Medicine

The United States – remains the epicentre of healthcare and biotechnology financing

The US has a more established ecosystem for businesses at various stages of development to turn to for funding needs. For instance, the National Science Foundation (NSF) is an independent federal agency to "support basic research and people to create knowledge that transform future" to apply for funding for entrepreneurs who are at the early stage of developing their research ideas further. The NSF acts not only as a source of funding, but also a beacon for entrepreneurs as reviewers of such funding would provide feedback to applications identified with a successful rate of 50% or higher. The applicants, having received such feedback from the reviewers, can then modify their discoveries and re-apply for NSF funding. Through this mechanism, the entrepreneurs understand the areas of improvement in their research and business ideas, which would pave the way to commercialise such research ideas.

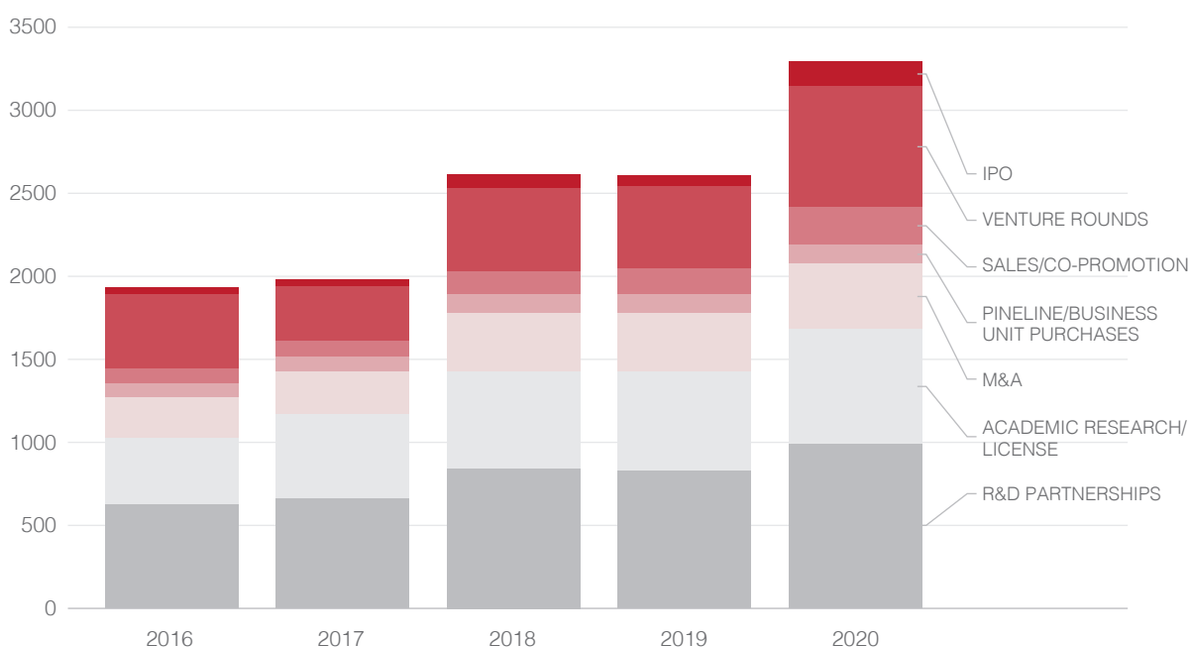
For those business experiencing the "Valley of Death", they have an easier access to venture capital industry because of the abundance of investors in the US market. According to the National Venture Capital Association[36], there were about 1328 active venture capital firms in the US as of the end of 2019 with an aggregated AUM of US$444 billion. Even though not all venture capital firms would have a healthcare or biotech focus, the number of active venture capital funds could reflect the ease of accessing the venture capital industry for start-ups who may, oftentimes, face negative cashflows for early stage.

[36] National Venture Capital Association, 2020 Yearbook
https://nvca.org/wp-content/uploads/2020/03/NVCA-2020-Yearbook.pdf

Funding activities in the US for healthcare and biotech sectors has been booming in 2020. This allows those firms at mature stage to find possible opportunity M&A or IPO opportunities. According to JP Morgan, investment in healthcare and life sciences businesses, including biotech and biopharma companies, have reached a record high in 2020, especially in the third quarter.[37] Investment opportunities in these sectors are not only attractive to venture capitalists and investors looking at public markets, as family offices, corporate venture capital, corporate partnerships and hedge funds are also tapping into relevant opportunities in the private markets.

As a whole, the investment volume and deals related to healthcare and biotech companies skyrocketed in 2020, according to JP Morgan (See Figure 4 below). A total of 147 healthcare and life sciences companies went public in 2020, compared to the 66 and 86 in 2019 and 2018, respectively. 729 venture rounds have been completed in 2020, a 49% increase compared to that of 2019. Venture capital funding for healthcare and life science companies also exceeded US$100 million in this year, as it continued to play a vital role in the funding ecosystem for start-ups in this space.

Figure 4. The investment activities within life science sector in the US



Source: J.P. Morgan

According to KPMG, venture investment in the US continued its momentum in Q1 2021, especially with the help on the mega-deals, including the US$1 billion raised by healthcare practice management platform VillageMD.[38] Venture capital activity within biotech & pharma in the US in 2020 recorded US$28.5 billion across 1,073 deals, reflecting a 60.5% year-over-year increase in deal value, with reference to PitchBook.[39]

[37] JP Morgan, Life Sciences Outlook 2021: The Evolution Continues for Startup Funding, 2021 https://www.jpmorgan.com/commercial-banking/insights/life-sciences-startup-outlook#infographic-text-version-uniqId1623795798226
[38] KPMG Private Enterprise, Venture Pulse Q1 2021, April 2021
[39] Pitchbook, PitchBook Q1 2021 Analyst Note: Biotech Went to Work as the World Stayed Home, March 2021 https://files.pitchbook.com/website/files/pdf/PitchBook_Q1_2021_Analyst_Note_Biotech_Went_To_Work_as_the_World_Stayed_Home.pdf

Mainland China – strong policy support to foster the development of the sectors

The ageing population in the Mainland has been one of the key drivers of the healthcare industry development in the country. According to the National Bureau of Statistics,[40] 264 million people or 18.7% of the Chinese population, are aged 60 or above, and the WHO estimated that such population would reach 402 million in 2040.[41]

References can be made to the significant increase in healthcare insurance coverage over time, which can demonstrate the soaring Chinese demand and affordability for quality healthcare treatments. In 2020 alone, the total premium revenue for health insurance in China reached RMB 817 billion, representing a 15.6% increase to the RMB 706 billion recorded in 2019.[42] Taking a longer horizon, the compound annual growth rate of healthcare premium was 28.48% p.a. between 2000 and 2020.[43]

Opportunities embedded in the rise in healthcare and biotech firms, as well as other technology-driven companies, are enormous. At the same time, understanding that the nature of relevant businesses – such as the fact that these businesses may need to invest much in the technology development stages prior to the commercialisation process – the Science and Technology Innovation Board (STAR Market) was established in June 2019 to facilitate easier fund-raising process for these companies domestically.[44]

Among others, "Outline of the Fourteenth Five-Year Plan for the National Economic and Social Development and the Long-Range Objectives Through the Year 2035" (the National 14th Five-Year Plan) in 2020, outlines the action agenda for the social and economic development of Mainland China for the next five years. The Plan stated that the Mainland will emphasise on, including but not limited to, information technology, biotechnology, high-end equipment and new-energy vehicles, in order to stimulate growth of advanced manufacturing. Furthermore, the Mainland will drive the development of biotechnology, especially in biomedicine and biomaterials. For instance, carrying out reforms in centralised procurement and utilisation of drugs and developing state-of-the-art medical equipment as the Plan stated.

The National Medical Products Administration has rolled out a series of policies in 2020 with an aim of pushing forward the development and refining the regulations around the biomedicine sector, including but not limited to the following (See Table 3 below).

[40] National Bureau of Statistics of China,「第七次全國人口普查主要數據情況」, May 2021, (Chinese only) http://www.stats.gov.cn/tjsj/zxfb/202105/t20210510_1817176.html

[41] World Health Organization, Ageing and health in China, February 2019 https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

[42] China Banking and Insurance Regulatory Commission via CEIC database

[43] Based on CEIC calculation

[44] Invesco, China's Science and Technology Innovation Board a bold step forward for capital-market reforms, June 2019 https://www.invesco.com/

Table 3. A non-exhaustive list biomedicine-related policies announced since 2020

Publication Date	Name	About
22 January 2020	Provisions for Drug Registration 《藥品註冊管理辦法》	To regulate the manufacturing, registration and commercialisation of drugs that are not yet authorised to marketing
22 January 2020	Measures for the Supervision and Administration of Pharmaceutical Production 《藥品生產監督管理辦法》	To regulate the manufacturing of drug that are commercialised
23 April 2020	Announcement of the National Medical Products Administration and the National Health Commission on Issuing the Good Clinical Practice for Drug Trials 《藥物臨床試驗質量管理規範》	A guideline for the process of clinical trials for drugs
7 July 2020	The Working Procedures for the Evaluation of Breakthrough Therapy Designation Drugs (for Trial Implementation) 《突破性治療藥物審評程序(試行)》	A pilot scheme for assessment system for breakthrough therapy
25 November 2020	The Work Plan for Regulatory Innovation and Development of Pharmaceutical and Medical Device in the Guangdong-Hong Kong-Macao Greater Bay Area 《粵港澳大灣區藥品醫療器械監管創新發展工作方案》	To push forward the development of innovative medical device in the GBA

Source: National Medical Products Administration of the Mainland

The policy direction of the Central Government and follow-up actions of relevant departments and bureaus highlight the determination of the country to nurture and support relevant industries. This, together with other factors – such as the need to address ageing population and the increased demand for healthcare products – have sped up investment activities in biotech in the Mainland noticeably. The healthcare and life science sectors ranked third in the number of new listings and total funds raised in the STAR market in 2020 and accounted for 13% of the proceeds in the A share market last year.[45] 66 biomedicine companies were listed on STAR Market since its introduction in 2019.[46]

[45] KPMG, 2020 review: IPOs and other market trends, December 2020 https://assets.kpmg/content/dam/kpmg/cn/pdf/en/2020/12/china-hk-ipo-2020-review-and-outlook-for-2021.pdf
[46] Shanghai Stock Exchange, Market Date Overview, available at http://star.sse.com.cn/en/marketdata/overview/

Europe – solid infrastructure and resources to shape the biotech hub

Europe has built a solid, though fragmented, biotech market, and Benelux – an economic union of Belgium, the Netherlands, and Luxembourg – is one of the sub-regions to watch.

Benelux has been one of the leading biotech hubs in Europe, given its standing as a centre where industry stakeholders, academics and government officials meet. Its importance could have been propelled by the UK's decision to leave the European Union (EU), as highlighted by the fact that European Medicines Agency has relocated from London to Amsterdam in 2019 given its EU-related mandate.[47] As of 2019, the Benelux region is home to five of the top 100 life sciences universities in the world and 30 life science research and medical centres, according to Mckinsey's study.[48] Some 110 medium-to-large biotech companies have also chosen to establish their headquarters in Benelux as of 2019. The region has also seen vibrant financing activities, as it is accounted for €115 million venture funding per year between 2012 and 2018, and €300 million public money per year was raised.

Efficient regional public-private sector collaboration, supported by the Benelux governments, is instrumental in the success of its transformation to become a biotech hub. The Benelux governments offer tax benefits for Research and Development (R&D) work as well as some regional investment funds in the Netherlands to provide seed money to early-stage companies, to stimulate biotech activity.

In fact, on top of Benelux, other countries in Europe have also demonstrated their potentials in leading biotech development efforts. Brinckmann et al. (2021), for instance, highlighted that France, Switzerland and the UK are the top three countries with booming biotech sector in Europe, and Europe, as a whole, leads the US and China in terms of scientific publications and biotech patents.[49] More specifically, in terms of scientific publications, Europe produced double and triple the amount of that published in the US and China, respectively; 43 of the top 100 life-science universities are located in the European continent, while 34 others are based in the US. In terms of patent registration, Europe has also seen some upward momentum, having granted over 40,000 biotech patents since 2015 such figures are still growing at roughly 3% per annum.

[47] Ministry of Health, Welfare and Sport of the Netherlands, Relocation European Medicines Agency (EMA), https://www.government.nl/ministries/ministry-of-health-welfare-and-sport/european-medicines-agency-ema-to-amsterdam

[48] McKinsey & Company, Scaling innovation: How Benelux could become Europe's leading biotech hub, March 2020 https://www.mckinsey.com/~/media/mckinsey/industries/pharmaceuticals%20and%20medical%20products/our%20insights/biotech%20in%20europe%20a%20strong%20foundation%20for%20growth%20and%20innovation/scaling-innovation-how-benelux-could-become-europes-leading-biotech-hub-march%202020.pdf

[49] McKinsey, Can European biotechs achieve greater scale in a fragmented landscape, June 2021 https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/can-european-biotechs-achieve-greater-scale-in-a-fragmented-landscape?cid=other-eml-alt-mip-mck&hdpid=5e4233ae-5464-46c1-a7d2-dbe3e444acaf&hctky=12237046&hlkid=1c97722e1dd84881955b5b9800fe064b#

As Europe continues to be a powerhouse in biotechnology development, the sector has attracted further investor attention in the public market. Euronext's Biotech Barometer H2 2020 shows the total market capitalisation of the 62 biotech companies listed on Euronext has reached a record high of €29.1 billion as of the end of 2Q 2020, up €4.7 billion over the year.[50] 16 of the 62 biotech companies had their market capitalization up by at least €100 million. IPO activities in healthcare sector in Europe stock exchanges continued to boom in 1H 2021.[51] A total of €3.2 billion were raised across 25 European stock exchanges for the first half of the year, compared to €716 million and €786 million raised in 2020 and 2019 respectively.

Besides listing near the home markets, European biotech firms are lured to the US capital market for its higher valuation and large pool of investor. In 2020 alone, nine European drug companies raised US$1.2 billion through IPO in New York.[52] This is compared to three which raised €727 million in 2019.

Other than listing on NASDAQ, biotech companies in the UK also sought public financing through share placements, follow-on offerings and private placements on London's Alternative Investment Market (AIM) and London Stock Exchange (LSE). Indeed, a spike of biotech companies financing activities in the UK recently, with UK biotech companies raising fresh capitals in both private and public markets. As a whole, the UK biotech sector raised £336 million and ranked fifth in global biotech venture capital financing in 2020. Such a strong momentum has extended to 2021, with more than £830 million in fresh capital being raised in the three months to the end of February 2021, as showed by Biotech financing update report by UK BioIndustry Association.[53]

[50] Euronext, Biotech Barometer H2 2020 https://www.euronext.com/en/news/biotech-barometer-h2-2020

[51] PriceWaterhouseCoopers, European IPO Activity, available at https://www.pwc.co.uk/services/risk/insights/ipo-watch-europe/ipo-watch-data-explore-exchange.html

[52] Bloomberg, New York's Promise of High Rewards Reels in Europe Biotech IPOs, January 2021 https://www.bloomberg.com/news/articles/2021-01-20/new-york-s-promise-of-high-rewards-reels-in-europe-biotech-ipos

[53] UK BioIndustry Association, Biotech financing update, March 2021 https://www.bioindustry.org/uploads/assets/05a0192c-1168-4bc6-a7ce5949e1a5f27c/BIOJ8840-Q1-Financing-Update-Leaflet-210326-WEB.pdf

Opportunities and Challenges for Hong Kong

As the leading international financial centre in Asia, the FSDC sees a strong case for Hong Kong to further develop a comprehensive ecosystem for healthcare and biotechnology industries to nurture home-grown start-ups, attract overseas talents to grow their ideas while gathering liquidity from the investment market. As a matter of fact, as defined by the Global Innovation Index 2020, Hong Kong is ranked among the top globally on some of the innovation areas, most notably the sophistication of the market.[54] Based on discussions with industry parties, there are still areas that the Government and the capital market can help improve in order to construct an ecosystem for the healthcare and biotech sector, leveraging the advantages Hong Kong has been enjoying as an international financial centre.

Capitalising on the dynamic financial markets

Following the new listing regime introduced by HKEX in 2018, more biotech companies have been attracted to Hong Kong to raise capital. As of June 30, 2021, 67 healthcare and biotech companies have been listed in Hong Kong, raising a total of HK$ 209 billion. 33 of them were listed under Chapter 18A of HKEX's listing rules, raising a total of HK$87 billion. Hong Kong has fared particularly well in being the host of issuers in the field of "pioneering medical AI applications", while being a part of the production process and the sales platform.[55] In order to further drive the development of the biotech and new economy system, HKEX signed a Memorandum of Understanding (MOU) with HKSTP in September 2021 to foster communication and exchange of knowledge and expertise between the two organisations.[56] According to the MOU, HKSTP's biotech experts will help HKEX in its review of biotech listing applications and assemble a team to provide advice on an "as needed" basis.

