

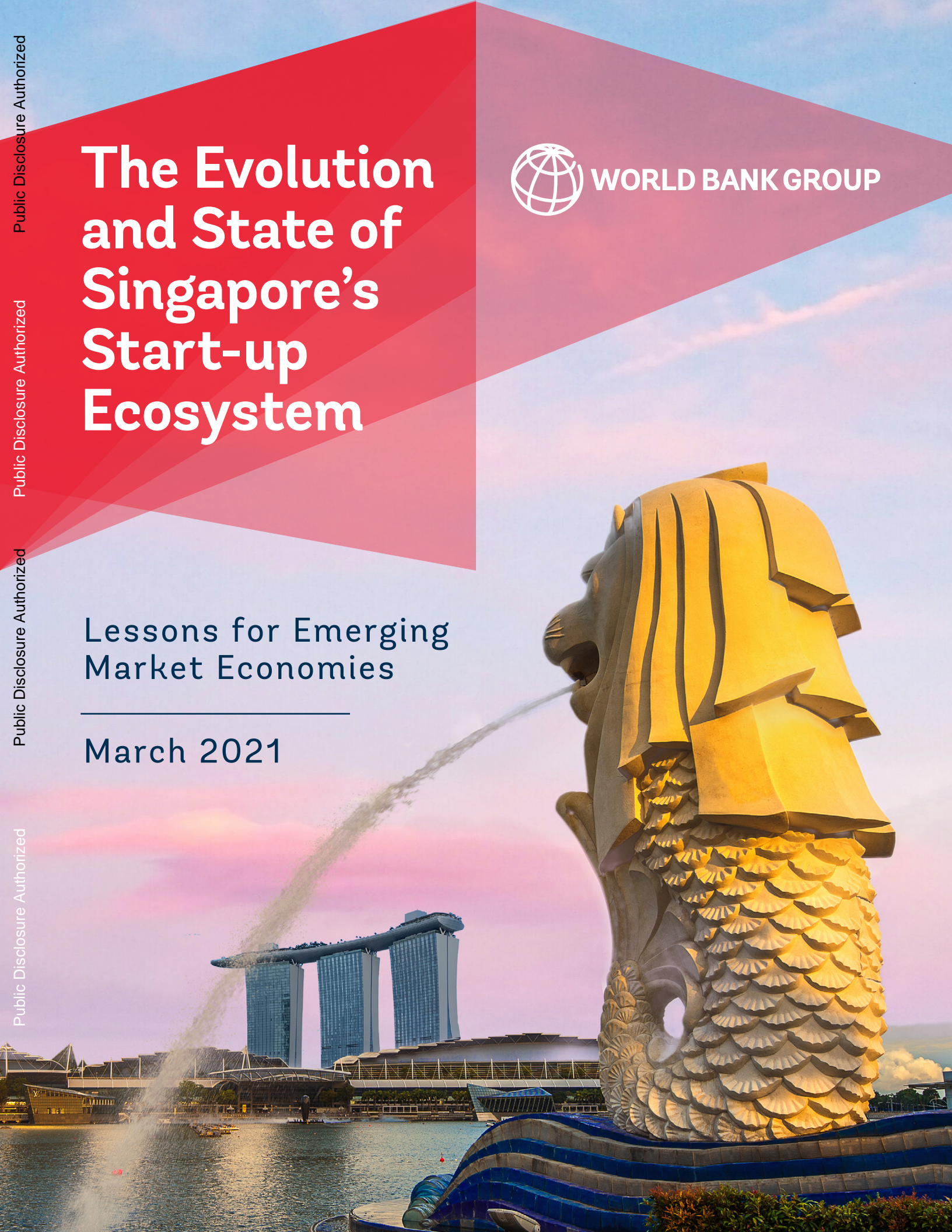
The Evolution and State of Singapore's Start-up Ecosystem



WORLD BANK GROUP

Lessons for Emerging
Market Economies

March 2021



An abstract graphic consisting of several overlapping red and pink triangles and polygons, creating a dynamic, geometric background for the title.

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This Report was prepared by a World Bank Group team led by Toni Elias, Jamil Wyne, and Sarah Lenoble. The team benefitted from the insights of Singapore's country office technical staff and from the support provided by Daniel Levine, James Tay, Philippe De Meneval and Jiayun Luo. Overall guidance was provided by Jyoti Shukla and Paramita Dasgupta. Furthermore, the team is grateful to the peer reviewers of this report including Justin Hill, Andrew Mason, Victor Mulas, Francesca Nicola and Jonathan Timmis for their valuable comments.

The team would also like to express their sincere gratitude to Enterprise Singapore, the Economic Development Board of Singapore and the National Research Foundation for their support, cooperation and overall guidance during the report's research and drafting.

Additionally, we are grateful to all individuals and organizations who provided their insights and through interviews, and a full list of those who participated in interviews can be found in the Appendix.

Lastly, the team thanks Nik Nikam for design and layout assistance.



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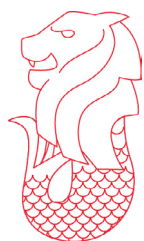
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Executive Summary

In the past several decades Singapore has made an increasingly strategic push to growing its start-up ecosystem. Numerous policies and committees, and agencies along with substantial government funding have been deployed to support the country's start-ups. Consequently, over the past several decades its community of investors, university programs for R&D and entrepreneurs, accelerators, unicorns, and start-ups has grown.¹ Today, its ecosystem, with circa 184 accelerators, incubators, and other intermediaries (such as angel networks), over 3,600 tech start-ups, has made Singapore a clear leader in terms of VC and PE investments in the ASEAN region, and it is ranked as one of the most developed ecosystems by global standards.

Long before the country had any unicorns, VC funds or accelerators, Singapore was laying the foundation for a competitive economy. For example, it specialized in select industries, build a business-friendly regulatory environment, and prioritized human capital development.^{2,3} After the country suffered its first major recession in 1985, the government commissioned an economy-wide review, which led to a national decision to ascend the global value chain, moving from being competitive in lower cost manufacturing services to being a player in global technology industries.⁴ These measures represent an evolution from a national focus on building a business-friendly environment that is globally integrated, the core policy agenda for the first half of the country's history, to one concentrating heavily on improving conditions for global competition through supporting innovation and start-ups directly.

This case study aims to document the state and evolution of Singapore's start-up ecosystem. It also identifies key characteristics that both distinguish the Singapore start-up ecosystem, as well as provide policymakers from other countries with a glimpse of specific measures they can pursue – identifying both its successes as well as lingering challenges - and to distill the lessons learned to inform policymaking in emerging markets that seek to emulate Singapore's success to date.