Hong Kong does not only act as a listing venue for healthcare and pre-revenue biotech companies, it also offers opportunities for those companies to reach out to different classes of investors, locally and internationally. For instance, the Hang Seng Hong Kong-Listed Biotech Index[57] was introduced in December 2019 to reflect the overall performance of the 54 biotech companies that are listed in Hong Kong, including 17 companies that are listed under the Listing Rule Chapter 18A. The index recorded a positive change of 23% since its launch date as of 30 June 2021, and the return, from 16 December 2019 to 30 June 2021, was 91.62%.[58]

Biotech companies can also benefit from the Stock Connect that opens a window for them to access Mainland investors. With effect from end-December 2020, pre-revenue biotech companies that are eligible constituent stocks for the Hang Seng Composite Index or have corresponding A share listed Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE), would be included in Southbound trading of Stock Connect. Further to the above expansion, with effect from February 2021, eligible A-shares listed on SSE's Sci-Tech Innovation Board (STAR Market) could be included in Northbound Stock Connect trading. Through the well-established capital market in Hong Kong, healthcare and biotech companies at maturing stage can connect with investors to attract more funding for their clinical trials or product launch.

[54] World Intellectual Property Organization, Global Innovation Index 2020, August 30, 2020 https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf
[55] How Hong Kong can cement its position as a biotech listing hub, by Bonnie Chan, published at South China Morning Post
[56] HKEX, HKEX to collaborate with HKSTP on biotech, fintech initiatives, September 2, 2021 https://www.hkex.com.hk/News/News-Release/2021/2109023news?sc_lang=en
[57] Hang Seng Indexes, Hang Seng Hong Kong-Listed Biotech Index, July 2021
[58] Based on Bloomberg calculation

Embracing digitalisation in biotech and healthcare

With a mature healthcare system and solid information and communications technology infrastructure, Hong Kong is capable of providing opportunities for healthcare and biotech start-ups to grow.

The high internet penetration rate in Hong Kong fosters the expansion of digital health. Nearly 94% of households in Hong Kong had internet access at home in 2020 while over 90% of businesses used the internet in 2019. Businesses in Hong Kong during the pandemic also responded quickly to social distancing measures by moving business operations to virtual settings whenever possible. 65% of Hong Kong business leaders considering hybrid workplace setting, as the Microsoft's 2021 Work Trend Index showed[59]. Such change in mode of business operation reflected the growing digital reliance in Hong Kong.

The Office of the Government Chief Information Officer coordinated with various public and private organisations to facilitate a wider dissemination and re-use of the information held by different organisations to increase the value of such information. Electronic Health Record Sharing System, developed by the Government and launched in 2016, "enables two-way sharing among public and private healthcare providers"[60]. The system integrates a person's medical record in order to facilitate a more comprehensive data storage and exchange between the public and private sectors.

The CUHK Medical Centre (CUHKMC) is another exhibition of Hong Kong's effort in enhancing its digital healthcare services. As the first smart hospital in Hong Kong that commenced services in January 2021, the CUHKMC partnered with a telecommunication services provider to implement a full 5G internet coverage to drive innovative medical application such as remote consultation and training.[61]

As a gateway to Mainland China

Hong Kong has a vital role to play in strengthening cooperation in biotech development within the Greater Bay Area (GBA). As a leading international financial centre serving enterprises in exploring opportunities in the Asian market, Hong Kong connects major research facilities and institutions locally and in the GBA to foster information flows and industry knowledge.

The introduction of the Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA) in 2003 has fostered the interaction between the Mainland and Hong Kong.[62] Under CEPA, healthcare experts who are registered to practise in Hong Kong are allowed to provide short-term services, with a maximum duration of three years, in the Mainland.

[59] Microsoft, Microsoft Work Trend Index Shows Hong Kong Businesses Proactively Embracing Change as Hybrid Work Evolution Accelerates, April 2021 https://news.microsoft.com/en-hk/2021/04/21/microsoft-work-trend-index-shows-hong-kong-businesses-proactively-embracing-change-as-hybrid-work-evolution-accelerates

[60] HKSAR Government, Electronic Health Record Sharing System, available at https://www.ehealth.gov.hk/en/whats-ehealth/index.html

[61] The CUHK Medical Centre, HKT Partners with CUHK Medical Centre for 5G smart hospital, June 2021 https://www.cuhkmc.hk/press-release/hkt-partners-with-cuhk-medical-centre-for-5g-smart-hospital

[62] Constitutional and Mainland Affairs Bureau of HKSAR Government, Policy Area: Medical Services, available at https://www.bayarea.gov.hk/tc/opportunities/medical.html

Moreover, service providers from Hong Kong can set up medical institutions, in the form of wholly-owned entities or joint ventures with medical institutions in the Mainland.[63] For example, the first wholly Hong Kong-owned eye hospital in Shenzhen was set up back in 2013 as CEPA opens windows for qualified doctors to practise in the Mainland and wholly-owned hospitals to set up in Guangdong. The eye hospital business was then listed on HKEX's Main Board to further its expansion in Mainland China and Hong Kong.

As it develops, the GBA development plan has further provided a more comprehensive, tailored cooperation framework for the area, including in the field of healthcare and biotech innovations. A more frequent exchange, in medical services and research, is expected within the GBA as Mainland China prioritised biopharmaceuticals as one of target industries to focus, in its National 14th Five-Year Plan . In fact, policies have been continuously rolled out over recent years to provide a clear guidance on the use of drugs and its registration. As said, the Work Plan for Regulatory Innovation and Development of Pharmaceutical and Medical Device in the Guangdong-Hong Kong-Macao Greater Bay Area (Work Plan) (《粵港澳大灣區藥品醫療器械監管創新發展工作方案》)[64] was implemented in December 2020 to better facilitate the healthcare services in the GBA for Hong Kong residents as well as business opportunities for medical and pharmaceutical companies in Mainland cities of the GBA. According to the Work Plan, drugs and medical devices used in Hong Kong public hospitals can be used in qualified medical institutions in the GBA, upon Guangdong province's approval. For a start, the University of Hong Kong-Shenzhen Hospital (HKU-SZH) was used as a pilot scheme until 31 July 2021 to facilitate healthcare services provided for Hong Kong residents. While the proposed arrangement would help product and service providers with an expanded commercialisation dimension, such policy design is at the heart of the development of the GBA, where seamless flows of people, goods, services and capital are sought.

Challenges facing the local community – survey and interview findings

As observed from the previous sections, while Hong Kong possesses endowed advantages as a financing hub for healthcare and biotech companies, it may benefit from having a highlighted strategic direction in developing its role in healthcare and biotechnology financing. With the above in mind, the FSDC developed a questionnaire and, with the kind assistance of HKSTP and Cyberport, disseminated to healthcare- and biotech-related start-ups and small and medium enterprises (SMEs) based in Hong Kong. 16 responses were received, sharing the challenges and potential opportunities these companies have faced in their entrepreneurial journey. Follow-up in-depth one-on-one interviews have also been conducted with seven start-ups.

The FSDC is mindful of the fact that, given a relatively small number of companies contacted, the numbers may not be significant or representative of the entire industry. That said, as it is not our intention to generalise such findings, some high-level information observed, as well as the takeaway from our one-on-one interviews, can serve as useful tools to analyse some pain-points facing these start-ups. While most of them focused on such areas as financing, talent, and commercialisation.

[63] Trade and Industry Department of HKSAR Government, Mainland and Hong Kong Closer Economic Partnership Arrangement, available at https://www.tid.gov.hk/english/cepa/tradeservices/med_relevant.html

[64] National Medical Products Administration of China, The Work Plan for Regulatory Innovation and Development of Pharmaceutical and Medical Device in the Guangdong-Hong Kong-Macao Greater Bay Area, November 2020

Financing was deemed an issue for most of the companies engaged in our study, regardless of the stages of development. Out of the 16 respondents, 15 indicated that they have encountered some difficulties in financing in one form or another. Several entrepreneurs further explained in interviews that investors in Hong Kong generally have lower risk appetites and prefer investing in start-ups at later development stages with established market shares and demonstrated business success as supported by steady revenue and profit streams.

Another area presenting acute shortages is talent. Perhaps due in part to the nature and size of respondent companies, difficulty in acquiring the right talents was frequently cited as an issue to their businesses. When asked what qualities they look for in new hires and employees, interviewees considered subject knowledge and work ethics as most important for junior/middle level staff, while work ethics, leadership and industry experiences were identified as the most essential for management. It is worth noting that almost two thirds of the respondents said they have obtained support from talent programmes provided the Government such as Research Talent Hub and STEM Internship Scheme.

When it comes to commercialisation, there is consensus that Hong Kong enjoys a unique edge as a springboard market given its proximity to the Mainland combined with connectedness with the rest of the world. Nevertheless, a number of respondents and interviewees flagged the differences in regulatory requirements across markets as a hurdle in the commercialisation process.

Please refer to Appendix 3 for more details of the survey results.

Policy Recommendations

As illustrated in the development of healthcare and biotech centres worldwide, funding and scale-up capabilities are the winning factors of world leading innovation and science-related business hubs. Through its value proposition as a leading IPO centre, Hong Kong has been serving as a key financing hub for many more mature healthcare and biotech companies especially since 2018, and the city should continue to develop this value proposition further for relevant local or non-local businesses and practitioners.

Informed by the literature review, the questionnaire and discussions with relevant practitioners in the fields of asset management, banking, healthcare and biotech, insurance, professional services, and others, the FSDC recognises that Hong Kong has much potential to be a major financing hub for healthcare and biotech financing activities. The recently released 2021 Policy Address has also put policy emphasis on the healthcare and biotech sector. With the proposal of establishing the InnoLife Healthtech Hub in the Hong Kong-Shenzhen Innovation and Technology Park as well as the GBA InnoExpress to help nurture start-ups and support enterprises in attracting investment, Hong Kong could continue to pave its way into being an international innovation and technology centre.

Nevertheless, as detailed in the previous sections of this paper, although Hong Kong is endowed with such advantages as proximity to market and a well-established financial system, there presents numerous challenges that policymakers and the industry would need to overcome. Taking into consideration Hong Kong's existing financial infrastructure and development in the healthcare and biotech space compared with peer jurisdictions, the FSDC has prepared several recommendations for policymakers' consideration. These recommendations are designed with an aim of facilitating further enhancement of our capacity and capability through the introduction of regulatory improvement, less stringent incentive programmes, and stronger public-private-partnership agenda.

Noting that companies at different stages of development would face challenges in various forms and magnitude, the recommendations mainly relate to and can be categorised into three broad themes, namely (i) financing; (ii) commercialisation; and (iii) talent. The recommendations set forth are designed to be considered in a holistic manner. However, noting that some of the proposed recommendations may take longer to be undertaken than others, these recommendations are deemed not to be implemented in a sequential manner.

Proposed solutions to issues facing healthcare and biotech firms by development stage

	Early stage	Growth stage	Mature stage
Financing	- More generous, less risk-averse government-led incubation programmes / grant schemes with streamlined administrative procedures	- Public sector to convene a group of asset owners (e.g. FOs) to co-invest in winners of certain competitions or, preferably, projects meeting certain standards - The Future Fund, and especially the newly established "Hong Kong Growth Portfolio", should consider to continue investing in relevant strategically important industries including healthcare and biotech	- Continuously review and renew the rules and practices of the financial markets to ensure they reflect global trends, regional competition as well as technological development

Proposed solutions to issues facing healthcare and biotech firms by development stage

	Early stage	Growth stage	Mature stage
Commercialisation	- Provide access to coworking space/ laboratories at discounted prices - Research universities should set up a dedicated commercialisation work stream/ department with an aim of strengthening relevant aspects of their researching results	- Promotional opportunities for homegrown start-ups beyond limiting to a handful of *poster-children* - Facilitate cross-boundary M&A activities through creating and nurturing B2B and business-to-investor events and relationships	- Pursue mutual recognition of standards with key markets in relation to service and product offerings
Talent	- University professorship assessments may consider covering commercial-related contributions that will, in turn, keep risk averse but knowledgeable research professors to stay put in Hong Kong; this will stimulate entrepreneurial opportunities for them - Existence and benefits of the city's Talent List, which currently includes pharmaceutical and life science/biotechnology talent, should be promoted and administrative burdens on employers should be minimised; this will attract non-local based research professionals to move to Hong Kong	- Universities should consider allocating a higher share of the endowment funding for health and biotech related research, and investing in projects led by affiliated professors/ researchers/students, which will not only help such process in securing financing needs but also help retain relevant talents in Hong Kong - Establish government funded programmes for homegrown talents to gain overseas exposure, corresponding to the Internationalised Talent Programme proposed in FSDC Paper No. 50	- Establish and formalise a mentorship programme, which will require private sector's participation, to nurture younger companies; this will also provide such more mature companies the opportunities to gain access to and invest in younger companies

Before delving into more detailed analyses of issues facing these start-ups, it is important to note that Hong Kong boasts a strong foundation for financing healthcare and biotech sectors, especially for companies in the more mature stages of the business cycle. Among others, the listing reform that has allowed pre-revenue biotech firms to be listed on the HKEX, a world-leading capital formation platform, has given Hong Kong an edge over the other financial and business centres. Hong Kong's status as Asia's premier private equity market also allows companies in the early and growth stages better access to potential investors and funding.

In this connection, recommendations set out in this paper aim to take Hong Kong further in this regard, for the city to grow from a world-class financing centre to a true global innovation hub with strong capital raising capabilities. Such a long-term vision, ambitious but achievable, will be built upon Hong Kong's ability to leverage its unique competitiveness underpinned by the following:

- A world-renowned equity market;
- Standards and practices closely aligned with international practices;
- Proximity to global and Mainland markets; and
- Talent pool attracted by vibrancy and cultural inclusion of the city.

This will have to be supported by three crucial roles the city will have to play for the biotech and health community, among others:

A financing hub: Continuously review and renew the rules and practices of the financial markets to ensure they reflect global trends, regional competition as well as technological development, so as to seamlessly bridge capital to innovation through active M&A, IPO, private investment and other fundraising activities.

A commercialisation launchpad: Seek to introduce business-friendly policies and other support to facilitate businesses entering and commercialising in the expanded international, as well as Mainland Chinese, markets. As industry standards of relevant industries vary from one market to another, more facilitative measures would be needed. This may include such measures as pursuing mutual recognition of standards with key markets in relation to service and product offerings. It is believed that the mutual recognition of standards can potentially begin with a pilot scheme within the GBA, where regulatory cooperation has been ongoing and ever strengthening.

A talent pool: Explore a mentorship mechanism, which will require private sector's participation, to nurture younger companies. Through participating in the mentorship programme, more mature companies will benefit from the opportunities to gain access to and potentially invest in younger companies. As the business community grows, it will nurture and cultivate financial practitioners and enhance their familiarity with the technology, valuation models as well as business realities that are unique to biotech and healthcare to enhance market efficiency with informed valuations.

With the longer-term goal in mind, the following section focuses on addressing more pressing needs, of those concerning companies at the early and growth stages, which are generally facing more resource-constraints and in more urgent demand for support measures.

Recognising that the regulatory framework and government-led incentives are comparable to, if not better than, some of the major healthcare and biotech markets, the recommendations set forth below will focus on designing a more conducive operating environment for companies in the early- and growth- stages, respectively.

i) Financing

As with other early-stage companies, besides the need for business ideas, companies in the healthcare and biotech sectors require investments from the start of the journey so as to get these projects going and, hopefully, turn these innovative ideas into profitable businesses. Perhaps, comparing to firms in other industries, the financing need of companies engaging in biotech and healthcare related business would face a higher hurdle in seeking investment from the private sector. This is due to the fact that sciences, research and technologies involved in such fields tend to be complex in nature and, as a result, the returns of such investments are usually more uncertain and the payback period also tends to be lengthier than that of other sectors. This is partly reflected in our survey and discussion with industry/start-up practitioners.