¹ OECD Reviews of Innovation Policy, Innovation in Southeast Asia, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

² Woo Jun Jie, Woo Jun. Singapore's Transformation into a Global Financial Hub. Lee Kuan Yew School of Public Policy, National University of Singapore, 2017. https://lkyspp.nus.edu.sg/docs/default-source/case-studies/entry-1516-singapores_transformation_into_a_global_financial_hub.pdf?sfvrsn=a8c9960b_2

³ Yusuf, Shahid. Building Human Capital, Lessons From Country Experiences, How Singapore Does It. Human Capital Project, 2020. <http://documents1.worldbank.org/curated/en/960921595409441570/pdf/Building-Human-Capital-Lessons-from-Country-Experiences-Singapore.pdf>

⁴ Poh, Lim Chuan. From Research to Innovation to Enterprise: The Case of Singapore. Global Innovation Index 2016. Winning with Global Innovation, World Intellectual Property Index, 2016. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf

Characteristics of the ecosystem

Government leadership from day one.

Besides decades of policy building efforts towards enhancing the local business environment, the government is recognized for its responsiveness and agility in reacting to changes in the market, including the actions taken during the global COVID-19 pandemic.

Strong university network that has a catalytic role in the ecosystem.

Singapore is home to several world-class universities with specializations in engineering, technology and other sciences. The government is involving several universities as well as A*STAR in its efforts to build strong linkages between researchers, students, start-ups and industry. In addition, innovation and start-up challenges and incubation programs also encourage aspiring entrepreneurs to start companies in key campuses. Many universities also have programs that establish and strengthen international linkages.

Global linkages and positioning.

The government has emphasized building global linkages to make the country a mainstay in international business, which has helped its ecosystem and supports start-ups' ambitions to scale. Despite its limited market and population size, Singapore has become a regional

base for numerous global tech giants including Google, Facebook, Microsoft, LinkedIn, and Stripe, which all have offices in the country. In fact, according to data from Singapore's Economic Development Board, 59% of technology multinational corporations have regional headquarters based in Singapore, adding to the country's profile as a regional business hub.⁵

Industry specialization.

Keeping in line with the government's historic industrialization approach, the government is supporting specific sectors, including a growing emphasis on deep-tech sectors. In this regard, the public sector is taking a lead role in beginning the specialization process, which could ultimately incentivize the private sector to follow suit. Additionally, multiple institutions and programs have been established with sector-specific focuses: CATALYST, PIER71, ICE71, Seeds Capital, Diagnostics Development (DxD) Hub, The National Additive Manufacturing Innovation Cluster (NAMIC) and GROW are several examples.

Substantial and growing investment activity.

Singapore is a regional leader in terms of venture capital activity.⁶ Initially, multi-national corporations were the main providers of risk capital to start-ups in Singapore, but the VC community began to grow in

⁵ Economic Development Board (EDB), Government of Singapore, 2020, accessed March 12, 2021. <https://www.edb.gov.sg/en/our-industries/industries-and-key-activities/headquarters.html>

⁶ Preqin "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

the 1990s.⁷ The government played an active role in this capacity as well through serving as a co-investor through public sector entities such as Temasek Holdings and TIF Ventures, in addition to directly creating VC funds.⁸

Challenges to ecosystem growth

Government involvement could be fostering too much dependency on the public sector.

69% of start-ups were participating in government schemes in 2017, an increase from the 19% in 2010.⁹ Too much government funding may be propping up foundering companies that should in fact cease operations, while also not effectively incentivizing private investors to engage with start-ups, and in general helping to build a market-driven ecosystem. However, there are signs that the government is recognizing the challenge related to its strong role in growing the start-up ecosystem and it is taking important measures to reduce dependency risks.

Fully utilizing and commercializing R&D outputs.

Gross expenditure on R&D rose from \$0.8 billion in 1991 to \$9.1 billion in 2017, a 10% CAGR, yet there is ongoing discussion as to the level of impact that R&D activities in the country have had on increasing start-up activity.¹⁰ Research from the NUS suggests that investors may still be reluctant to invest in deep-tech, opting for less innovative companies.¹¹

Start-ups face challenges to acquiring and retaining talent.

The university system in Singapore is strong, yet given the country's small size there is inevitably a limited talent pool. While Singaporean start-ups could find talent from abroad, restrictions on the number of international workers, and quotas surrounding local hires, may further hinder start-ups' efforts to find the necessary skills, and could lead both employees as well as entrepreneurs to settle in neighboring markets.¹²

⁷ OECD Reviews of Innovation Policy, "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

⁸ Ibid.

⁹ Wong Poh Kam, Ho Yuen Ping, Ng Su Juan Crystal. "Growth Dynamics of High-Tech Start-ups in Singapore A Longitudinal Study". Final Report 2017. Kam et. Al, National University of Singapore, Entrepreneurship Centre, 2017, accessed March 12, 2021. https://www.academia.edu/40044173/Growth_Dynamics_of_High_Tech_Start_ups_in_Singapore_A_Longitudinal_Study_Final_Report_2017

¹⁰ Economic Survey of Singapore. "Returns to research and development (R&D) among firms in Singapore", Ministry of Trade and Industry, Government of Singapore, Third Quarter 2019. https://www.mti.gov.sg/-/media/MTI/Resources/Economic-Survey-of-Singapore/2019/Economic-Survey-of-Singapore-Third-Quarter-2019/FA_3Q19.pdf

¹¹ Wong Poh Kam, Ho Yuen Ping, Ng Su Juan Crystal. "Growth Dynamics of High-Tech Start-ups in Singapore A Longitudinal Study". Final Report 2017. Kam, et Al, National University of Singapore, Entrepreneurship Centre, 2017, accessed March 12, 2021. https://www.academia.edu/40044173/Growth_Dynamics_of_High_Tech_Start_ups_in_Singapore_A_Longitudinal_Study_Final_Report_2017

¹² Randolph Sean. "Singapore and the Bay Area, Leveraging Emerging Opportunities in Southeast Asia". Bay Area Council, Economic Institute, January, 2020. <http://www.bayareaeconomy.org/files/pdf/SingaporeAndTheBayAreaJanuary2020.pdf>

Increased regional competition.

As neighboring countries – i.e. Vietnam, Indonesia, etc. – have created their own start-up ecosystems, regional competition has in turn increased. A start-up attempting to scale from Singapore into a neighboring market will now find more difficulty than it may have faced in years past. Taking note of this, Singapore's 2020 budget features specific allocations for enhancing regional and global connectivity for its ecosystem.¹³

Funding gaps remain.

Singapore ranks below the global average for early-stage funding.¹⁴ According to the 2019 global Start-up Genome report, the average early-stage funding size for start-ups stood at \$284, 000, versus an average of \$202,000 in Singapore. Additionally, funding for later-stage companies may also be harder to come by in the country. The country's small market size also mean that many investors need to operate with a regional scope to ensure a sufficient pipeline.

Limited access to data and validation of impact.

There is minimal data available on the ecosystem, as well as the degree to which efforts to support start-ups have achieved developmental

impact.¹⁵ The government has spent large sums to create new funds, programs, real estate, and other initiatives, yet the specific results and how these efforts have led to tangible development outcomes is still unclear. Without knowledge on the specific outcomes of individual efforts and impact that the funding has achieved, pinpointing the precise areas for improvement is difficult.