This observation is well supported by the literature. For instance, according to Opler, Garrett and Langer (2014), due to the nature of their businesses, risk-adjusted returns are the key metric studied in transactions in these sectors, while different discount rates for projects with various risk levels would be adopted in relevant analysis.[65] Such approaches are generally applied by other industry players too, as suggested by ConductScience, which cited that "drug research and development are a challenging field; clinical trials are prone to errors, risks, delays, and unexpected costs", and, therefore, valuation models such as risk-adjusted net present value would be adopted to take into account the foreseeable risk and expenditure items involved in biotech deals.[66] While these valuation models are commonly used by financiers and the likes, the risk-based approach would pose additional difficulties for companies without much proven track record to access capital and, thus, hinder their development and potentially eliminating them from the races together with the potential science breakthroughs that may come along with them.[67]

Again, due to the relatively uncertain nature of healthcare- and biotech-related businesses, investors' interest, or lack thereof, would become more apparent at the time during financial turbulence. Taking small biotechnology companies as an example, Paul, Thangaraj and Ma (2015) suggested that many of them had become financially vulnerable as a result of the burst of the dot.com bubble in 2000-01.[68] During challenging times like when the financial crisis hit the global economy in the late 2000s, smaller biotech firms, in particular, could face relatively higher pressure of survival. Such observation is supported by Giovannetti and Jaggi (2011), who pointed out that although the amount of funds raised by biotech firms in 2010 was largely similar to the average raised during the four years prior to the global financial crisis, the 20% of companies based in the US on top of the list in fund raising took up 82.6% of capital in 2010, comparing to 78.5% in 2009 and 68.7% in 2005; meanwhile, the lowest echelon (i.e. bottom 20%) raised only 0.4% of funds comparing to 0.6% in 2009.[69]

A less direct source of financing that may have been less commonly mentioned for their role in supporting the growth of business of healthcare and medical services companies is the insurance sector. As the largest payer for the medical services in Hong Kong only after the Government, 17.5% of Hong Kong's 2019/20 health expenditure was contributed through private insurance and financing schemes[70], and the trend of the insurance sector increasingly taking up a higher share as a medical expenditure payer continues. In addition, with the ability to underwrite risks and assessments for healthcare - and biotech-related businesses, insurers enable such businesses to reach larger clientele with their innovative healthcare products and services. It is also noteworthy that the insurance sector plays an important role in terms of intellectual property financing. Support from the insurance sector is crucial so as to build a comprehensive financing ecosystem.

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[65] Torreya Partners, Valuation Analysis in Pharmaceutical Licensing and M&A Transactions, January 2014 https://torreya.com/publications/pharmaceutical-valuation-in-licensing-dec2013-torreya.pdf

[66] Conduct Science, rNPV: Approaches to net present value (NPV) in pharmaceutical research and development (R&D), July 2018 https://conductscience.com/npv-approaches-to-net-present-value-npv-in-pharmaceutical-research-and-development-rd/

[67] Mayer Brown, Pharma & Biotech, March 2009 https://www.mayerbrown.com/-/media/files/perspectives-events/publications/2009/03/pharma-amp-biotech--drug-development-valuing-the-p/files/0728tenvaluationreportpdf/fileattachment/0728ten_valuation_report.pdf

[68] Plant Biotechnology Journal, Commercialization of new biotechnology: a systematic review of 16 commercial case studies in a novel manufacturing sector, May 2015 https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/pbi.12426

[69] Ernst & Young, Global biotechnology report, 2011

[70] Food and Health Bureau, Hong Kong's Domestic Health Accounts (HKDHA) Estimates of Domestic Health Expenditure, 1989/90-2019/20 (SHA2011), June 2021

Against this backdrop, through collaborating with healthcare and medical services companies, insurers can expand the scope of their own insurance coverage, and at the same time open up new market opportunities for these companies. For the companies, especially those in earlier stages of development, such collaboration with insurers will be helpful in generating more and steadier revenues streams, particularly in their early days of trying to secure a firm footing in the market. In fact, many insurers in Hong Kong are already integrating services offered by start-up in their health insurance product offerings and customer acquisition strategy. One of the more successful examples known to the FSDC involved a local company specialised in genetic testing, which has partnered with financial institutions to provide genetic test services under insurance coverage to customers.

Although there is no apple-to-apple comparison between a time and another, previous experiences show that, in order to nurture the ecosystem, a diversification of financing channels should be established as funding from a platform – say, equity or private market investments – may be subject to much uncertainties. With the above in mind, and noting that many of the firms in Hong Kong, especially start-ups, are small in size to begin with, some recommendations designed to help strengthen financing channels for early- and growth-stage companies are proposed as follows.

Early stage

In principle, industry practitioners believe that more generous, less risk-averse government-led incubation programmes / grant schemes with less cumbersome administrative procedures will be beneficial. Many of the discussions have touched upon the importance of government grants, which led to a general consensus that the US approach should be considered. OECD (2020) also highlighted that start-ups and SMEs could have favourable access to investments through supply side incentives provided by the government and investments by angel investors with an aim of nurturing innovation and development of smaller companies.[71] The provision of financial resources through such channels as seed funding, grants, special loans, loan guarantees and venture capital, would also be helpful in encouraging innovation-related research.

Reasonable budget

Setting aside a reasonable budget on healthcare and biotech research should be a start. References can be made to the America's Seed Fund (ASF), covering both the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programmes in the US. According to Ezell (2019), ASF was considered one of the most important sources of capital for early-stage technology commercialisation in the US.[72] Indeed, according to the National Institute of Health (NIH), with an investment amount of over US$1 billion, SBIR and STTR "allow US-owned and operated small businesses to engage in federal research and development that has a strong potential for commercialisation."[73] It also appears that the US has been increasing such a budget over time, as Stephanie Fertig, HHS Small Business Program Lead, highlighted that the NIH has now set aside US$1.2 billion for 2021.[74] To this end, **the Government should consider setting aside a definitive budget on healthcare- and biotech-related research and development activities, with references being made to that of other markets and the existing threshold**.

[71] Organisation for Economic Co-operation and Development, Evolution and Trends in SME Finance Policies since the Global Financial Crisis, July 2020
[72] Information Technology & Innovation Foundation, The Bayh-Dole Act's Vital Importance to the U.S. Life-science Innovation System, March 2019 https://itif.org/publications/2019/03/04/bayh-dole-acts-vital-importance-us-life-sciences-innovation-system
[73] The National Institute of Health of the United States, the Small Business Innovation Research (SBIR) an Small Business Technology Transfer (STTR) – available at https://sbir.nih.gov/
[74] The National Institute of Health of the United States, America's Seed Fund is Open for Business, May 2021 https://sbir.nih.gov/sites/default/files/SEED_-Conference/Americas-Seed-Fund-is-Open-for-Business-slideset.pdf

Transparent mechanism

Meanwhile, **it is equally important for the grant or subsidy application process to be transparent**. Relatedly, our discussions also led us to believe that the model adopted by the US National Science Foundation (NSF) could also be considered. According to its strategic plan, the NSF receives some 50,000 requests for funding every year, and awards funding to 11,000 to 12,000.[75] A merit-based review process has been put in place with an aim of ensuring that proposals are reviewed in a "fair, competitive, transparent, and in-depth manner" (P.2), using two primary criteria, namely the project's intellectual merit and broader impacts, as key metrics for proposal evaluation. In this regard, industry participants, especially those with experience applying for such funding schemes in the US, applaud the transparent approach adopted by both NSF and NIH.

With the above references, **public sector funding schemes should consider laying out examples of successful and unsuccessful applications, developing fund-specific FAQs, and streamlining the application to the extent possible**.

Phased approach

The FSDC also believes that **a phased-approach for funding availability** would be useful in managing risks of public funding abuses. According to Ezell, the two-phase funding approach for ASF involves "Phase 1 feasibility studies (grants of up to $150,000), which may be extended into Phase II development activities funded at $1 million, with a possibility of a Phase IIB competing renewal award".

Understandably, while the Government and other public sector bodies are, part and partial, already carrying out such practices, the industry considers such efforts inadequate. For instance, in 2020 the average research grant by NIH for a project was some US$566,774; whilst the average received by biotechnology projects is approximately HK$ 2.1m under the ITF since its inception (calculated based on ITF data).[76] While the Innovation and Technology Fund programme is investing in start-ups, the average funding amount is significantly lower than the NIH Research Project Grant in the US and the Innovate UK scheme in the UK (See Table 4).

[75] National Science Foundation, NSF Strategic Plan for Fiscal Year 2018-2022, February 2018 https://www.nsf.gov/pubs/2018/nsf18045/nsf18045.pdf
[76] National Institute of Health, Data Book Fiscal Year 2017 https://report.nih.gov/nihdatabook/static/historical/NDB_2017_Final.pdf

Table 4. Average funding for biotechnology projects in the US, the UK and Hong Kong

	Average Funding given for Biotechnology Projects	Name of Project
US	US$ 566,774[77]	NIH Research Project Grant
UK	GBP 387,872[78] (US$539,142)[79]	Innovate UK (Ageing Society, Health & Nutrition)
HK	HK$ 2,100,000 (US$269,230)	Innovation and Technology Fund

Source: UK Government, OECD and ITF. Calculation by FSDC staff.

Tax incentives to encourage investments

Mobilising and incentivising the private sector to invest in these innovative but not yet proven companies will be important. OECD (2020) suggests that different markets have adopted an array of measures to stimulate such investments, including the models adopted by **Italy** and **Japan** whereby tax exemptions were granted for business angel investors' investments in start-ups.[80] In fact, since 2013, angel investors in **Turkey** are eligible for an annual tax base deduction of no more than 75% of capital invested in SMEs. **Sweden** introduced a tax relief for private business angel investors in 2013, amounting to roughly US$85 million per year (or SEK 800 million).

In Mainland China, venture capital companies and corporate/ individual partners of venture capital partnerships are eligible for a tax base deduction of 70% of capital invested in small to medium-sized technology companies once the investment period has reached 2 years. These tax incentives have been well-received by the venture capital/ angel investor sectors. **Singapore** also had a scheme in place to allow deduction for qualifying investments in qualifying start-up companies, though the approval period for the scheme has now lapsed. The scheme had provided a deduction for the cost of investments (capped at SGD500,000) given the qualifying conditions are met and that a government agency has pre-approved the scheme.[81] **In Malaysia**, angel investors who invest in venture companies are eligible for a tax exemption against their aggregate income based on the total value of investments in approved venture companies. The maximum exemption is up to RM500,000 per annum and are contingent on the Malaysian Ministry of Finance's approval and endorsement.[82]

[77] National Institute of Health, Research Project Grants: Average Funding in Current and Constant Dollars, available at https://report.nih.gov/nihdatabook/report/155
[78] Innovate UK, Innovate UK funded projects 2004 to 1 August 2021, May 2014 https://www.gov.uk/government/publications/innovate-uk-funded-projects
[79] Assuming USD/GBP 1.40
[80] Organisation for Economic Co-operation and Development, Evolution and Trends in SME Finance Policies since the Global Financial Crisis, July 2020 https://www.oecd.org/industry/smes/Trends-SME-Finance-Policy-July-2020.pdf
[81] See Section 37K of the Income Tax Act, https://sso.agc.gov.sg/Act/ITA1947?ProvIds=P1IX-#pr37K-
[82] Accreditation is to be granted by the Malaysian Business Angel Network: https://mban.com.my/

Whereas **in Hong Kong**, on top of patents, know-how, copyright, registered designs and registered trademarks, the scope of tax deduction has been expanded to cover three additional types of IP rights, namely the rights in layout design (topography) of integrated circuits, plant varieties and performances, following legislative amendments in 2018. Moreover, in order to encourage enterprises to invest more in R&D activities in Hong Kong, the hitherto 100% tax deduction for expenditure incurred by enterprises on R&D activities was enhanced in 2018. The deduction is 300% for the first $2 million of the aggregate number of payments made to "designated local research institutions" for qualifying R&D activities and expenditures incurred by the enterprises, and 200% for the remaining amount.

While it is understandable that the public sector will not be able to fund all the start-ups, the ability to mobilise investors to invest in Hong Kong-based healthcare - and biotech-related start-ups through such tax incentives will be significant to nurture the ecosystem. More importantly, such incentives would not lead to tax leakages or revenue losses from the Government's perspective, as such investments would arguably not have otherwise happened in the first place.

Growth stage

As highlighted in the previous section, companies at the growth stage could benefit from enhanced awareness of the services and products, which will in turn lead to lesser financing pressure for the innovators and entrepreneurs. Meanwhile, findings from our discussion with practitioners coincide with that of our literature review, suggesting that the public sector could help these businesses in different forms.

Seeking investments from local investors

Hong Kong is a leading international financial centre, and the presence of asset owners and managers is a key contributor. For the past decades, Hong Kong has been serving a facilitator role, connecting investors and investment opportunities from the East and the West. Concurrently, due in part to the abundance of liquidity and low interest rate - and, relatedly, investment yield - environment, wealth and asset managers have called for a change in investment strategies. Some of the investors, mostly often those of relatively higher net worth, have turned to investment opportunities in the private market. These factors, together with the growth momentum of the Chinese economy and industries, explain why Mainland China and Hong Kong are Asia's top and second leading private equity markets, respectively.

The vibrance of the private equity market is one of the reasons why, as advocated by the FSDC (2020), Hong Kong possesses much potential to be the family office hub in Asia.[83] Besides being endowed with world class tax and legal systems and other financial infrastructure, the vast amount of wealth and number of high-net-worth individuals based in the GBA also cement Hong Kong's role as a family office hub. These family offices, as well as other private equity investors, are all seeking for investment opportunities.

[83] Financial Services Development Council, Family Wisdom: A Family Office Hub in Hong Kong, July 2020 https://www.fsdc.org.hk/en/insights/family-wisdom-a-family-office-hub-in-hong-kong

Although the public sector should avoid being a part of the investment process of the private sector in all circumstances, it can consider ways to lower the transaction costs of both sides - namely, private sector investors looking for investment opportunities and businesses looking for funding. **As a continuum of the support extended to early-stage companies showing that the public sector has "skin in the game", public sector players - such as Cyberport and HKSTP - may convene a group of asset owners (e.g. family offices) to co-invest in winners of certain competitions or, preferably, projects meeting certain standards.**

Relevant initiatives are done in other markets. For instance, the **New Zealand** Government established New Zealand Growth Capital Partners (NZGCP) in 2002 to "build a vibrant early-stage technology investment market in New Zealand."[84] Under NZGCP, there are two investment vehicles – Elevate and Aspire funds – designed as fund of funds with a co-investment model to stimulate private investment into the early-stage investment system in New Zealand. Zooming into the Elevate fund, a fund of funds programme that focuses on bringing capital, especially in Series A and B rounds, to high-growth technology businesses in New Zealand. The fund will invest in venture capital funds that target New Zealand entities that are at Series A and B stages. All underlying funds will need to raise matching capital from other investors, at least, equal to the amount from Elevate fund. Through this mechanism, the New Zealand government is expecting to stimulate investment of NZ$1 billion into businesses that are at Stage A and B in New Zealand over the next 15 years.

Acknowledging that public monies would not be sufficient for the expansion needs of all private sector start-ups, these firms would benefit from receiving fundings and investments from other reputable and experienced private investors. According to Walsh and Look, besides grants and subsidies provided by the government, family offices and corporate investors, who are sometimes known as strategic investors, would be important to the success of such companies' fundraising activities.[85] The FSDC believes that, with the public sector orchestrating such efforts, funding and/or investments made by experienced investors and asset owners will have positive impacts on company development in early stages, including those in start-up and growth stages, investment and operating environment, leading to increased trust and positive network effect (e.g. word of mouth) for their future funding needs.

Staunch government support

Stevens (2017) suggested the public sector should be aware of the fact that, if tertiary education institutions are expected to be a factor bolstering and contributing to the domestic economy, the Government would need to be setting aside a budget for such purposes.[86] Take the **UK** government's practice as an example, it has launched a "Third Stream" funding with an aim of supporting economic development through the Higher Education Innovation Fund in 2002/2003, contributing some GBP160 million annually to UK universities to support their technology transfer offices. Relatedly, in a recent assessment of the research programmes of universities in the UK, 25% of the score was attributed to the impact of the research.

[84] New Zealand Growth Capital Partners, available at https://www.nzgcp.co.nz/about-us/
[85] Tanner De Witt, Overview of early stage and venture capital investment in Hong Kong, available at https://www.tannerdewitt.com/early-stage-venture-capital-investment/
[86] Nature Biotechnology, Volume 35, An emerging model for life sciences commercialization, July 2017 https://www.nature.com/articles/nbt.3911.pdf

Besides the Third Stream funding in the UK, as well as NIH and NSF fundings in the US, similar programmes were also available in other markets, and Stevens proposed that relevant government support would need to stay intact for a period of time.[87] Taking the situations in **Denmark** and **Japan** as examples, these countries had supported technology transfer activities at university-level for ten years before they moved on to change their respective legal systems to a different model. Meanwhile, France has also committed EUR1 billion for a period of ten years to subsidise regional technology transfer centres through its SATT (Société d'Accélération du Transfert de Technologie) programme. The heart of the issue that Stevens propounded was that governments would need to be supportive of technology transfer via monetary support, and should be doing it consistently over a reasonably long period before expecting such efforts to bear fruits.

Hong Kong's public sector has given much support to relevant start-ups, too. Among others, HKSTP has put in place a series of programmes aiming to help companies at earlier stages of development, such as pre-incubation and incubation stages, and accelerate their success when they become more developed. The Science and Technology Entrepreneur Programme, for instance, offers seed funding and co-working space. At the same time, the four-year Incu-Bio incubation programme is targeted at helping biomedical start-ups with the launch of their research and development of life-changing innovative solutions, which provides working space, technology, and business solutions to the firms, as well as offering up to HK$6m of financial aid.[88]

In 2020, the Government accepted recommendations of setting aside part of the Future Fund to establish a "Hong Kong Growth Portfolio (HKGP)", aiming to "enhance returns, while also consolidating Hong Kong's status as a financial, commercial and innovation centre, and raising Hong Kong's productivity and competitiveness in the long run."[89] It is the FSDC's belief that, in today's world with growing awareness of the importance of a well-functioning public health system and enhancing overall wellness as a society in view of an ageing population, healthcare and biotech should be attached with strategic value in the construction of the "Growth Portfolio". With the above in mind, **the Government's Future Fund, especially the newly established HKGP should consider putting stronger emphasis on the healthcare and biotech industries, even though they are already included as priority target sectors. Also, within the capacity of its governance and mandate, the HKGP should continue investing in these relevant strategically important industries**.

Similar to this proposal, the Japanese government has announced earlier the establishment of the University Fund focusing on investment in science research including but not limited to that in Japan.[90] An endowment fund projected to reach approximately US$95 billion over time is expected to begin the investment process in 2022. The government said the new fund under the Japan Science and Technology Agency, but professionally managed to achieve gains from the stock and bond markets, would invest in internationally competitive research and shared facilities for universities, increased R&D infrastructure for universities to scale up research, and a national innovation ecosystem.

[87] Ibid.
[88] Hong Kong Science and Technology Park, Incu-Bio, available at https://www.hkstp.org/innovate-with-us/incubation/incu-bio/
[89] HKSAR Government, Government accepts recommendations of the Group of Experienced Leaders on Future Fund, February 2020 https://www.info.gov.hk/gia/general/202002/26/P2020022600468.htm
[90] University World News, Japan to set up massive fund for scientific research, February 2021 https://www.universityworldnews.com/post.php?story=20210203130630432

ii) Commercialisation

For healthcare and biotech companies, like other innovative companies, the commercialisation phase of a product or service is the turning point whereby the firm can materialise or monetise from the invention it has invested time and other resources in. Rodet-Kroichvili, Cabaret, and Picard (2014) pinpointed that, "the economic value of a technology remains latent until it is somehow commercialised via a business model which unlocks the value potential embedded in technologies and converts them into market outcomes".[91] According to Times Higher Education's University Ranking, the amount of research income generated by an institution drawing from the industry is now a metric reflecting the universities' ranking, showing the importance of commercialising university-based research ideas and findings.[92] This is, surprisingly, perceived as a weakness of Hong Kong's ecosystem, which was revealed from our discussion with relevant practitioners.

Challenges

Challenges for innovators to commercialise their innovations have been well-documented (Stevens, 2017; Paul, Thangaraj and Ma, 2015; Zehner, Trzmielak and Zehner, 2013). For instance, through their study looking into molecular pharming's pre-commercial development, Paul et al. (2015) asserted that the absence of a commercial mindset in start-up companies had led to the failure of many spin-out companies across various technology fields. The authors suggested that it was common for these firms to have taken too long (i.e. an average of five years) to shift their attention to products and "a general lack of focus on products that pharmaceutical companies wanted to buy", among others.

In addition, as informed by our discussions with industry practitioners, the inadequacy of low-cost laboratory rental is a discouraging factor for scientists and other academics to move into the commercialisation process – and this may be specific for Hong Kong based healthcare- and biotech-related start-ups.

Luoma, Paasi, and Nordlund (2015) highlighted that the commercialisation of innovations - especially that of such products and services involving breakthrough technologies - would tend to encounter uncertainties in relation to the business model, markets and technologies.[93] Given the different risks involved in the commercialisation process, most innovations would fail before reaching commercial success. To this end, innovators and scientists are encouraged to start thinking about commercialisation of their inventions and begin mitigating other risks.

Another dimension of commercialisation is the size of the market. To this end, Hong Kong is blessed with the proximity to the Mainland, one of the largest and fastest growing markets in the world, and many conducive policies in place. For instance, according to the Chief Executive (2019),

> over the years, the Department of Health has put in place various facilitation measures to promote Hong Kong as a clinical trial hub, including streamlining and simplifying the application procedures and by providing advice throughout the application process. We also have strong support from the Mainland authorities in this regard. At present, the National Medical Products Administration of China recognises clinical trials data from over 30 specialties at the Queen Mary Hospital, the Prince of Wales Hospital, the Hong Kong Eye Hospital and the Hong Kong Sanatorium & Hospital for the purpose of drug registration in China.[94]

[91] New Insights into Innovation: The Business Model Approach and Chesbrough's Seminal Contribution to Open Innovation, 2014 https://www.cairn.info/revue-journal-of-innovation-economics-2014-3-page-79.htm

[92] Times Higher Education, University Industry Collaboration: The vital role of tech companies' support for higher education research, November 2020 https://www.timeshighereducation.com/hub/huawei/p/why-commercial-investment-university-research-will-only-grow

[93] Rantala, Tuija & Paasi, Jaakko & Nordlund Hanna, Managing Commercialisation Risks in Innovation Development: Linking Front End and Commercialisation, 2021 https://www.researchgate.net/figure/Case-studies_tbl1_267774698

[94] HKSAR Government, HK is a biotech centre, May 2019 https://www.news.gov.hk/eng/2019/05/20190529/20190529_152626_328.html

Although such policies have put Hong Kong in an advantageous position, some practitioners have shared with us that more needs to be done. For instance, as IP rights are territorial in nature and are granted by each jurisdiction separately based on its laws and given the fact that standards towards innovation would vary from one market to another, entrepreneurs and innovators would benefit from having some mutual recognition agreement, or synchronisation of standards, with different markets so that applicability of their innovation would be widened. Similarly, there have been various instances whereby disruptive innovators had not been able to monetise their innovations due in part to appropriate intellectual property protection measures in place - and the very fact that laws and regulations around IP vary from one market to another. In addition to certain existing bilateral or multilateral treaties or arrangements between different jurisdictions which serve to facilitate or expedite the application procedures within the participating jurisdictions, the Government should step up relevant efforts in protecting its home-grown innovations.

Arguably, the commercialisation process is as important as, if not more important than, any other process in the journey of an innovative company. Chesbrough (2003) articulated that "a mediocre technology pursued within a great business model may be more valuable than a great technology in a mediocre business model".[95] With this in mind and as discussed with the relevant industry leaders, the following recommendations catering to the needs of companies at different stages are set out for policymakers' consideration.

Early stage

Among other challenges they face, early-stage start-ups and entrepreneurs who have gone through the stage shared that a major hurdle for them to operate in Hong Kong was related to land prices. Indeed, according to Colliers Hong Kong Office – Net Effective Rent – Overall – Hong Kong Index from Bloomberg, office space in Hong Kong averaged HKD 60.11 per square foot as of June 2021, putting Hong Kong ahead of other major cities in Asia. The Government is fully aware of such issues, and space made available by Cyberport and HKSTP, for instance, was designed to address such needs. At the same time, while tenants of the two innovation and technology parks appreciate the Government and the respective teams' effort in supporting the healthcare and biotech ecosystem, some specific recommendations are worth considering.

Price and availability of laboratory space

The FSDC takes note of the fact that the planning and development of the Hong Kong-Shenzhen Innovation and Technology Park ("the Park") in the Lok Ma Chau Loop has been progressing since the agreement was signed between Hong Kong and Shenzhen governments in January 2017.[96] With the Hong Kong-Shenzhen Innovation and Technology Park Limited who is responsible for the construction, operation, maintenance and management of the Park - and the fact that it is a wholly-owned subsidiary company set up by the HKSTP, as well as the humongous space available when the Park is completed - more possibilities will be available upon the completion of the Park. That said, some interim solutions must be sought.

[95] Open Innovation: The New Imperative for Creating and Profiting From Technology.

[96] Legislative Council, Development of the Hong Kong-Shenzhen Innovation and Technology Park in the Lok Ma Chau Loop, (LC Paper No. CB (1) 150/20-21(4), November 2020
https://www.legco.gov.hk/yr20-21/english/panels/ci/papers/ci20201117cb1-150-4-e.pdf

Perhaps a happy problem indicating the attractiveness of the innovation and technology parks and the vibrancy of relevant sectors, some industry practitioners shared with the FSDC that it was a major challenge to become a member of the communities due to overwhelming demand. **In this regard, it would be useful if Cyberport and Hong Kong Science and Technology Park can consider prioritising the extension of support to smaller-scale start-ups in the tenant selection process and, to the extent possible, consider granting access to laboratory facilities to start-ups that meet the eligibility requirements but whose application are not successful solely due to limited capacity.**

In addition, some industry players have also highlighted that, specifically for biotech, healthcare and other life science subjects, the required equipment and setup of the laboratory would vary significantly, depending on the very specific specifications required for different research areas. As such, it may be difficult for the innovation and technology parks to adopt a one-size-fits-all approach and expect tenants to be fully satisfied with the setups prepared. Therefore, the Government and relevant parties may consider alternative approaches to the current practices. For instance, to incentivise science-backed entrepreneurship, **the Government may consider providing subsidies to these potential entrepreneurs covering the rental of the laboratory and co-working space based outside the current innovation and technology parks.**

Terms and conditions may be discussed further, while references can be made to existing practices. The eligibility of such subsidies should be similar, if not identical, to such conditions set out by the innovation and technology parks. Meanwhile, the subsidised amount should be similar to that provided to tenants in the innovation and technology park communities, and it may be benchmarked against the difference between market rates and the cost to Cyberport/ HKSTP tenants. In terms of the duration of subsidies, it should also be subject to the maximum length of tenancy at such parks. The primary design of such ideas is to allow scientists to embark on an innovation-driven entrepreneurial journey.

Technology transfer office (TTO)

Technology transfer is an essential element in the commercialisation process. While established commercial-based organisations should not face as high of a hurdle in their commercialisation process, it is oftentimes an issue involving innovations discovered by university-based researchers. This explains why TTOs in leading research universities in the US and the UK, for instance, are tasked to be the key liaison parties between university-based researchers and commercial industries, being responsible for managing and protecting the intellectual properties (Kern, 2016;[97] Varma, 2014;[98] Ramsden, 2009;[99] Shih, 2016[100]). In Hong Kong, the University of Hong Kong,[101] the Chinese University of Hong Kong,[102] the Hong Kong University of Science and Technology,[103] the Hong Kong Polytechnic University,[104] and other research universities have set up their TTOs, too. That said, beyond establishing the TTOs, **universities in the city should consider reviewing and modernising the operation model of such offices**, including the TTOs' setup and incentive schemes for staff members working for TTOs, among others.

[97] Friedrich Kern, The Role of Technology Transfer Offices in Academic Entrepreneurship, 2016 https://www.grin.com/document/350910
[98] Treatise on Process Metallurgy, Volume 3: Industrial Processes, 2014 https://www.sciencedirect.com/book/9780080969886/treatise-on-process-metallurgy
[99] Applied Nanotechnology, The Conversion of Research Results to Products, A volume in Micro and Nano Technologies, 2009 https://www.sciencedirect.com/book/9780815520238/applied-nanotechnology
[100] Start-Up Creation, The Smart Eco-Efficient Built Environment, 2016 https://www.sciencedirect.com/book/9780081005460/start-up-creation
[101] The University of Hong Kong, Technology Transfer Office, available at https://www.tto.hku.hk/
[102] The Chinese University of Hong Kong, Office of Research and Knowledge Transfer Services, available at https://www.orkts.cuhk.edu.hk/
[103] The Hong Kong University of Science and Technology, HKUST Technology Transfer Center, available at https://ttc.ust.hk/m/index.php?p=3&sp=52
[104] The Hong Kong Polytechnic University, Knowledge Transfer and Entrepreneurship Office, available at https://www.polyu.edu.hk/ife/corp/en/index.php

According to Tom Hockaday, who led the University of Oxford's technology transfer activities between 2006 and 2016, noted that the success of a "TTO is wholly dependent upon the willingness of researchers to engage in the process, support from senior university members, and should adopt a philosophy of supporting researchers who want support," good governance structures should be in place.[105] Hockaday suggested that in designing the setup of TTOs, a university could consider whether it should be a part of the school's administration, a strategic partnership with a contractual long-term relationship, a company with partial ownership, or a fully owned company. Among different forms, he generalised and suggested that it would be most ideal for research universities to consider setting up TTOs that are wholly owned subsidiaries of the universities. One of the reasons behind such suggestions is to ensure that TTO staff members are appropriately incentivised to commercialise the IPs generated by affiliated researchers.

A key factor to commercialisation via technology transfer is the sufficient interaction and connection between the research field and commercial industries. On this note, the HKSTP has also recently taken the lead in setting up an Institute of Translational Research with aims to turn research into products for the market.[106] The establishment of the Institute could foster closer communication between researchers and the market and could play a part in attracting more new talents to Hong Kong.

While it is not the intent of this paper to dictate what the best approach of TTO management is, a comprehensive review of such aspects is considered appropriate. The FSDC trusts that it will help the commercialisation process of Hong Kong-founded innovations if universities in Hong Kong should hire people with strong technical knowledge and commercial sense to steer the development of TTOs.

Growth stage

According to Bellavitis, Filatotchev, Kamuriwo, and Vanacker (2017), different governments around the world have geared up their support for start-ups and SMEs with an agenda of driving new research and enhancing the commercialisation aspects of innovation.[107] This is consistent with Binh, Dung, and Trong (2017), who found that countries have adopted laws focusing on shaping regulatory frameworks aiming at promoting start-ups and SMEs, with an aim of ensuring that these companies would receive specific preferences and support from governments.[108]

For instance, supported by the Indian Government, a unit tasked with helping start-ups with their product commercialisation process has been established by the Biotechnology Industry Research Assistance Council (BIRAC).[109] Meanwhile, in 2018, the Secondary Agriculture Entrepreneurial Network (SAEN) was formed and is led by partners from both public and private sectors, with an overarching goal of supporting the promotion of new start-ups and existing ones in the secondary agriculture sector. The BIRAC has also launched the Accelerating Entrepreneurs Fund, to provide access to additional funding to successful applicants as well as addressing the importance of the focused mentorship relationship between successful companies and nascent biotech start-ups.[110]

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[105] Tom Hockaday, What is the best structure for a University Technology Transfer Office? http://www.technologytransferinnovation.com/tto-structure.html

[106] SCMP, Hong Kong's R&D investments pay off with Beijing's go-ahead for health tech hub in Greater Bay Area, 4 October 2021 https://www.scmp.com/news/hong-kong/politics/article/3151049/hong-kongs-rd-investments-pay-beijings-go-ahead-health-tech

[107] Bellavitis, C., Filatotchev, I., Kamuriwo, D. S., and Vanacker, T. (2017). Entrepreneurial finance: new frontiers of research and practice. Venture Capital, 19(1–2), 1–16. doi:10.1080/13691066.2016.1259733.

[108] Binh, L. D., Dung, N. K., and Trong, T. D. (2017). SME Laws in Selected Countries and Implication for Vietnam Retrieved from https://www.economica.vn/-Portals/0/Documents/SME%20Laws%20-%20Intl%2 0Practices%20and%20Implication%20to%20VN.pdf.

[109] The Ministry of Science and Technology of India, Department of Biotechnology, Make in India & Start-up in India, available at https://dbtindia.gov.in-/schemes-programmes/translational-industrial-development-programmes/make-india-start-india

[110] Biotechnology Industry Research Assistance Council (BIRAC), Accelerating Entrepreneurs (ACE) Fund, available at https://birac.nic.in/aceFund.php

With this in mind, the FSDC believes that the public sector - led by the Government, the Innovation and Technology Commission,[111] the innovation and technology parks, as well as other promotional agencies such as InvestHK and the Trade Development Council - should brush up its promotional efforts and provide opportunities for homegrown start-ups. While these parties may already have a range of initiatives in place, respectively, a stronger coordination mechanism should be in place in order to achieve a more diversified group of beneficiaries - that is, additional attention should be dedicated to start-ups whose products and services are being produced but may not be well-known enough for many targeted users. To the extent possible, **the public sector bodies enlisted with market development mandates should also consider facilitating cross-boundary investment and merger and acquisition activities through creating and nurturing B2B and business-to-investor events and relationships via online, offline, or online-to-offline events**, which will be helpful in facilitating a more efficient price-discovery and capital-recycle process.