Key takeaways for policymakers

The government has led the creation of the ecosystem as well as in identifying gaps where others could enter.

Singapore's government has actively cultivated the ecosystem both in country and abroad. It has also steadily identified gaps in the ecosystem and taken bold steps to address them. For example, the current experience in supporting specific deep-tech verticals demonstrates this role as the government has prioritized deep-tech in its national strategy, helping universities, funds, accelerators and start-ups to enter deep-tech verticals.

Singapore's academic sector plays a lead role, both in terms of education and direct support to the ecosystem.

While Singapore's academic sector is first and foremost tasked with

¹³ KPMG. "A Time Move to Forward", Singapore Budget 2020, accessed March 12, 2021. https://assets.kpmg/content/dam/kpmg/sg/pdf/2020/02/KPMG_Singapore_Budget_2020_Report.pdf.

¹⁴ Start-up Genome. "Global Start-up Ecosystem Report, 2019", May, 2019. <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>.

¹⁵ World Bank team interview in Singapore, 2020.

educating its youth, examples such as NUS demonstrate how the country's educational institutions provide far more to the start-up ecosystem than talent. To date, NUS has supported the ecosystem both in and outside of the country, championing incubation and community initiatives such as Block71, supporting R&D, and built linkages abroad to other ecosystems via NUS Overseas College (NOC) programme.

Singapore's story from day-one was one of globalization, and its ecosystem, has adopted this mentality as well.

The country's start-up ecosystem is constantly creating footholds in other markets and also helping other countries' ecosystems to establish a presence in Singapore. Global accelerators, universities, and corporate VC's from MNC's, to name a few, all have a presence in Singapore, just as ESG's partnerships with accelerators with in-market networks abroad - under the GIA programme, NUS Block71, and other entities have pronounced presence abroad. The country has also created talent exchange programs to facilitate the movement of Singapore students as well as foreign students out and into the country, respectively.

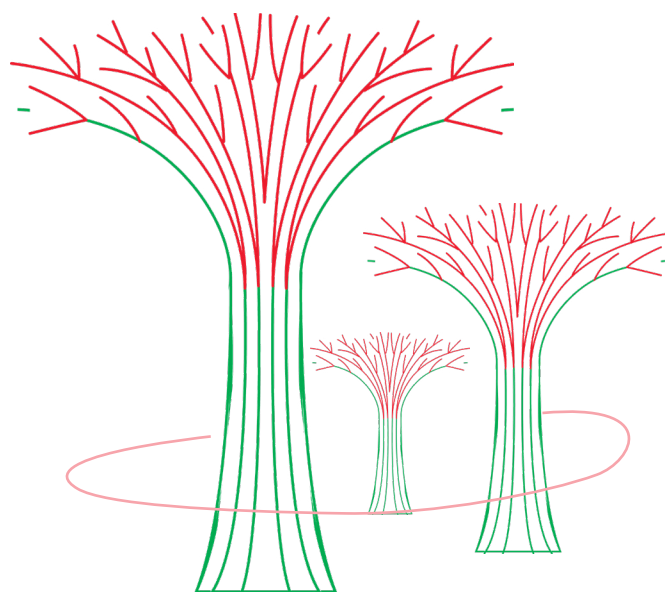
The country's ecosystem is driven with a forward-looking mindset to maintain pace with global start-up tech and entrepreneurship trends.

From attracting international leaders in the VC and accelerator space, to serving as the home for big name

tech corporations, and establishing a foothold in the global deep-tech sector, Important to note as well is that while new funds and other organizations may be the surface-level symbols of this connectedness, they are also underpinned by a decades-long commitment to R&D and a healthy academic sector.

Singapore constantly evaluates its strategies, adjusts priorities as needed and operates with agility to address evolving challenges.

Talent, funding gaps, and increased regional competition, to name a few, are all areas requiring new solutions. While there are common themes that have influenced Singapore's development strategy throughout its history – global linkages, a business-friendly environment, etc. – its approach to supporting its start-up ecosystem has evolved over time. To this day the government still initiates new strategies and remains quick to respond to challenges at home as well as new opportunities from abroad.



Abbreviations

A*STAR	Agency for Science, Technology and Research
ACE	Action Community for Entrepreneurship
AUM	Asset Under Management
AI	Artificial Intelligence
ASEAN	Association of Southeast Asian Nations
Bansea	Business Angel Network of Southeast Asia
CAGR	Compound annual growth rate
COVID-19	Coronavirus Disease 2019
CREATE	Campus for Research Excellence and Technological Enterprise
DISG	Digital Industry Singapore
EDB	Economic Development Board
EDBI	Corporate investment arm of Economic Development Board
ESG	Enterprise Singapore
EU	European Union
GDP	Gross domestic product
GIA	Global Innovation Alliance
ICE71	Innovation Cybersecurity Ecosystem at Block71
IDA	Infocomm Development Authority
IMD	International Institute for Management Development
IMDA	Infocomm Media Development Authority
IoT	Internet of Things
JTC	JTC Corporation
M&A	Mergers and acquisitions
MAS	Monetary Authority of Singapore
MDA	Media Development Authority
MNC	Multinational Corporation



NAMIC	The National Additive Manufacturing Innovation Cluster
NFIE	National Framework of innovation and Enterprise
NOC	NUS Overseas Colleges
NRF	National Research Foundation
NSTB	National Science and Technology Board
NTU	Nanyang Technological University
NUS	National University of Singapore
OECD	Organisation for Economic Co-operation and Development
PE	Private equity
PIER71	Port Innovation Ecosystem Reimagined at Block71
PPP	Public Private Partnership
PwC	PricewaterhouseCoopers
R&D	Research and development
RIE	Research Innovation & Enterprise plan
SGX	Singapore Exchange
SISIR	Singapore Institute of Standards and Industrial Research
SME	Small and medium-sized enterprises
SMU	Singapore Management University
SPRING	Standards, Productivity and Innovation Board
SSFS	Special Situation Fund for Start-ups
SSGA	Start-up SG Accelerator
SUSS	Singapore University of Social Sciences
SUTD	Singapore University of Technology and Design
T21	Technopreneurship21
TIF	Technopreneurship investment Fund
US	United States
USD	United States dollar
VC	Venture capital
VCC	Variable Capital Company



Introduction

Despite its size and relative youth, Singapore has become an international business hub that is recognized for its population of major multinational corporations, its workforce, and an efficient public sector that provides a high quality of life for its citizens. Along its journey to build a thriving business environment, Singapore has cultivated a start-up ecosystem, which is home to thousands of young tech companies, a growing population of VC's and several unicorns that have either been founded in-country or opened offices within it. In turn, other countries have questioned how to replicate the country's success in developing a start-up ecosystem. A combination of government support, education, and global linkages, expertise in banking and asset management, among other factors, have all aided in the ecosystem's success to date. There is indeed much to be learned from Singapore's story of building an entrepreneurship ecosystem and emerging markets globally seek to emulate certain aspects of it. However, the country is still facing distinct challenges in evolving its start-up community that it must address if it is to build a truly globally competitive environment for start-ups as well as groundbreaking innovation. Moreover, when assessing how to replicate the Singapore experience, countries must bear in mind that certain facets of the country's ecosystem are unique or require significant time to cultivate. While it has certainly achieved much over a short while, not all its approaches can be replicated.