IP protection and development

Putting IP into good use and practices is commonly identified by the literature as an effective tool. According to IP Australia,[112] one way of bringing a company's products or services to the market is to do it through commercialising IP. According to the University of Wisconsin – Madison, IP

> is a work or invention that is the result of creativity, such as a design, method or manuscript, to which one has rights and for which one may apply for a patent, copyright, trademark, etc. Some examples include devices, machines, composite materials, algorithms, artwork, and manuscripts. The Bayh-Dole Act pertains only to patentable inventions, and has no impact on copyright (manuscripts, artwork, etc.) or trademark.[113]

When a company considers IP commercialisation, its strategy should be dependent on various variables, including but not limited to personal circumstances, access to finance, business or commercial capabilities, as well as the operating environment (e.g. competitiveness of similar companies). Owners of the IP could benefit from it in various ways and business conditions. Tolkoff and Anders (2013), though, opined that there would be other options for companies who do not desire or are not able to market newly invented products or services by themselves through introducing licensing arrangements as a part of the commercialisation package.[114] Licensing agreements often set out the rights, duties and obligations of each party in relation to the licensed IP and licences are granted for royalties with upfront licensing fees. With licensing arrangement in place, the inventor-company (the company which owns the IP) could be benefitted as it is able to visualise its forthcoming revenue stream.

While these license agreements would allow the inventor-company to create an immediate and more predictable revenue stream – especially from markets where the company may not establish presence in the foreseeable future – it would require the inventor-company to give up certain rights to others. For instance, in the case that the inventor-company would need to forgo the exclusivity of such products or services to the licensee(s), the value of the invention could be dented as prospective acquirers and partners might value such foregone benefits.

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[111] under which the InnoHK initiative has been rolled out -
[112] Sheldon A. Buckler, The Spiritual Nature of Innovation, January 2016 https://www.tandfonline.com/doi/abs/10.1080/08956308.1997.11671116
[113] The University of Wisconsin-Madison, Bayh-Dole Act: Regulations Impacting Ownership of Patent Rights https://research.wisc.edu/bayhdole/
[114] Tolkoff & Anders (2013). Chapter III.2.2. - Commercialization: What it Takes to get a Product to Market. Biomaterials Science (Third Edition) An Introduction to Materials in Medicine (2013), doi: https://doi.org/10.1016/B978-0-08-087780-8.001303
https://www.sciencedirect.com/science/article/pii/B9780080877808001303

At the same time, while IP commercialisation was deemed a viable route for some, Zehner et al., for instance, said that the nature of patent application would risk the disclosure of intellectual "secret" to an innovator's competitor.[115] In addition, application of patents could be time-consuming and costly. Taking the situation in the US as an example, the application of a patent would traditionally take 22.8 months, while the USPTO had 625,168 unexamined patent application inventories as of May 2021, according to the US Patent and Trademark Office.[116] According to a US-based patent financing, insurance and loans specialist estimated that the average total patent cost to be US$56,525.[117]

As a small but open economy with extensive connections with international markets, Hong Kong should extend such advantages to the IP commercialisation space. To this end, the Asia IP Exchange (AsiaIPEX)[118] has been developed and is managed by the HKTDC, currently hosting 28,000 tradable IP listings on the platform. The Original Grant Patent (OGP) system was also implemented by the Intellectual Property Department in December 2019 allowing inventors to seek standard patent registration directly in Hong Kong. More recently, with a view to providing more structured and advanced training programmes for IP Managers to cater for their specific career needs, an enhanced "IP Manager Scheme PLUS" with more breadth and depth in contents was launched in October 2020. The IP Manager Scheme aims to provide SMEs training courses on IP related subjects.

Building on such existing infrastructure, Hong Kong can go one step further in IP protection and development to foster homegrown and international innovation. **Riding on the support of the Central People's Government to develop Hong Kong into a regional IP trading centre as set forth in the National 14th Five-Year Plan, the Intellectual Property Department should continue to forge strengthened cooperation internationally and with the Mainland (starting with the Greater Bay Area), to promote IP awareness and development, among others.**

iii) Talent

Healthcare and biotech firms around the world are in a war for capable talents, and that is applicable to companies of all types, backgrounds, and origins (Meaney and Pucci, 2017; Stevens, 2017; Paul et al., 2015). Taking the US as an example, JLL reports that the life sciences sector in the US made up some 2.1 million jobs among 82,300 companies,[119] and the strong demand is likely to stay given the country's devotion to the sector.

Oftentimes talent is regarded as a key factor to sustain the growth of an industry. However, for the healthcare and biotech sector, attracting relevant talents to should be the priority and the key driver in fostering a comprehensive healthcare and biotech ecosystem in Hong Kong. Hence, the need for Hong Kong to expand its healthcare and biotech talent pool is well recognised. For instance, HKEX's Head of Listing, Bonnie Chan (2021) addressed that there has been a growing demand for financiers, researchers and legal professionals, but it would require the collaboration of different parties, including the industry, universities, and the private sector to collaborate and build a stronger homegrown talent pool. Specifically on Hong Kong's talent pool for the healthcare and biotech sectors, interviewees also suggested that a higher degree of emphasis should be laid on a comprehensive and cross-disciplinary training system in the current education curriculum, technology transfers from universities to commercial market and a clearly depicted career path.

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[115] Zehner, Trzmielak & Zehner. Commercialization of Biotechnology Science Molecules to Market Global and American Perspectives, https://pdfs.semanticscholar.org/1cba/e25a248e7364d3cf825ac1728ec6fbf929e0.pdf?_ga=2.256709131.1092475703.1625477820-1714868680.1625477820

[116] The United States Patent and Trademark Office (2021). Patents Data, at a Glance June 2021, https://www.uspto.gov/dashboard/patents/

[117] BlueIron (2021). How Much Does A Patent Cost? https://blueironip.com/how-much-does-a-patent-cost/

[118] Asia IP Exchange, available at https://www.asiaipex.com/AboutUs/AsiaIPEX_EN

[119] JLL, The Life Sciences Talent Imperative

According to the Coalition of State Bioscience Institutes' 2018 Workforce Trends Report, the soaring demand for soft skills has become the top priority for employers, as they look for people who can navigate the dynamic and competitive industry.[120] In spite of their differences, while these companies would need to fill such science-intensive roles requiring technical expertise, they would also have demand for people with consumer goods and services background to market their products even though they may not have healthcare- or biotech-related experience. Relevant firms would also need people equipped with finance and human resources management skills to carry out relevant functions. The inadequacy of such talents with cross-disciplinary skillsets and capabilities was specifically pinpointed by a Hong Kong-based, world renowned oncologist and entrepreneur. To say the least, employers in related fields are seeking candidates who are able to navigate the complex and rapid internal and external changes, while being able to develop innovative products.

The battleground for talent is not confined to the private sector, and Stevens (2017) highlighted that "brain drain" was an issue for universities, too. It is commonly observed that some of the better students having studied or researched in emerging economy-based universities would choose to study or continue their research abroad through obtaining advanced degrees and, say, post-doctoral fellowships. Notwithstanding the fact that universities in emerging economies could also possess advanced technologies and equipment, these high-potential researchers would generally endeavour to remain in the developed economies if such opportunities arose. Oftentimes, it would mean that their homelands have lost their talents and, as a result, Stevens suggested that "governments in developing countries may be reluctant to create opportunities for their young stars to travel abroad for training".

That said, it would be unjust to say that the Government has not done anything to feed the talent demand of the industry. The Innovation and Technology Commission, for instance, has multiple schemes designed for companies at different stages of development (e.g. incubatees, companies engaged in innovation and technology projects), whereby companies in the healthcare and biotech sectors would be eligible as well.[121] As set out in the Policy Address 2020, the Chief Executive also proposed the Global STEM Professorship scheme, which was designed to nurture, retain and attract talent, thereby boosting the local innovation and technology related talent pool.[122] Meanwhile, the Talent List of Hong Kong, compiled by the Government, has identified "pharmaceutical and life science/biotechnology" as one of the key areas of focus under the "Innovation and Technology Experts" category, indicating the Government's determination for and openness to inviting overseas talent to come and work in Hong Kong.[123] However, in spite of the various measures in place, the effectiveness of the Government's talent strategies for the industry is debatable. For example, although the Technology Talent Admission Scheme (TechTAS) was launched in June 2018, only 25 non-local persons were approved for entry under TechTAS.[124]

[120] Coalition of State Bioscience Institutes, 2018 Life Science Workforce Trends Report, http://docs.wixstatic.com/ugd/dd6885_7b39782aca824539b5032acee46f2722.pdf

[121] Innovation and Technology Commission of the HKSAR, Research Talent Hub, available at https://www.itf.gov.hk/en/funding-programmes/nurturing-talent/research-talent-hub/

[122] Legislative Council of the HKSAR Government, Global STEM Professorship (LC Paper No. CB(1)482/20-21(03), January 2021 https://www.legco.gov.hk/yr20-21/english/panels/ci/papers/ci20210126cb1-482-3-e.pdf

[123] HKSAR Government, Talent List Hong Kong, available at https://www.talentlist.gov.hk/en/talentlist.html

[124] Innovation and Technology Bureau, Replies to initial written question raised by Finance Committee Members in examining the Estimates of Expenditure 2021-22 https://www.itb.gov.hk/assets/files/itb-e.pdf

Early stage

Equipping and attracting talent with multidisciplinary skill-sets and mindsets

While some of the interviewees have shared with the FSDC that Hong Kong might be facing a shortage of science-trained talent, they also emphasised that people with multidisciplinary skill-sets and mindsets were of utmost importance to the success of their business. While the sheer amount of science-based talent may be boosted by the provision of subsidies,[125] nurturing scientists with a business-oriented mentality may take longer.

Meaney and Pucci (2017) emphasised that healthcare and biotech firms would benefit from talents with a multi-disciplinary mindset and background.[126] Specifically, the authors revealed that Sanofi, a French-headquartered pharmaceutical firm, would specifically look to hire people who have lived in more than one country so as to employ team members who would likely be adaptable to cultural differences and other aspects. The company had established a programme with an aim of bringing leaders of the firm to various markets and exposing them to innovations that could potentially disrupt the firm's businesses, holding the belief that such arrangements can nurture an innovation-prone mindset. The programme would bring leaders to places including but not limited to Mainland China and the US, exposing to more relevant topics and those seemingly less relevant ones, ranging from healthcare, to virtual realities and augmented realities, artificial intelligence, crypto-currencies, big data and others. Similar appeals were brought up by Paul et al. (2015), who highlighted that despite having a lesser general emphasis as compared to research and development ability and quality, management quality would be crucial to a firm's ability to leverage and capitalise on business opportunities.

While it may be difficult to set out concrete policy recommendations to address such concerns, universities may consider incentivising students with life science majors to take part in business- and management-related courses and access relevant training materials, perhaps, during summer and winter breaks at no additional cost. The launch of open access to such course materials, which have been developed by world renowned institutions such as Yale University[127] and Massachusetts Institute of Technology, can be used as references.[128]

[125] Such as the US$23,000 living expenses subsidies proposed by the Japanese government for doctoral students engaging in scientific research (see https://www.universityworldnews.com/post.php?story=20210203130630432)
[126] McKinsey, What talent management can do to shape next-generation pharma leaders, 2017 https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/what-talent-management-can-do-to-shape-next-generation-pharma-leaders
[127] Yale University, Yale Poorvu Center for Teaching and Learning, available at https://poorvucenter.yale.edu/online-courses
[128] Massachusetts Institute of Technology, MIT Opencourseware, available at https://ocw.mit.edu/index.htm

Growth stage

Universities to invest in their own research and researchers

Studying the success stories of other research universities around the world, the **FSDC believes that universities, among others, should consider allocating and investing a higher share of their endowment funds in projects led by affiliated professors and researchers**, as it will not only help secure financing needs but also retain relevant talents in Hong Kong.

References can be drawn to world renowned universities in the US and the UK. Taking the University of Oxford's Oxford University Innovation (OUI) as an example, it is a wholly-owned subsidiary of the school that is governed by the board of directors made up of senior staff from the school and other non-affiliated members with extensive industry experience. According to OUI's website, it has created over 100 new technology companies utilising academic research produced within and owned by the school, and has, on average, generated new spinout companies every other month.[129] With these newly established companies that have been contributing millions of dollars back into research activities happening within the school, the school and the local economy has both benefited from added economic activities and job opportunities. Indeed, once the research process continues to be based in the neighbourhood of, or somewhere close to, the university, it would essentially mean that the talent will reside in such areas.

Separately, in relation to the setup of the University Fund by the Japanese government mentioned earlier in this report, Japan believes that the fund will boost the country's talent pool by increasing the number of doctoral students in the research and development fields, on top of strengthening the country's research performance and improving the country's universities international rankings.

Salary subsidies

According to JLL, the cost of living in a city can become a hindrance to a city/region's weakness in drawing talent. Using the largest biotech and healthcare innovation clusters in the US as examples - that is, San Francisco Bay Area and Boston - as these clusters have been facing challenges in their infrastructure and affordability, it has become increasingly difficult for them to attract and retain talent. The high housing and other expenses, in particular, can make Hong Kong an unattractive market for new graduates.[130]

Meanwhile, considering that developing homegrown talent may take a longer period to bear fruit and that Hong Kong may not be the most attractive market for life science graduates, some other measures should be deliberated. Taking reference to FAST and FIRST introduced amidst the pandemic and the Government's determination to stabilise the souring unemployment situation, **salaries subsidies may be provided to jumpstart the further development of the industry**. Conditions relating to the amount of subsidies (e.g. HK$10,000 per head per month), duration (e.g. 12 months), desirable skill-sets (e.g. a life science graduate with business related work or academic exposure), and employers' eligibility (e.g. a biotech or healthcare related start-up with a certain amount of Hong Kong-based employees) can be considered.

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[129] University of Oxford, Oxford University Innovation, available at https://innovation.ox.ac.uk/portfolio/

[130] The starting salary of a life science graduate with a graduate degree is estimated at HK$19,000 (Science graduate) per month (Source: https://www.edigest.hk/%e8%81%b7%e5%a0%b4/8%e5%a4%a7%e7%95%a2%e6%a5%ad%e7%94%9f-%e6%94%b6%e5%85%a5%e6%8e%92%e8%a1%8c%e6%a6%9c-%e5%b9%b3%e5%9d%87%e6%9c%88%e8%96%aa-%e6%9c%88%e5%85%a5%e4%b8%ad%e4%bd%8d%e6%95%b8-1517/3/), comparing to the average rental expense of a type A housing being HK$382 per sq meter per month (Source: https://www.statista.com/statistics/1041280/hong-kong-island-private-apartment-average-monthly-rent-by-size/).

Conclusion

According to the Global Innovation Index 2020, there are different clusters of cities where higher efficiency of innovation is achieved through each city contributing to the overall success of the cluster by leveraging its complementary advantages. Among the clusters selected, the Shenzhen-Hong Kong-Guangzhou cluster ranked second among the top 100 city clusters identified in 26 countries. Undoubtedly, Hong Kong, with its premier listing platform for the healthcare and biotech sectors, especially since 2018 when the listing reform was introduced, brings its unique value as a capital formation centre to the cluster. Nevertheless, **Hong Kong, which also boasts world-class research facilities and universities, should also grasp the opportunity to leverage such advantages to strengthen its research endeavours**, so as to create a virtuous cycle for the synchronised development of financing and research capabilities.

It is a global phenomenon that innovation-driven biotechnology and healthcare companies are facing increasing challenges in this digital age, when the rise of artificial intelligence is reshaping the decision-making process and the proliferation of blockchain technology adoption - among many other technologies - is transforming how trials and tests are conducted. With such developments, life science organisations are required to be nimble and they have to adhere to the new model of work by adopting and adapting to new technologies. Such observations highlight that the commercialisation process, financing, and talent aspects of this paper are all interlinked. According to the British Department for Business Innovation and Skills,

> In order to ensure that researchers, clinicians, businesses and investors see the UK as the location of choice for life sciences, we must build a fully integrated life sciences ecosystem from our world-class research and clinical infrastructure. We will achieve this by making it easier for researchers to commercialise academic research; placing clinical research at the heart of the NHS; and by empowering patients to participate in research (P. 8, Department for Business Innovation and Skills).[131]

As well covered in this paper, **access to financial resources and investors are some of the most important elements to the survival and success to healthcare- and biotech-related start-ups and SMEs**. Wisuttisak (2020) highlighted different markets have developed a variety of regulations and policies to promote development start-ups and small and medium sized companies.[132] Using the US as an example, the Office of Small Business Administration works hand in hand with different organisations for grant offerings and, as proven in the success of the US's start-up ecosystem, such grants could also bring in or lead to venture capital investments by large corporations. In the EU, an array of funding support, income subsidies, and other support provided by the public sector have been in place to stimulate entrepreneurial activity.[133]

[131] Department for Business Innovation & Skills of the United Kingdom, Strategy for UK Life Sciences, December 2011 https://assets.publishing.service.gov-.uk/government/uploads/system/uploads/attachment_data/file/32457/11-1429-strategy-for-uk-life-sciences.pdf

[132] Asian Development Bank Institute, Comparative Study on Regulatory and Policy Frameworks for Promotion of Startups and SMES in Japan, the Republic of Korea, Malaysia, and Thailand, December 2020 https://www.adb.org/sites/default/files/publication/668331/adbi-wp1206.pdf

[133] European Commission, Funding opportunities for small businesses, available at https://ec.europa.eu/info/funding-tenders/how-apply/eligibility-who-can-get-funding/funding-opportunities-small-businesses_en

Stevens (2017) highlighted that “The Triple Helix” model would be a winning formula for a market to successfully develop its innovative industries, which require favourable government policies toward innovation commercialisation and others. Relying on the tripartite coordination involving industry practitioners, academic institutions, and government, the closer relationship would be conducive to the spurring commercialisation of such products and services. Conversely speaking, as observed in emerging economies where policymakers tend not to have a strong belief and trust in the Triple Helix model, universities were oftentimes considered and also considered themselves as a supplier of knowledgeable labour. As these institutions are not set up or tasked to contribute to the economic development of a city through generating innovation, technology transfer offices of such institutions are essentially not incentivised to transfer the innovation to the industry for commercialisation purposes.

Given the endowed advantages, Hong Kong does not need an overhaul, but refinements to the existing frameworks so that its arsenal can become more diverse and efficient. **With an enhanced public-private-partnership model, a strengthened university-led technology transfer office programme, an optimisation to be carried out on public sector-led incubation programmes / grant schemes, and stronger emphasis on life science talent**, the FSDC believes that Hong Kong will be able to be the incubator of healthcare and biotech companies in Hong Kong, the country, and the rest of the world.

Appendix 1. Support available to healthcare and biotech sectors by Cyberport and Hong Kong Science and Technology Park

1) Cyberport

HealthTech is one of the major verticals in Cyberport's Smart Living cluster. There are around 90 Cyberport community companies developing and providing multiple HealthTech solutions.

Cyberport's HealthTech companies apply technologies, such as artificial intelligence (AI), virtual reality (VR), Internet of Things (IoT), 5G technologies, to develop diverse HealthTech solutions which aim to cater health needs of different stages, ranging from medical equipment, remote diagnosis and treatment, healthcare devices, telemedicine platform to mental health services:

- **Prevention and early detection of illnesses:** to develop a new examination method for illness, such as cataract, with VR technology, which is deemed more effective for early diagnosis and treatment

- **Mental Health Service:** online counselling services provided through mobile applications with a matching algorithm for users and licensed psychologists. Users can communicate with professional psychologists through video conferences so as to tackle their emotional issues and improve their mental well-being

- **AI Diagnosis and treatment:** telemedicine & telehealth platforms providing video consultation service, medicine home delivery service, portable self-help medical imaging device for remote in-depth health monitoring and diagnostic screening

- **Rehabilitation:** to assist stroke patients with rehabilitation training at home by robotics devices and alleviate the shortage of physiotherapists in Hong Kong

- **5G AI Robotics Solutions for Healthcare:** the use of robots to control the function of ventilation pumps and equipment in the intensive care unit (ICU) of hospitals

In order to support the development of HealthTech solutions, Cyberport has provided the following incentives to companies in this field:

- **Financial Support:** Cyberport provides holistic programmes that support start-ups at different stages. Start-ups can receive up to HK$1.1million in financial assistance, rent-free working space, professional trainings and support from Cyberport.

- **Investment Fund:** Cyberport has also set up a co-investment fund of HK$400m (initially focus on series A or per-A investment and now extended to beyond series A) to attract co-investment from venture capitals to invest in Cyberport community companies.

- **Collaboration:** through established networks and various collaboration programmes, Cyberport actively connects community companies with different stakeholders, including the Government, medical institutions and social welfare organisations.

- **Social health/impact:** Cyberport initiated a "Braving the Epidemic" programme to gather over 70 solutions to help combat COVID-19 and to promote services provided by our community companies. These solutions covered mainly four areas, namely, medical and healthcare services, distance learning and work from home, household and workplace improvements and insurance and relief funds.

2) Hong Kong Science and Technology Park (HKSTP)

Biomedical technology is one of the strategic focuses of HKSTP, over 140 biotech partner companies which conduct research in fields ranging from diagnostics technologies, medical devices, pharmaceutics, stem cell and regenerative medicine to traditional Chinese medicine, call HKSTP their homes.

By providing quality infrastructure and technical support throughout the development cycle, incubation programmes and partnerships, the HKSTP aims to facilitate the R&D and commercialisation process of biotech companies.

Programmes and Initiatives offered by HKSTP

- **Incu-Bio** is a 4-year incubation programme which provides business, technology and workspace support. Start-ups can also access funding support up to HK$6 million.

- **Clinical Translational Catalyst (CTC)** provides financial support to biomedical companies in the processes of attaining regulatory approval for and conducting clinical trials, as well as achieving commercialisation.

- **ELITE** offers subsidies to match the R&D expenditures of local companies. The subsidies are the equivalence of up to 50% of the candidate company's R&D expenditures to a maximum of HK$20 million, plus up to HK$1.5 million of rental subsidies.

- **Medical Technology Integration Consortium (MedICon)** programme is a technology-matching marketplace for R&D projects to advance biomedical technologies. It aims to augment the strengths of our innovation and technology ecosystem for all stakeholders.

Facilities and Services provided by HKSTP

- HKSTP provides a wide range of facilities support to start-up companies in the healthcare and biotech-related sector in its **Biomedical Technology Support Centre, Healthcare Devices Innovation Hub** and **Chemical Co-Working Centre**. Companies are able to get access to facilities such as Genomics Laboratory, Freeze Dryer Room, Bioanalysis Laboratory, wet laboratories and instruments such as IP search engine, 3D CAD modelling and 3D printers such as LabView, Matlab etc.

- HKSTP is also working on establishing PIC/S-certified **Good Manufacturing Practices (GMP) facilities** (Cell Processing) for advanced therapy products (ATPs) manufacturing through collaboration with local universities. Besides, HKSTP has established a centralised resource, **Biobank** and a cloud-based data ecosystem, **Biomedical Information Platform**. The former stores and distributes biospecimen to facilitate biomedical research activities, whereas the latter enables users to search and access datasets and deploy new analytic methods for biomedical research.

Appendix 2. Intellectual property financing – opportunities and challenges

Among increasing efforts by global governments to promote IP financing as part of the race in driving technological development, several challenges have been commonly identified by existing literature on IP financing, which were also touched upon in a number of the FSDC's focus group discussions with practitioners.

Valuation - Just like any other assets, the valuation of the IPs concerned lies at the heart of their eligibility, or "financeability", as collaterals or underlying assets. In contrast to tangible assets such as real estate, whose valuation models and methods have been widely studied and thoroughly tested with abundant market data accumulated, the valuation of an IP, partly due to the lack of sufficient data to connect a creation directly to its economic value, remains a challenge to many. This is particularly so for biotech IPs, which requires subject expertise to understand the scientific and technological behind, not to mention their economic and financial value. To address such issues, the industry has been exploring common standards for determining IP valuation. Basing on the International Valuation Standards, which lists intellectual property rights under the larger category of intangible assets,[134] the Royal Institution of Chartered Surveyors' "Valuation of intellectual property rights"[135] puts forth three approaches - cost-based, marked-based and income-based - as common approaches for valuation of IP rights. Nevertheless, as revealed in a survey report by the University of London[136], the biggest difficulty facing universities in commercialisation of IP is assessing the economic value of the IP rights. As the paper puts it, "this may be linked to the fact that academic knowledge is often quite basic in nature, and therefore it is characterized by high uncertainty in terms of the type and amount of potential implementations that it may give rise to, as well as in terms of the time it will take for those to emerge."

Legal - Generally speaking, an IP right is granted by the government of a jurisdiction and hence is in force only within its territorial boundaries, which led to the international patent application, administered by the WIPO under Patent Cooperation Treaty (PCT), aiming to assist applicants in seeking patent protection internationally for their inventions. However, the varied development stage of global IP markets and relevant laws and regulations in each jurisdiction poses a significant risk to the claim on IP rights, especially in today's rapidly digitalising world. Different levels of domestic enforcement, specifically as it relates to infringement and counterfeit, also have strong implications on the value of the IPs within borders.

Risk sharing - Due in part to the aforementioned challenges for IP financing in valuation, enforcement and other procedural matters, a risk mitigation mechanism, where various participants collectively share the risks of an IP financing transaction, is central to its success and scalability. This explains the role of the risk manager, oftentimes insurers, seen in many of the successful examples of such transactions. However, the insurers' participation is in turn affected by their risk appetites, which, usually as long-term capital in the financial services ecosystem, tend to stay on the cautious side when it comes to unfamiliar new technologies whose valuation models are still being refined. The level of risk of a new invention failing could be as high up to 80% when it is at discovery development, according to WIPO.

[134] International Valuation Standards Council, International Valuation Standards, available at https://www.ivsc.org/standards/international-valuation-standards/IVS

[135] Royal Institution of Chartered Surveyors, RICS professional standards and guidance, global valuation of intellectual property rights, 2nd edition, March 2020 https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/valuation/valuation-of-intellectual-property-rights-2nd-edition.pdf

[136] Anderson and Rossi, Inefficiencies in markets for intellectual property rights: Experiences of academic and public research institutions, March 2012 https://www.researchgate.net/publication/241736622_Inefficiencies_in_markets_for_intellectual_property_rights_Experiences_of_academic_and_public_research_institutions

According to the Global Innovation Index 2021 published by WIPO in which Hong Kong ranked 14 in the overall ranking, in the area of market sophistication, Hong Kong ranked number one in venture capital investors but only number 33 in venture capital recipients. It appears that while Hong Kong investors are keen on making venture capital investments, not many Hong Kong start-ups benefit from such venture capital deals. The financial service providers in Hong Kong may consider identifying Hong Kong start-ups with good potentials and valuable IP rights in the biotech and healthcare industries which may be introduced to the venture capital investors in Hong Kong and elsewhere, so as to leverage the strong Hong Kong position on venture capital investments.

Latest overseas reference may be made to a paper prepared by the British Business Bank (in collaboration with the UK Intellectual Property Office) which identified banking regulations, legal enforceability in default, valuation of the IP assets concerned and liquidity as the main obstacles to using IP as loan collateral[137].

As highlighted in a paper by the Working Group on Intellectual Property Trading back in 2015,[138] discharging the potential of IPs may be a direction for Hong Kong to look into going forward. To this end, reference can be drawn from the below two markets, where the public and private sectors have made continuous efforts to nurturing a friendly and supportive system for IP development, registration, enforcement, laying a solid foundation for further explorations of IPs as financing assets.

International Experiences

US

The US's 2017 National Trade Policy Agenda identified "providing adequate and effective protection and enforcement of U.S. intellectual property rights" as a top priority. There are several government agencies and bodies involved around the US's effort in providing adequate and effective protection and enforcement of IPs.

- The US Patent and Trademark Office (USPTO) is the federal agency advising the US government bodies on IP policy, protection and enforcement as well as promoting more effective IP protection around the world. The Office's annual 301 Report[139] provides an annual review of the situation of IP protection and enforcement in global jurisdictions. The USPTO sets out various IP policies to provide policy leadership and "expertise in the domestic and international enforcement of intellectual property rights".

- The US Copyright Office is responsible for protecting and registering any patent applications in the US.

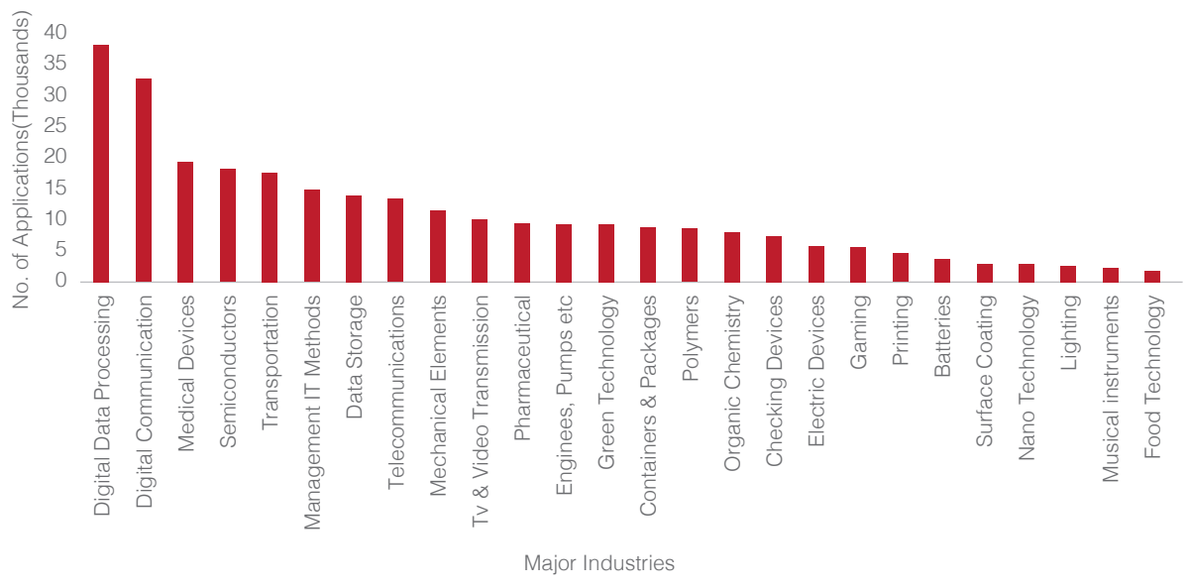
- The Office of International Intellectual Property Enforcement (IPE) "promotes strong intellectual property rights systems". The IPE works with US ambassadors and diplomats to ensure the interest of IP rights owned by US citizens are well-protected.

[137] British Business Bank, Using Intellectual Property to Access Growth Funding, https://www.british-business-bank.co.uk/wp-content/uploads/2018/10/502-IP-Report_singles.pdf

[138] Legislative Council of Hong Kong, Report of the Working Group on Intellectual Property Trading (LC Paper No. CB(1)680/14-15(01). March 2015 https://www.legco.gov.hk/yr14-15/english/panels/ci/papers/cicb1-680-1-e.pdf

[139] Office of the United States Trade Representative, USTR releases Annual Special 301 Report on Intellectual Property Protection, April 2021 https://ustr.gov/about-us/policy-offices/press-office/press-releases/2021/april/ustr-releases-annual-special-301-report-intellectual-property-protection

Figure 5. Example of US IP-Backed Financing in various industries



Source: Relecura.com

As one of the world leaders in both the financial markets as well as international patent application, the US has been spearheading in the financing space, having successfully seen IP financing transactions in many IP-intensive sectors, pharmaceutical included. Below is an example of how IP financing was utilised to foster the development of technological and product innovation in the pharmaceutical industry.

In December 2005, a US pharmaceutical company which develops ophthalmic pharmaceutical products and other therapeutic products for common eye problems like infection, pain and inflammation in ocular surgery and glaucoma raised US$6 million from debt financing. In this transaction, a US bank served as collateral agent and a global pharmaceutical development and healthcare investment firm was the main investor. The all-asset collateral included the company's portfolio of patents which were eight years old on an average. The company announced through a press release that the funds would go towards clinical trials and future applications for approval of new products.[140]

[140] Duff & Phelps, IP-Backed Financing: Using Intellectual Property as Collateral, December 2019 https://ciiipr.in/pdf/CII-Duff-&-Phelps-Report-on-Using-IP-as-Collateral-2019.pdf

South Korea

With its economy being largely technology driven, South Korea is one of the first-movers in the IP financing space spearheading its development in Asia. In 2019, the total amount of IP financing transactions in Korea reached KRW 1.34 trillion (US$1.11 billion), a 77% upsurge from 2018.[141]

Originally established as an external bureau of the Ministry of Commerce and later changed as a central executive agency, the Korean Intellectual Property Office (KIPO) carries out the mission of establishing new markets and leading the growth of corporations with IP.[142]

Under strong government support[143], various participants have been established, attracted or under development, to contribute to the IP financing market in South Korea, including both state-backed and commercial banks as lenders, as well as investment funds supported by government funding to diversify funding channels. An IP recovery institution is also reported to have been established for the risk sharing across the financing cycle.[144]

In July 2020, the Korean Intellectual Property Office (KIPO) announced complementary plans to increase its IP financial investment market to KRW 1.3 trillion (US$1.08 billion) by 2024 to help firms deal with liquidity issues triggered by the current pandemic, and generate up to 20,000 new jobs.[145] The plans are aimed at funnelling quality IP rights as investment items while attracting capital to such items, through its aims of establishing platforms for individuals and firms to directly invest in IP and profit from royalties, sales and even lawsuits.

Among others, South Korea recognises that the use of IP-backed financing by SMEs is limited due to their dependence on mortgage and credit loans provided by banks, insufficient public awareness of IP as a collateral and the immature legal infrastructure and support.[146] In order to address these issues, apart from general initiatives aimed at nurturing the IP-backed financing market at large, KIPO also rolled out support measures specific to SMEs, including offering up to 70% deduction in fees for applications for preferential examinations filed by start-ups[147], and a 50% deduction in IP security fees of banks who own collateral in the form of certain IPs generated by SMEs. Amidst COVID-19, KIPO clearly emphasised its effort to expand IP financing to support local SMEs, especially IP-based innovative companies, to overcome financial difficulties.