The rapid onset of COVID-19 globally and the increasing economic uncertainty that it creates has also mobilized different policy responses to help businesses to keep their lights on.¹⁶ At the time of writing, there have been just over 60,000 cases reported and 30 deaths confirmed in Singapore. While the population is small and the healthcare system strong, the threat of disruption to the local market, caused by slowdowns in foreign markets and supply chains is a significant risk. While COVID 19 has, and will continue to spur turmoil globally, it will also likely accelerate the diffusion and adoption of technologies. Start-up ecosystems play a critical role in this process, enabling the testing and scaling of new technologies that can help Singapore expedite and deepen its digitization process. Learning from the successes of select start-up ecosystems can help inform other countries' strategies in developing high growth tech start-ups of their own.

This case study aims to document the evolution of Singapore's start-up ecosystem – identifying both its successes as well as lingering challenges – and to distill the lessons learned to inform policymaking in emerging markets that seek to emulate Singapore's success to date.

¹⁶ Caroline Freund, Alfonso Garcia Mora. "Keeping the lights on: Supporting firms and preserving jobs from crisis through recovery". Private Sector Development Blog, World Bank, April 30, 2020. <https://blogs.worldbank.org/psd/keeping-lights-supporting-firms-and-preserving-jobs-crisis-through-recovery>

Box 1

Glossary of select terms used in the report

Accelerator: Short term programs that provide business advisory, coaching and mentorship and optionally financial support to growth-stage start-ups.

Incubator: Typically, a combination of a shared office space with business support services (including training, coaching and mentorship) serving early-stage start-ups.

Start-up: According to Enterprise Singapore, the start-up definition in 2020 refers to tech entities that (Enterprise Singapore is currently reviewing Singapore's tech start-up definition):

- a. Have innovative technologies with the potential to disrupt existing industries;
- b. Are registered in the past 5 years;
- c. Have more than 50% individual shareholding at the reference year; and
- d. Employ at least 1 person. In light of the evolving tech landscape.

Deep-tech: According to Enterprise Singapore deep-tech is “defined as cutting-edge technologies founded on scientific discoveries or engineering innovations, deep tech encompasses transformational technologies such as artificial intelligence (AI), robotics, blockchain and MedTech” Source: <https://www.enterprisesg.gov.sg/blog/start-ups/5-tips-for-deep-tech-start-ups>

Unicorn: privately held start-up companies valued at more than \$1 billion. Lee, A. 2013. “Welcome to The Unicorn Club: Learning from Billion-Dollar Start-ups.” TechCrunch. <https://techcrunch.com/2013/11/02/welcome-to-the-unicorn-club/>

About this report:

This report was created via a mixture of primary and secondary research, including a week-long visit to Singapore during February 2020. Interviews were organized with a select group of ecosystem stakeholders, including representatives from the government, research institutions, academia and private sector. The report also incorporate feedback received from the EDB, ESG, NRF and World Bank Group during the review stage. This study is part of a series of papers that the World Bank is producing on Innovation and Technology topics in developing East Asia. Collectively, these reports will provide insights on policy approaches governments in the region are taking to propel future growth and development of their economies.