In part due to such continuous efforts, South Korea ranked fourth globally by number of international patent applications filed under the WIPO in 2020, and the amount of IP financing reached a record high of KRW 2.64 trillion, a 56.2% year-on-year increase.[148]

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[141] Global Innovation Index, IP-backed financing in the Republic of Korea, August 2020 https://www.globalinnovationindex.org/gii-blog/2020/brand-value-becomes-the-newest-global-innovation-index-data-indicator--b223

[142] Korean Intellectual Property Office, Mission & Vision, June 2017 https://www.kipo.go.kr/en/MainApp

[143] The Korea Herald, Govt vows to promote 'IP-based financing' for tech SMEs, December 2018 http://www.koreaherald.com/view.php?ud=20181211000687

[144] The Korea Herald, Govt vows to promote 'IP-based financing' for tech SMEs, December 2018 http://www.koreaherald.com/view.php?ud=20181211000687

[145] The Investor, S. Korea to expand IP financial investment market to W1.3tr by 2024, July 2020 https://www.theinvestor.co.kr/view.php?ud=20200702000773

[146] See footnote 169

[147] See footnote 169

[148] Korean Intellectual Property Office, IP Finance Transactions of South Korea Surpass KRW 2 Trillion, March 2021 https://www.kipo.go.kr/en/BoardApp/UEngBodApp?a=&c=1003&seq=1712&supp_cd=001&board_id=kiponews&cp=1&pg=1&npp=10&catmenu=ek06_01_01&sdate=&edate=&type=&bunryu=&tag_yn=&searchKey=1&searchVal=

Appendix 3. Survey findings

As observed from the previous sections, while Hong Kong possesses endowed advantages as a financing hub for healthcare and biotech companies, it may benefit from having a strategic direction in developing its role in healthcare and biotechnology financing. With the above in mind, the FSDC developed a questionnaire and received responses from 16 biotech-related start-ups and SMEs – many of whom are start-ups based in Hong Kong – sharing the challenges and potential opportunities faced in their entrepreneurial journey. While most of them focused on such areas as financing, talent, and commercialisation, other concerns were also raised. Follow-up one-on-one interviews have also been conducted with seven start-ups.

The FSDC is mindful of the fact that, given a relatively small number of companies contacted, the statistics below may not be significant or representative of the entire industry.[149] That said, as it is not our intention to generalise such findings, some high-level information observed, as well as the takeaway from our one-on-one interviews, can serve as useful tools to analyse some pain-points facing these start-ups.

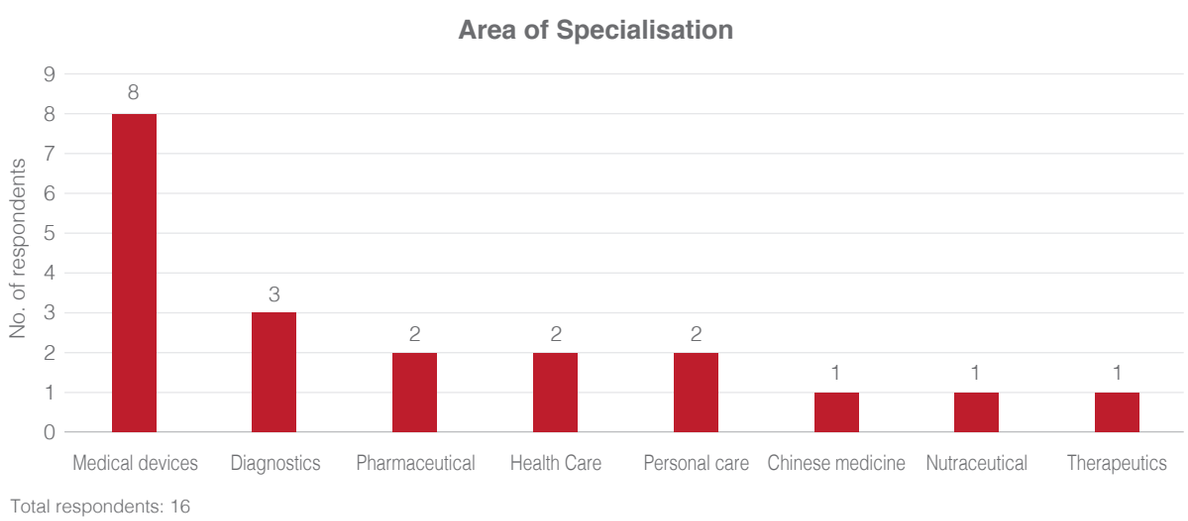
Background

HKSTP and Cyberport are the cradle of science and technology in Hong Kong, where many early-stage local healthcare and biotechnology companies set foot in. All of the 16 respondents are affiliated with the innovation and technology parks: 12 of them are currently based at HKSTP, three of them are at the Cyberport, and the remaining one receives fundings from the Cyberport but stations in Causeway Bay.

Area of specialisation

These respondents possess a wide variety of expertise in the healthcare and biotechnology sector. Figure 6 illustrates that the areas of specialisation of the respondents spanning from, medical devices, diagnostics, and to pharmaceutical, health care, personal care, Chinese medicine, nutraceutical and therapeutics.

Figure 6. Area of specialisation (Note: More than one option allowed)

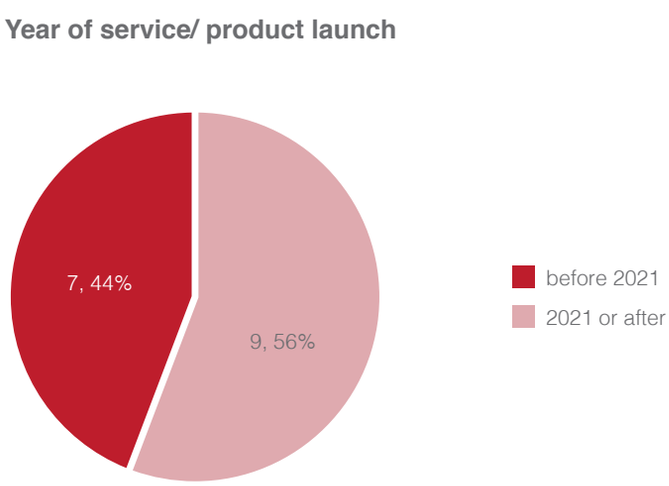


[149] More than half of the respondents are hiring fewer than 10 employees. In this regard, in accordance with the definition of SMEs in Hong Kong, only one respondent who engages over 70 is deemed not a SME. In Hong Kong, SMEs are defined as manufacturing firms which employ fewer than 100 persons, or non-manufacturing firms which employ fewer than 50 persons.

Commercialisation

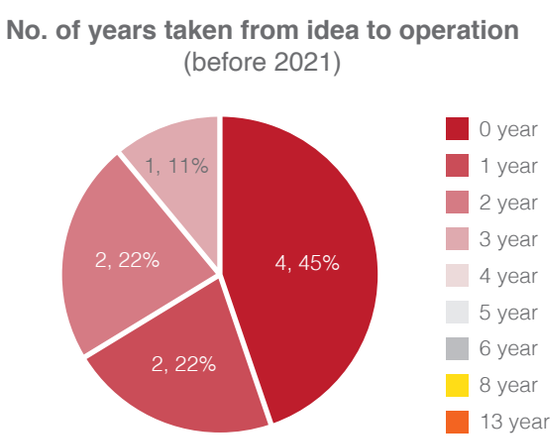
Nine out of the 16 respondents had launched their first service/product before 2021, while the rest of them had planned to launch in 2021 or after (see Figure 7). From the respondents of these firms, while getting their services/products launched within one year was not uncommon, it appears that a clear majority of them considers that a product/service launch within three-year-since-operation would be a reasonable timeframe.

Figure 7. Year of service/ product launch

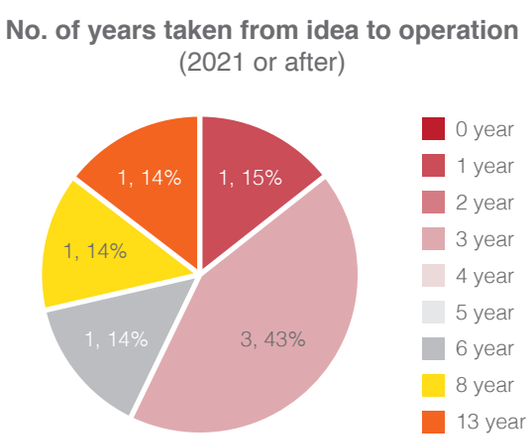


Total respondents: 16

Figure 8. No. of years taken from idea to operation (before 2021 and 2021 or after)



Total respondents: 7



Total respondents: 9

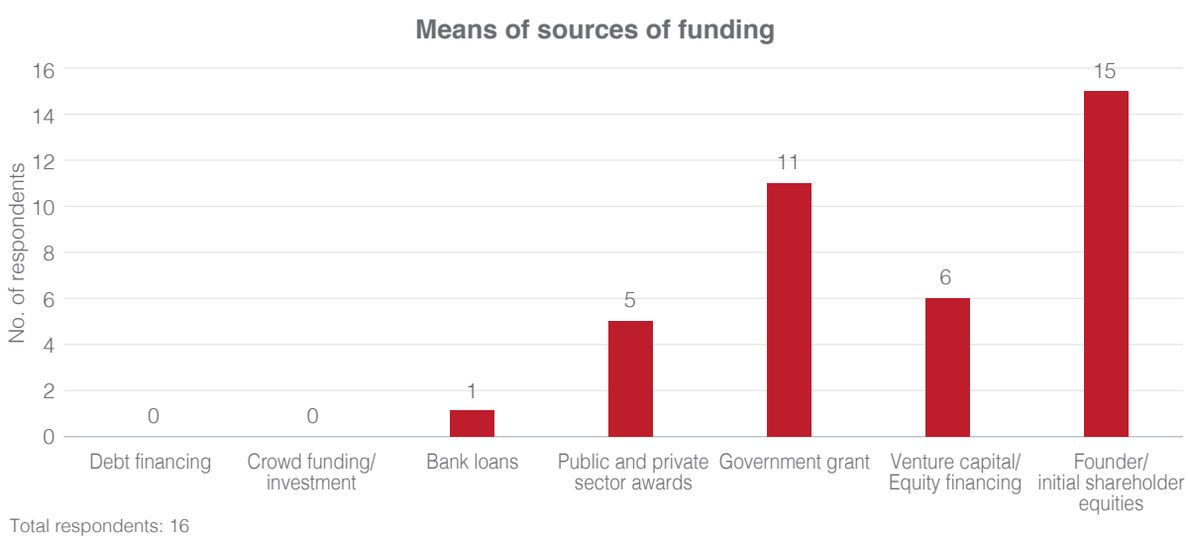
Financing

Financing was deemed an issue for most of the companies engaged in our study, regardless of the stages of development. Investors' risk appetite, knowledge of the healthcare and biotech sectors, platforms and channels to bond the supply of and demand for funding are some of areas worth looking into.

Sources of funding

Figure 9 shows that the majority of respondents take founder/initial shareholder equities as the main source of funding, followed by venture capital/equity financing. A few of them secured their fundings by means of public and private sector awards and nearly one-third of them, a small but significant portion, did not have the government grants as their source of fundings. Notably, only 1 respondent whose source of funding comes from bank loans and debt financing and crowd funding/investment are not the options for the respondents to source their funds.

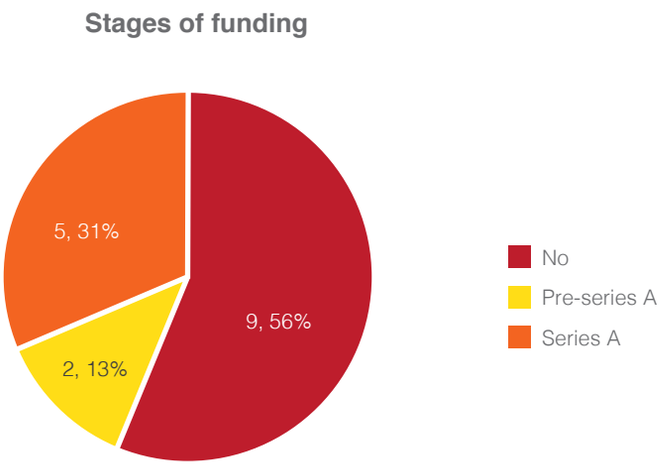
Figure 9. Means of sources of funding (Note: More than one option allowed)



Stages of funding

Series A financing is a kind of share-based financing. That is, by selling the company's shares, the start-up can acquire the investors' capital while giving up a share of, proportionate or not, voting rights to the investors. From Figure 10, more than half of the respondents have yet entered Series A financing, looking for venture capital, and a very small portion of them were at the pre-Series A stage. Only less than a third of them have gone through Series A funding round.

Figure 10. Stages of funding



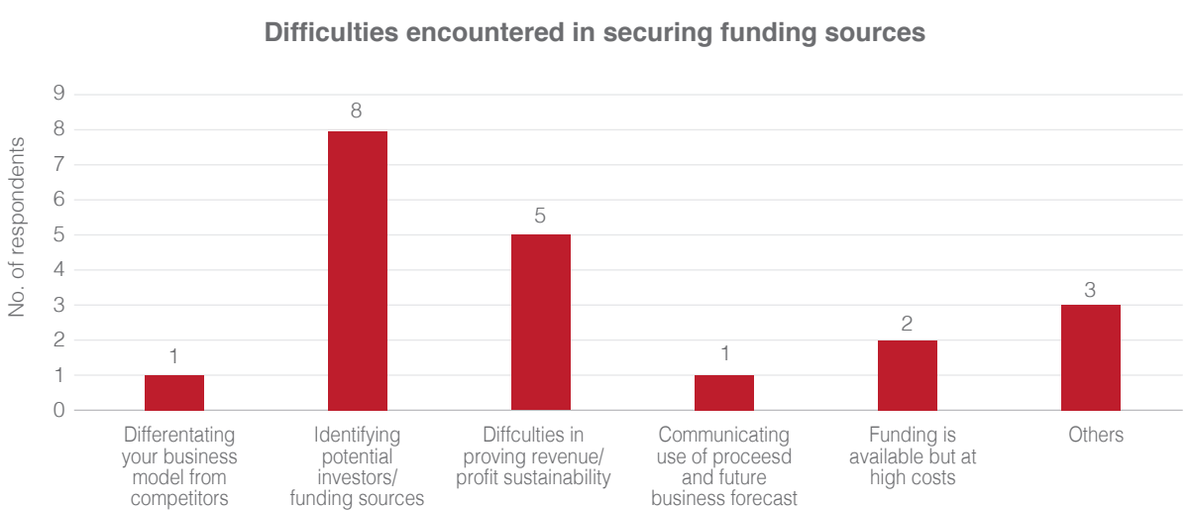
Total respondents: 16

Difficulties encountered in securing funding sources

Among 16 respondents, 15 of them indicated that they have encountered some difficulties in financing in a form or another. Figure 11 shows that half of the respondents found difficulties in identifying potential investors / funding sources, and almost one-third also had difficulties in proving revenue / profit sustainability in the process of securing funding.

Some respondents and interviewees also reflected that Hong Kong investors tend to invest into the start-ups in later rounds to avoid the potentially higher risk perceived at the earlier stages. Even if these investors are willing to invest at the early stage, only a low valuation is offered as a way to balance risks and potential investment returns. This is the difficulty more specific to start-ups at the 3F (Friends, Family and Fools) stage, as they seek initial investments from investors.

Figure 11. Difficulties encountered in securing funding sources (Note: More than one option allowed)



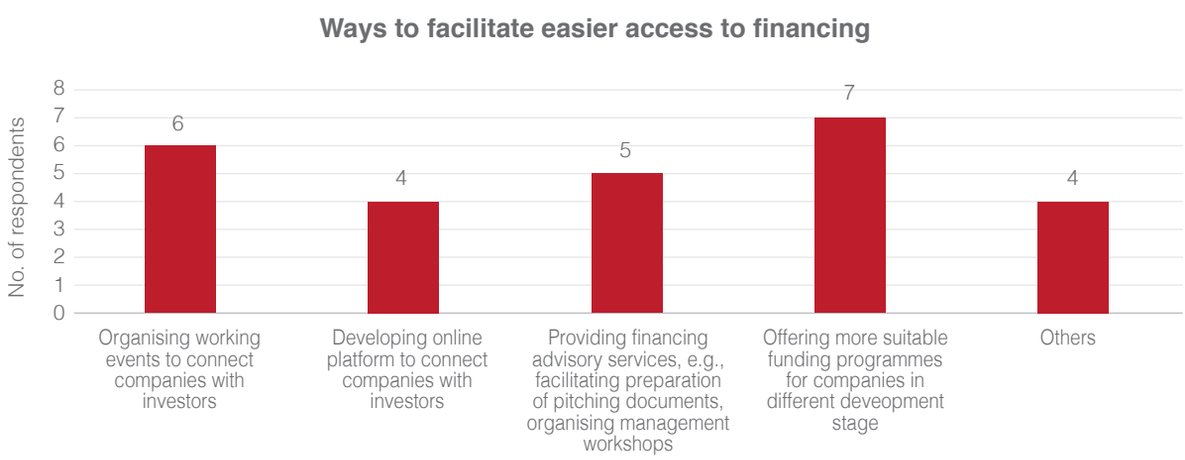
Total respondents: 16

Ways to facilitate easier access to financing

Funding gaps can be bridged through better connection among the public sector, investors, and start-ups. Figure 12 reveals that nearly half of the respondents consider offering more suitable funding programmes for companies useful, and about one-third are of the opinion that organising networking events to connect companies with investors was considerable. Other options, such as providing financing advisory services and developing an online platform to connect companies with investors are other ways preferred by a few respondents.

From our discussion with these innovator-entrepreneurs, the idea of setting up a biotech and healthcare specific fund of funds (FOF) that targets seed rounds / angel rounds of investment arose. With this FOF in place, start-ups in relevant industries may get a valuation more reflective of their underlying value and, at the same time, allow these specialist-investors to tap on these budding companies at an early stage.

Figure 12. Ways to facilitate easier access to financing (Note: More than option allowed)



Total respondents: 16

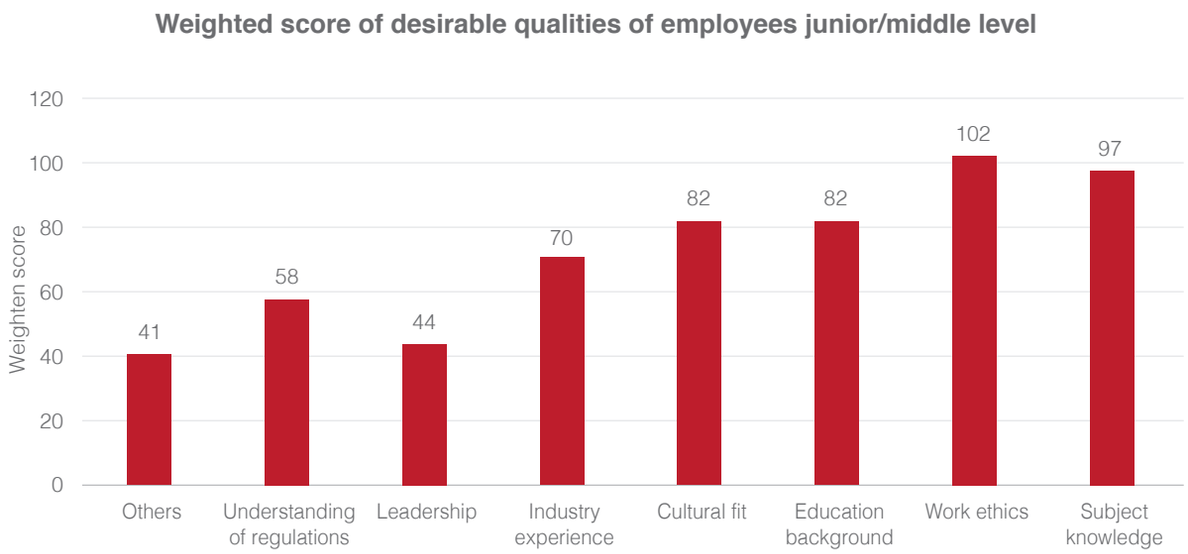
Talent

Human resources is one of the most important assets of a company, particularly for these innovation-driven start-ups. Since the companies involved in our study are all start-ups and mostly SMEs, the acute shortage of right talents was frequently cited as an issue to their businesses.

Quality for junior/middle level staff

Figure 13 shows that the most wanted qualities for staff at junior/middle level were subject knowledge and work ethics. Almost half of the respondents considered these two qualities one of the top three most important qualities, followed by education background, cultural fit and industry experience. At the other end of the spectrum, leadership and understanding of regulations were qualities of which the employers would have relatively less emphasis on. Furthermore, through our discussions with industry practitioners, dynamic personality, strong business acumen, loyalty, and the ability to learn were some of the desirable qualities among employees at junior/middle level.

Figure 13. Weighted score of desirable qualities of employees at junior/middle level



Quality for management level staff

The expectation on management is, expectedly, different from that on employees at junior/middle level. Work ethics, leadership and industry experience were considered the top three most important qualities by the majority of respondents. Subject knowledge, understanding of regulations and cultural fit were the secondary qualities wanted from the employers.

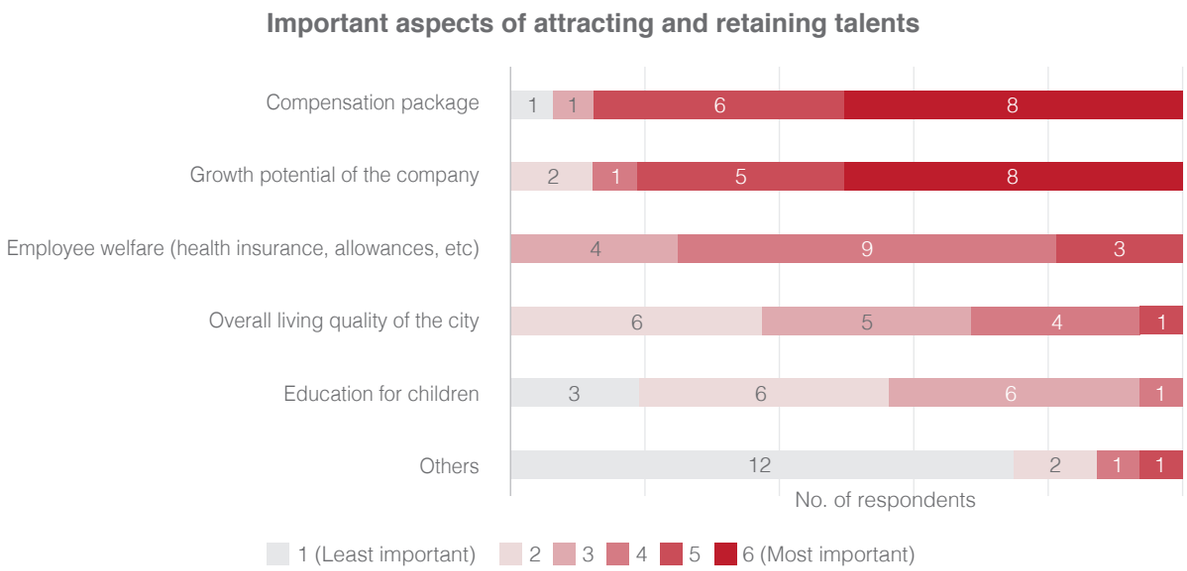
Further discussions with innovator-entrepreneurs revealed that loyalty, execution, project and people management skills are some other qualities that healthcare and biotech employers would look for in their management staff.

Important aspects of attracting and retaining talents

As shown in Figure 14, the two important aspects to attract and retain talents were compensation package and growth potential of the company. 14 and 13 of the 16 respondents ranked compensation package and growth potential of the company as the one of the two most important aspects in attracting and retaining talents; three-fourths of the respondents considered employee welfare, including health insurance and allowances, as one of the top three considerations. While they are sometimes reported in the media as important considerations, education for children and the overall living quality in the city were relatively less important in talents' consideration to come and stay in Hong Kong.

Other aspects mentioned by interviewees include employees' eligibility for equity and profit sharing, learning capability and living expenses.

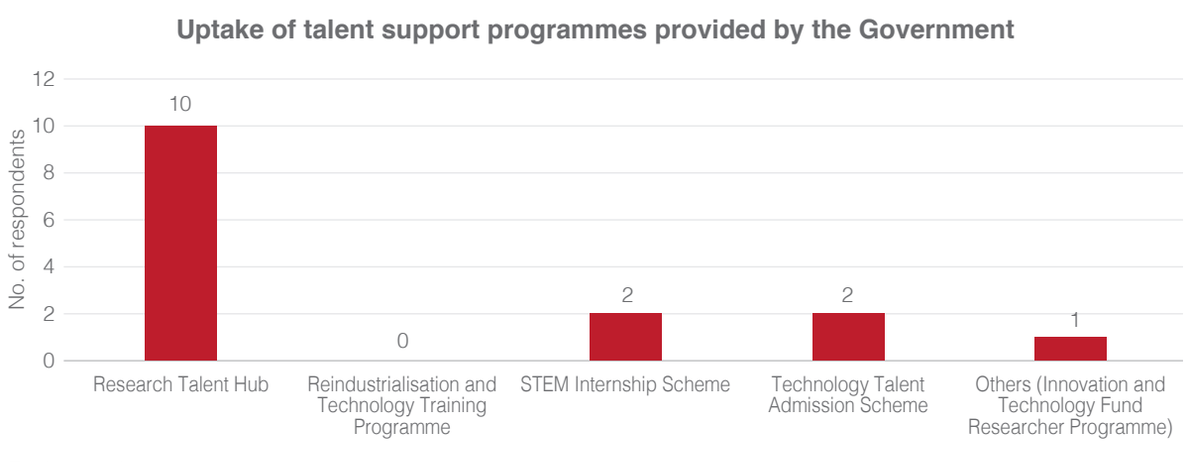
Figure 14. Important aspects of attracting and retaining talents



Talent support programmes provided by the Government

Figure 15 illustrates that almost two thirds of the respondents received talent support from Research Talent Hub, while only a handful of respondents also participated in STEM Internship Scheme, Technology Talent Admission Scheme, and Innovation and Technology Fund Researcher Programme. No respondents had applied for Reindustrialisation and Technology Training Programme, an Innovation and Technology Fund initiated scheme subsidising local companies to train their staff in advanced technologies. Such findings, which may be skewed because of the limited sample size, show that further promotional efforts about the relevant talent schemes are needed.

Figure 15. Uptake of talent support programmes provided by the Government (Note: More than one option allowed)



Commercialisation

The commercialisation process is arguably the most important step in an innovator's entrepreneurial journey, for that it is the defining moment when the innovation can be put to commercial uses. Given Hong Kong's proximity to the Mainland Chinese market and its connectiveness to the other major markets, innovator-entrepreneurs set foot in Hong Kong tend to utilise the city as a platform to tap business potentials in these markets.

Commercialising in Hong Kong

While Hong Kong is one of the markets for businesses based here, less than two fifths of the respondents targeted Hong Kong as the major market (see Figure 16). In fact, as shown in Figure 17, Mainland China is a key target market of these healthcare and biotech firms, followed by Southeast Asia.

Figure 16. Is Hong Kong your major market?

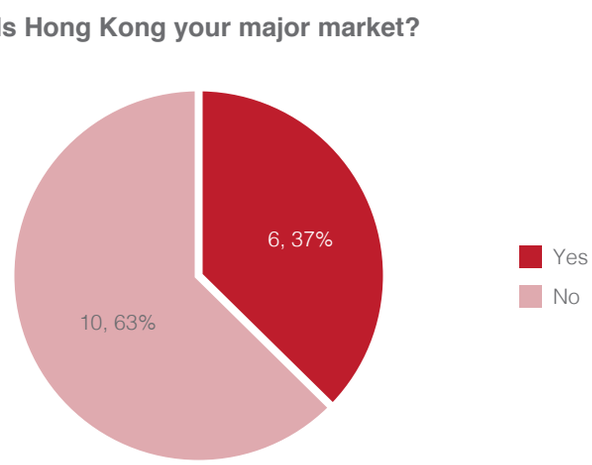
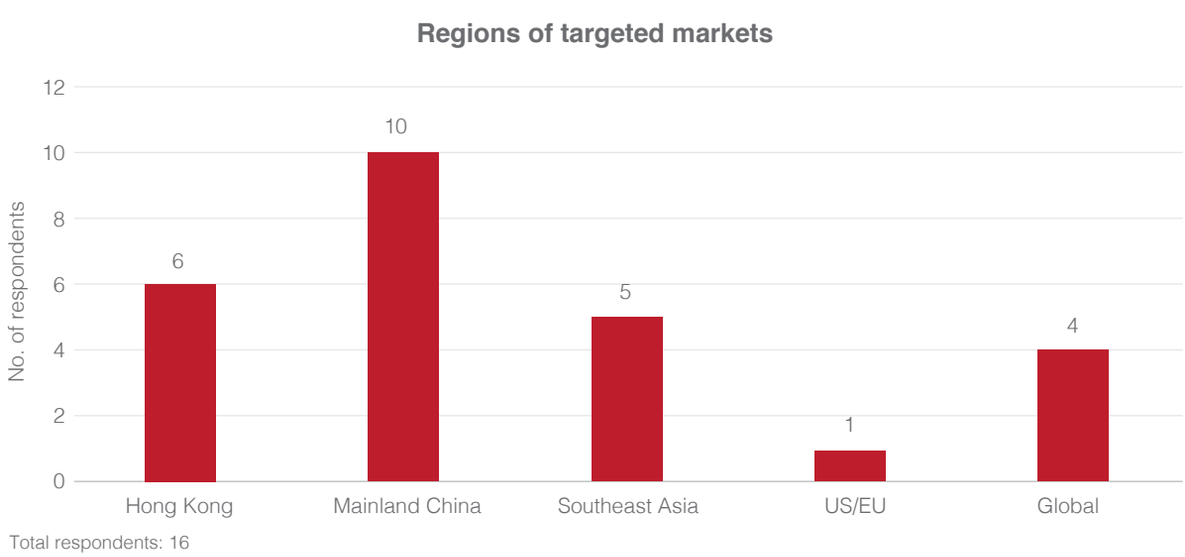
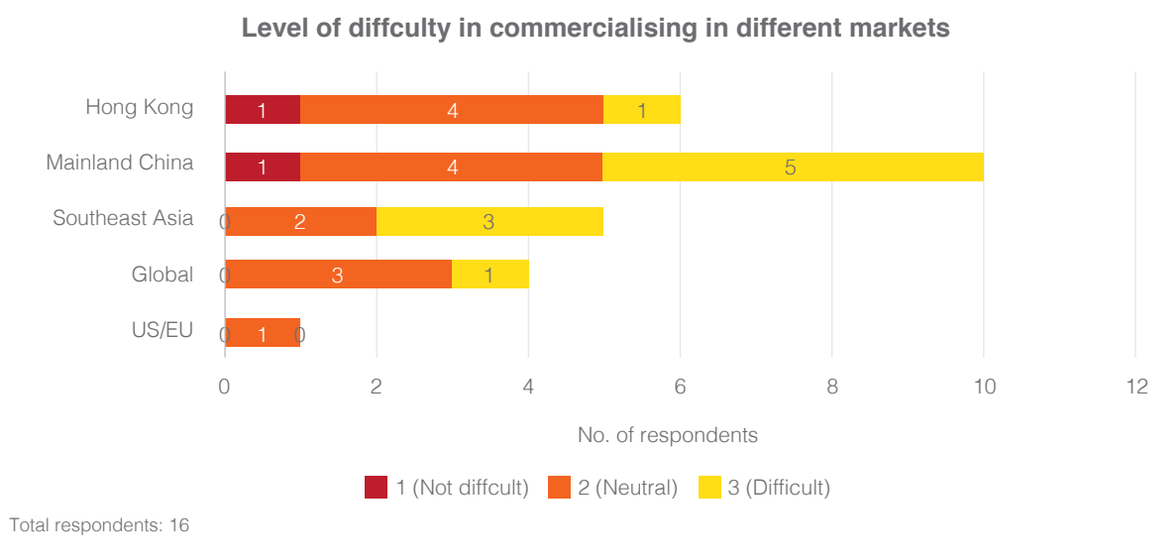


Figure 17. Regions of targeted markets (More than one option allowed)



While these firms may have or plan to commercialise in Mainland China, Figure 18 reveals that on a scale of 1 to 3, five respondents found it difficult to commercialise in Mainland China by giving it a 3, while four others believed that it was neutral. As for the Southeast Asia market, three respondents were of the view that commercialising in the market is difficult, and another two thought it was neutral. In addition, the other respondents revealed that the difficulty in commercialising in the US/EU and global markets were relatively less.

Figure 18. Level of difficulty in commercialising in different markets



Total respondents: 16

A number of respondents and interviewees described the differences in regulatory requirements across markets as a hurdle in the commercialisation process. Meanwhile, noting that one would need to invest time and other resources to build credibility in various markets, gaining access to relevant target customers in these markets is also said to be challenging.

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About the FSDC

The FSDC was established in 2013 by the Hong Kong Special Administrative Region Government as a high-level, cross-sectoral advisory body to engage the industry in formulating proposals to promote the further development of the financial services industry of Hong Kong and to map out the strategic direction for the development.

The FSDC has been incorporated as a company limited by guarantee with effect from September 2018 to allow it to better discharge its functions through research, market promotion and human capital development with more flexibility.

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