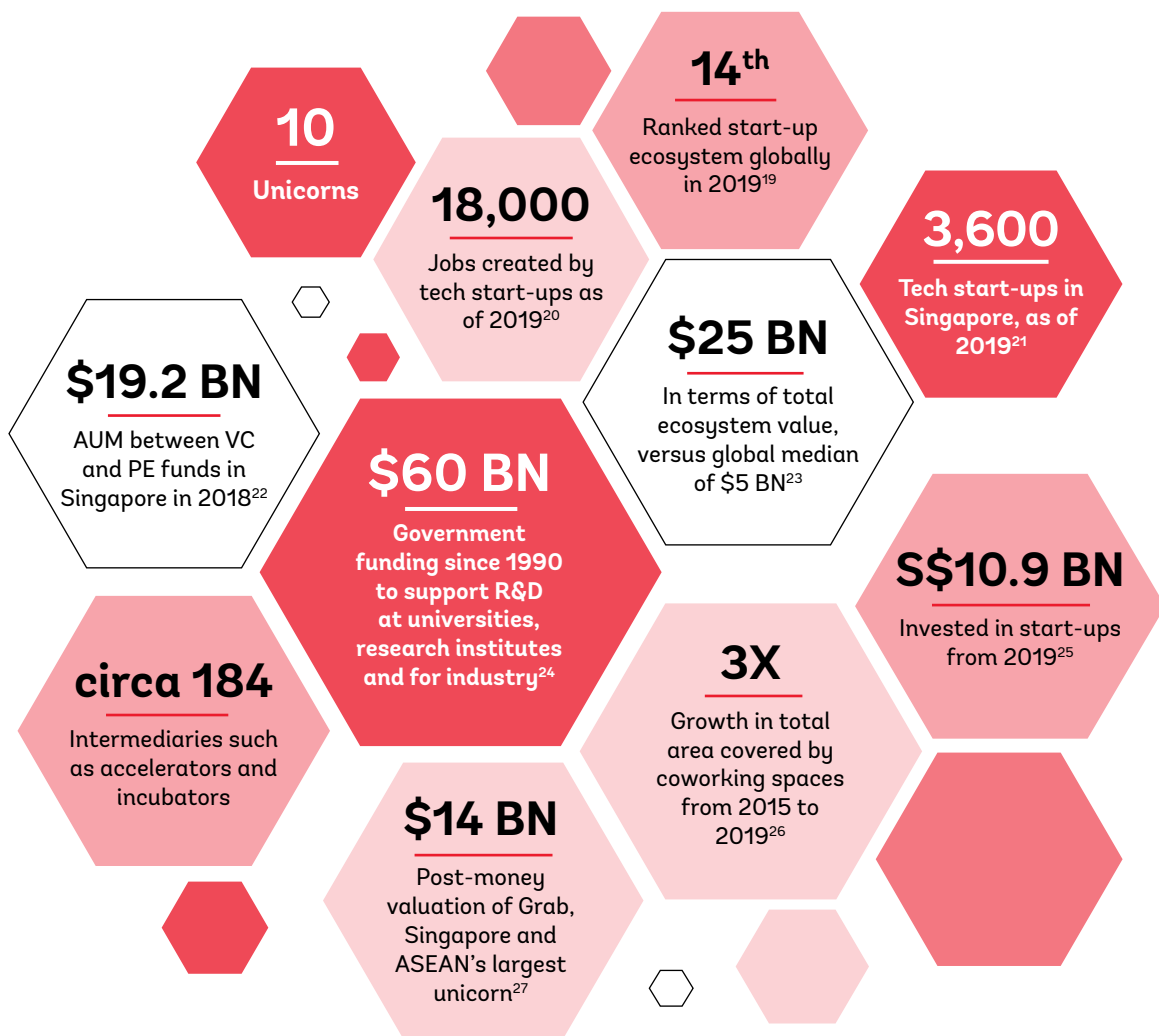
State of Singapore's start-up ecosystem

In the past several decades Singapore has made an increasingly strategic push to growing its start-up ecosystem. Led by the government, the country leveraged its unique mixture of industrialization, global integration, and talent workforce, among other assets that it has accumulated over its short history, to begin to build its start-ups community, which has been critical to the country's evolution from being simply a business hub and adopter of technologies, to a producer of innovative companies.¹⁷ Today, its start-up ecosystem is globally recognized, being ranked as the 14th most developed ecosystem globally by the 2019 Start-up Genome report.¹⁸

¹⁷ OECD Reviews of Innovation Policy. "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

¹⁸ Start-up Genome. "Global Start-up Ecosystem Report, 2019", May, 2019. <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>

Figure 1 Singapore's start-up ecosystem by the numbers



¹⁹ Start-up Genome. "Global Start-up Ecosystem Report, 2019", May 2019. . <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>

²⁰ Singapore Department of Statistics, 2019. <https://www.singstat.gov.sg/>

²¹ Singapore Department of Statistics, 2019. <https://www.singstat.gov.sg/>

²² Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

²³ Start-up Genome. "Global Start-up Ecosystem Report, 2019", May, 2019. <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>

²⁴ Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

²⁵ Enterprise Singapore. <https://www.enterprisesg.gov.sg/>

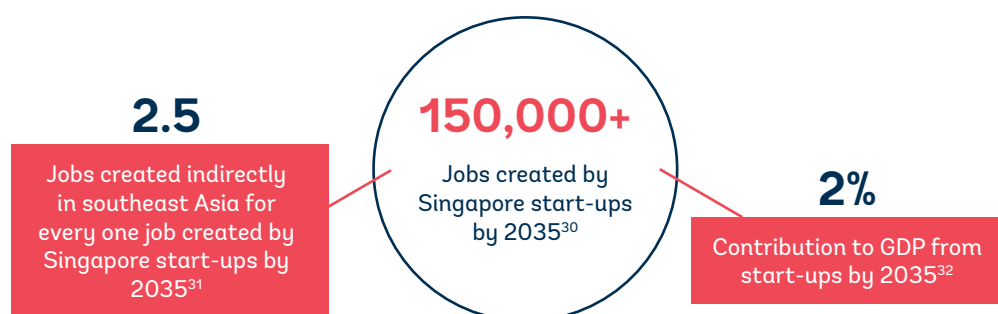
²⁶ Tay, Vivienne. "Coworking spaces in Singapore tripled since 2015 to 3.7m sq ft: Colliers". The Business Times, September 17, 2019. <https://www.businesstimes.com.sg/real-estate/coworking-spaces-in-singapore-tripled-since-2015-to-37m-sq-ft-colliers>

²⁷ Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

The start-up ecosystem is growing in terms of size, dynamism and contribution

In 2019, according to the Singapore Department of Statistics the country was home to 3,600 tech start-ups which had created 18,000 jobs.²⁸ Even though the definition for start-ups differed, according to a 2016 study from the National University of Singapore, there was a significant growth of start-ups between 2004 and 2015 and each tech start-up in the country created approximately 0.9 jobs annually.²⁹

Figure 2 Future projections by PWC



Regarding future projections, in 2015, PricewaterhouseCoopers (PwC) projected that tech-enabled start-ups would contribute approximately 2% to Singapore's GDP by 2035. At the time, that figure was roughly equal to the tourism sector's contribution to GDP.³³ Similarly, by the same year PwC predicted that tech-enabled start-ups would employ an estimated 168,000 people, accounting for just under 5% of the country's total workforce. At the time of these calculations PwC also forecasted that job creation from Singapore's start-ups would have a regional ripple effect, with every job created by a start-up potentially creating 2.5 additional jobs in southeast Asia.³⁴

²⁸ Singapore Department of Statistics, 2019. <https://www.singstat.gov.sg/>

²⁹ Wong Poh Kam, Ho Yuen Ping, Ng Su Juan Crystal. "Growth Dynamics of High-Tech Start-ups in Singapore A Longitudinal Study". Final Report 2017. Kam, et Al, National University of Singapore, Entrepreneurship Centre, 2017. Accessed March 12, 2021. https://www.academia.edu/40044173/Growth_Dynamics_of_High_Tech_Start_ups_in_Singapore_A_Longitudinal_Study_Final_Report_2017

³⁰ PWC. "Singapore's tech-enabled start-up ecosystem", PWC Strategy April, 2015. <https://www.pwc.com/sg/en/microsite/media/assets/startup-google.pdf>

³¹ Ibid.

³² Ibid.

³³ PWC. "Singapore's tech-enabled start-up ecosystem", PWC Strategy,, April, 2015. <https://www.pwc.com/sg/en/microsite/media/assets/startup-google.pdf>

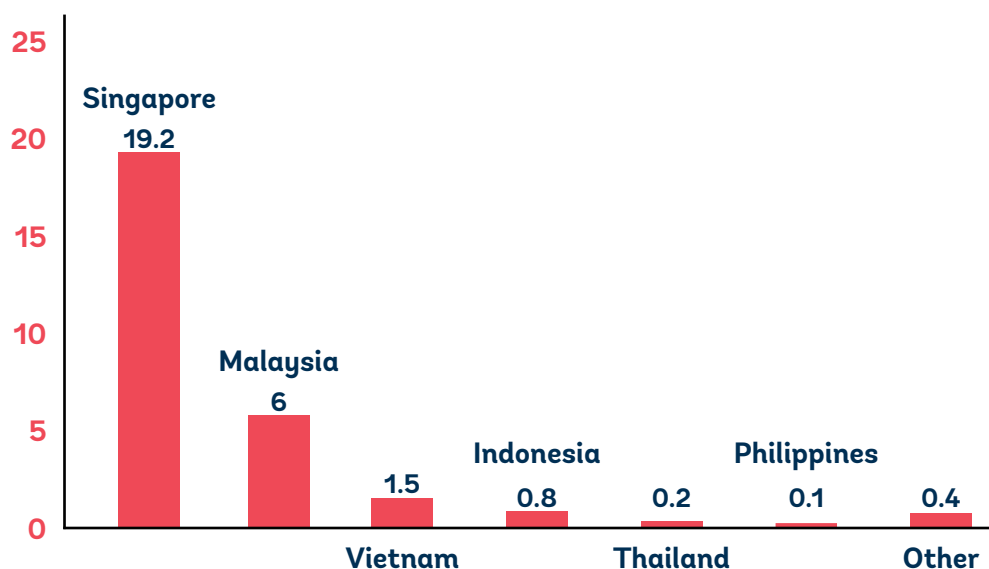
³⁴ Ibid.

Singapore is a leader in Southeast Asian venture capital

Today, vis a vis its Association of Southeast Asian Nations (ASEAN) neighbors Singapore is a leader in terms of VC and PE investment (See Figure 2). In 2018, Singapore and Indonesia accounted for over 80% of all PE and VC activity in southeast Asia, yet Singapore was responsible for the lion's share between the two countries.³⁵ Regarding venture capital activity specifically, since

2014, Singapore has accounted for well over half of total aggregate value of deals in the ASEAN region as well, and in 2019 Singapore invested approximately 75% of total VC dollars in the region, solidifying its leadership role amongst its neighbors.³⁶ At a more granular level, in 2019 approximately S\$10.9 BN was invested across 592 start-ups.³⁷

Figure 3 ASEAN-Based Private Equity & Venture Capital Assets under Management by Location (2018-2019)³⁸



³⁵ Singapore Venture Capital and Private Equity Association, "Southeast Asia Private Equity & Venture Capital". Factsheet, 2019, accessed March 12, 2021. <https://www.svca.org.sg/editor/source/Publication/Research%20Publications/SVCA%20Factsheet%202019.pdf>

³⁶ Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

³⁷ Enterprise Singapore, Venture investments in Singapore rise, with emerging interest in deep tech sectors, 2019. Note: Original data collected through Pitchbook, AVCJ, Crunchbase and Enterprise Singapore's data. Figure includes Grab's S\$4.65b round, and reflect funding raised through equity financing, including mergers and acquisitions.

³⁸ Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

Singapore has been able to nurture several Unicorns

The ASEAN region's largest unicorn to date, Grab, was headquartered in Singapore (See Table 1). Collectively, Singapore has been home to ten unicorns, three of which have been IPO (Nanofilm,

Razer and Sea) and two have been acquired, one by giant Alibaba (Lazada), and one by Chinese streaming major YY (Bigo Live). Grab, Trax, Acronis, JustCo, and PatSnap make the remaining five.

Table 1 Largest Unicorns in ASEAN³⁹

Company	Country	Industry	Post-money valuation (\$b)
Grab	Singapore	Transportation	14
Gojek	Indonesia	Transportation	9.5
Tokopedia	Indonesia	Internet	7
Traveloka	Indonesia	Travel	4.1
Lazada	Singapore	Internet	3.2
VNG	Vietnam	Software	1.6
Bukalapak	Indonesia	Internet	1
Revolution Precrafted	Philippines	Commercial property	1

Singapore is also home to a large community of accelerators, incubators, and other supporting organizations

ESG database lists 184 incubators, accelerators and related intermediary organizations that support start-ups in Singapore. Important to note as well, many of these organizations have presences in multiple countries – i.e. corporate accelerators backed by multi-national companies and Blk 71, which has been labeled as “the world’s most tightly packed entrepreneurial ecosystem.”^{40,41} A number of the incubators and accelerators in the country have received support from the

Start-up SG Accelerator (SSGA). SSGA’s aim is to improve the quality of programs offered to start-ups through its funding and non-financial support.

In addition to its accelerator and incubator community, Singapore has witnessed an increase in the number of coworking spaces in recent years. Currently, coworking facilities in the country take up nearly 4 MM square feet in net lettable area of the country’s commercial space, a three-fold increase from 2015.⁴²

³⁹ Preqin. “Markets in Focus: Private Equity and Venture Capital in Southeast Asia”. Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

⁴⁰ “All together now, What entrepreneurial ecosystems need to flourish”. The Economist, January 18, 2014. <https://www.economist.com/special-report/2014/01/16/all-together-now>

⁴¹ Anthony, Scott D. “How Singapore Became an Entrepreneurial Hub”. Harvard Business Review, February 25, 2015. <https://hbr.org/2015/02/how-singapore-became-an-entrepreneurial-hub>

⁴² Tay, Vivienne. “Coworking spaces in Singapore tripled since 2015 to 3.7m sq ft: Colliers”. The Business Times, September 17, 2019. <https://www.businesstimes.com.sg/real-estate/coworking-spaces-in-singapore-tripled-since-2015-to-37m-sq-ft-colliers>

Box 2

LaunchPad @ One-North and Block71 in focus

LaunchPad @ One-North, developed by JTC, is arguably the best example of a tech and start-up hub within Singapore, with a collection of offices, meeting spaces, accelerators and other venues. In many respects it is a catalyst for the ecosystem itself, convening a wide spectrum of different players, from the entrepreneurs running start-ups to the investors backing them. While the industrial area was established decades earlier, the initial spark to the thriving start-up community was given in 2011 at Blk71, through a collaborative effort by NUS, IMDA, and SingtelInnov8. The designated area at Blk71 was focusing on a core group of start-ups to house (and the VC arm of Singtel as an anchor tenant), and gradually over time it has attracted more interest from both the government as well as the private sector (with corporate accelerators).

Now, LaunchPad @ One-North is home to a tremendous number of start-ups as well as ecosystem players across a cluster of over 8 blocks and 6.5-hectare site. In 2020, there are between 800 and 1000 start-ups housed at its premises, accompanied by 50 different support organizations – i.e. funds, accelerators, etc. and its residents represent roughly 50 nationalities. It is still largely backed by JTC and supported by A*Star, IMDA, NRF and ESG.

NUS has also managed to build a model around the thriving start-up community it helped to start at Blk71. NUS Enterprise made a coworking space the heart of its community and offers events, incubation and other relevant services under the Block71 brand. Block71 still received support from government agencies as well as receives some sponsorship funding from corporations, but start-ups are required to pay a subsidized fee or provide in-kind value to cover the costs of being a resident. Block71 also takes equity positions in companies once they have reached a certain size and scale.

NUS Enterprise, with the support of its partners, has also succeeded in making Block71 a global brand amongst start-up ecosystems and drawing attention back to Singapore. San Francisco, Jakarta, Saigon, Yogyakarta, Bandung, and Suzhou are all metropolitan areas where Block71 now calls home. “Welcome to The Unicorn Club: Learning from Billion-Dollar Start-ups.” TechCrunch. <https://techcrunch.com/2013/11/02/welcome-to-the-unicorn-club/>



Communities of entrepreneurs, start-ups, investors, mentors and other stakeholders are forming

A final key feature of Singapore's ecosystem is the level of connectivity between the different stakeholders within it. Mentorships, partnerships, and other forms of connectivity are prevalent throughout the ecosystem. Connectivity is fueled by major events such as the annual Singapore Week of Innovation and Technology (SWITCH), organized by Enterprise Singapore, together with National Research Foundation (NRF) and Intellectual Property Intermediary. SWITCH brings together global start-ups, innovators, investors and other stakeholders and in 2020 it managed to attract 60,000 attendees, when organized in conjunction with Singapore Fintech Festival.

Relative to other start-up ecosystems around the world, Singapore's tech entrepreneurs are highly connected to each other, which tends to have a positive effect on company growth.⁴³ For example, according to research from Endeavor Insight, entrepreneurs in Singapore who ran tech companies with more than ten employees and employee growth of at least 20% annually, were on average connected, often times as mentors or mentees, to five other entrepreneurs in the country. This finding suggests that entrepreneurs in Singapore's ecosystem are both highly connected and that this connectivity may indeed boost growth.⁴⁴

⁴³ Singh, Samridhi and Torok, Lili. "Tech Founders in Asia's Model City". Lessons from Mapping the Singapore Tech Ecosystem. Endeavor Insight, December 14, 2015. https://issuu.com/endeavorglobal1/docs/singapore_tech_map

⁴⁴ Ibid.



Government leadership in creating the start-up ecosystem

With few natural resources, a limited land area of 722 square kilometers and a population of 5.6 million people, Singapore is one of the smallest independent nations in the world. However, since its inception the city-state has been an increasingly powerful economic force, and is considered to be one of the first knowledge-based economies in the world.⁴⁵ Long before the country had any unicorns, VC funds, accelerators or even a basic semblance of a start-up ecosystem, Singapore was laying the foundation for an increasingly competitive economy globally. Under the leadership and vision of Lee Kuan Yew, a presence that is still ever-prominent



the country into a hub for large global businesses, as well as leading financial and educational institutions.

One hallmark of the Singapore growth story has been its increasingly transparent and friendly business environment as well as an agile government that could respond quickly to challenges in the market. This emphasis on economic openness and

global business linkages has been a core focus since day one. Government stability has also played a key role in making the country an international business hub. Of the many dividends that this approach has yielded, one has been helping local firms acclimate to global competition and quality expectations. For example, as the country attracted a growing population of Multinational Corporations (MNCs) its local firms and entrepreneurs were subject to the demand for quality and process improvement services. Put differently, by interacting with, and integrating into supply chains, or leading global firms, Singapore companies were forced to become more efficient and operate at higher levels of quality or else they would be overtaken by regional competitors.⁴⁶

In addition to becoming a global business center, Singapore also built specializations in select industries, as it evolved its economic growth strategy. For instance, it built a globally renowned shipping and logistics industry through its port, and also established a foothold as a leader in the region's financial services sector.⁴⁷ The rise of these two competitive advantages was also symbiotic as the financial services sector benefitted from the country's integration into global trade flows, and its port benefitted equally from the country's growing expertise in investment banking, asset management, and other finance verticals.⁴⁸

⁴⁵ "The knowledge-based economy" is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors. <https://stats.oecd.org/glossary/detail.asp?ID=6864>

⁴⁶ OECD Reviews of Innovation Policy. "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

⁴⁷ Woo Jun Jie.. "Singapore's Transformation into a Global Financial Hub". Lee Kuan Yew School of Public Policy, National University of Singapore, 2017, accessed March 12, 2021. https://lkyspp.nus.edu.sg/docs/default-source/case-studies/entry-1516-singapores_transformation_into_a_global_financial_hub.pdf?sfvrsn=a8c9960b_2

⁴⁸ Ibid.

Human capital development was also a top priority in the country from day one, an integral part of its economic modernization and development strategy.⁴⁹ To support Lee's vision to create a highly-industrialized state, the country also endeavored to build an equally talented workforce. A high quality talent base would be critical to its objective of attracting investment and becoming a regional business hub.⁵⁰ The early decades of building its population of human capital saw an emphasis on free education for all, and creating the proper syllabus and infrastructure needed for its growing population, ensuring that the country's students developed skills to serve the pool of MNC's, and also that its own local industries could be viable players within global value-chains.⁵¹ Also important, during its early years the government established a meritocratic bureaucracy that could more easily confer on large political decisions and create policies, which ultimately improved its delivery process.⁵²

Then, in the 1980s, once MNC's were a fixture within Singapore's economy and it had attracted a large amount of foreign investment, the government turned its focus to higher-value manufacturing.⁵³ This move came as a result of seeking

to move into the ranks of the world's most knowledge and innovation-driven economies, and also from a realization that, following an evaluation of its educational outcomes from the 1970s, that learning outcomes still had room to improve.⁵⁴ The government also improved its ability to monitor student progress, deepened collaborations with foreign investors to upgrade its local population's skills, and established the Curriculum Development Institute of Singapore to improve the alignment between the skills taught in schools and those that would be needed to fulfill the country's long-term industrial ambitions.⁵⁵

As the country's growth strategy evolved, the government placed a higher premium on building its research and development (R&D) capabilities and growing its expertise in technology industries. In fact, the emphasis on R&D began as early as 1969 when the government created the Singapore Institute of Standards and Industrial Research (SISIR). Another milestone in the country's efforts to support science and technology was the creation of its first science park in 1980, housing both government agencies and private companies.

⁴⁹ Yusuf, Shahid. "Building Human Capital, Lessons From Country Experiences, How Singapore Does It". Human Capital Project, World Bank Open Knowledge Repository, World Bank, July 21, 2020. <http://documents1.worldbank.org/curated/en/960921595409441570/pdf/Building-Human-Capital-Lessons-from-Country-Experiences-Singapore.pdf>

⁵⁰ Ibid.

⁵¹ Global Delivery Initiative. "Integrating Human Capital into National Development Planning in Singapore", Human Capital Project, World Bank Open Knowledge Repository, World Bank, May, 2020. <https://openknowledge.worldbank.org/bitstream/handle/10986/34212/Integrating-Human-Capital-into-National-Development-Planning-in-Singapore.pdf?sequence=4&isAllowed=y>

⁵² Yusuf, Shahid. "Building Human Capital, Lessons From Country Experiences, How Singapore Does It". Human Capital Project, World Bank Open Knowledge Repository, World Bank, July 21, 2020. <http://documents1.worldbank.org/curated/en/960921595409441570/pdf/Building-Human-Capital-Lessons-from-Country-Experiences-Singapore.pdf>

⁵³ Ibid.

⁵⁴ Ibid.

⁵⁵ Ibid.



After Singapore suffered its first major recession in 1985, the government commissioned an economy-wide review, which led to a national decision to ascend the global value chain, moving from being competitive in lower cost manufacturing services to being a player in global technology industries.⁵⁶ Singapore's first significant policy recognition of the economic importance of R&D came in 1989 when a committee of Ministers of State was formed to outline the long-term strategy and direction of the country's development. The result was a "vision" document called "The Next Lap", which highlighted the need to focus on R&D and specialize in high-technology niches so that Singapore could catch up with

the advanced countries over the next 20 years.⁵⁷ These measures, among others, coupled with the government's leadership in ensuring that the country continuously enhances its economic competitiveness have indeed paid off. Following the global financial crisis in 2008-09 real GDP rebounded sharply with a growth rate of 14.5% in 2010, following a contraction of 0.8% in 2009.⁵⁸ Knowledge-intensive services and manufacturing are now being the key drivers of Singapore's economic growth (see Table 2) for GDP growth between 1980 and 2018), with an increasing role played by tech-enabled start-ups which could contribute to about 2% to GDP by 2035 according to a 2015 study from PwC.⁵⁹

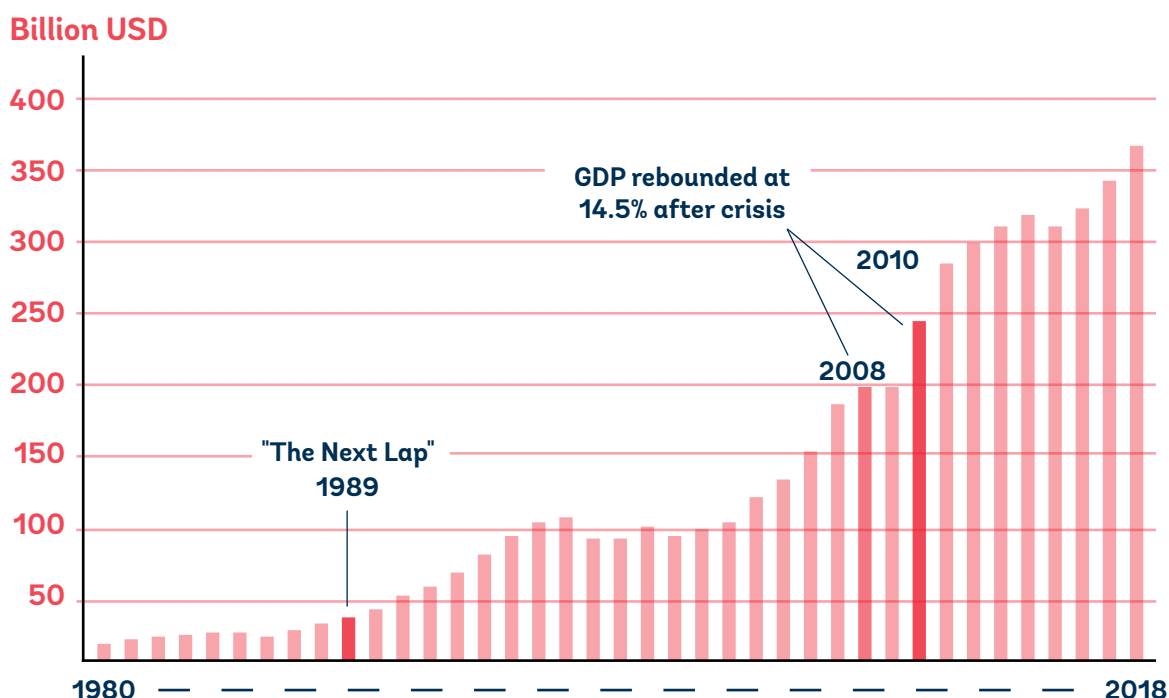
⁵⁶ Poh, Lim Chuan. "From Research to Innovation to Enterprise: The Case of Singapore". Global Innovation Index 2016. Winning with Global Innovation, World Intellectual Property Index, 2016, accessed March 12, 2021. Chapter 10, page 133. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf

⁵⁷ Kok, Lee Min. "Committee on the Future Economy releases report: A look at the 3 economic units tasked to chart Singapore's future". The Straits Times, February 10, 2017. <https://www.straitstimes.com/politics/heng-swee-keat-to-lead-the-future-economy-committee-other-similar-efforts-in-the-past>

⁵⁸ World Bank, GDP growth (annual %) – Singapore, World Bank national accounts data, and OECD National Accounts data files. Available at: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=SG>

⁵⁹ PwC. "Singapore's tech-enabled start-up ecosystem" PwC Strategy, April, 2015. <https://www.pwc.com/sg/en/microsite/media/assets/startup-google.pdf>

Table 2 Singapore GDP (1980 to 2018)⁶⁰



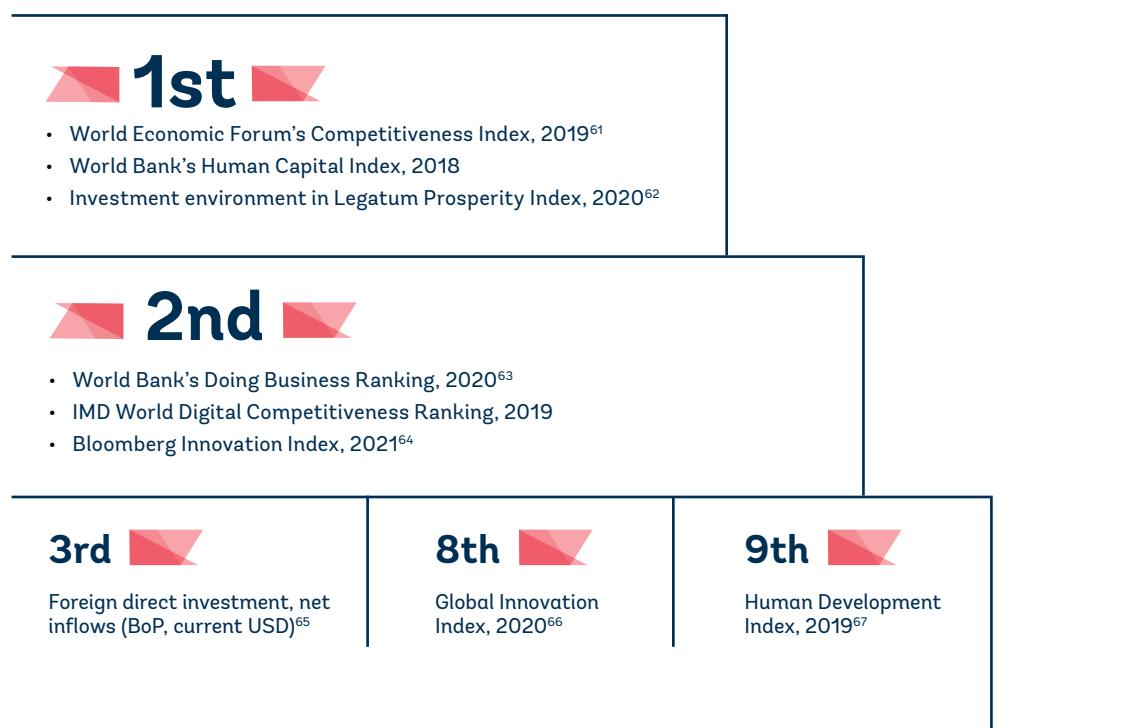
Global indices on business environment quality, education, and innovation all consistently recognize Singapore's prowess (See Figure 3). For example, the World Bank's Human Capital Index ranked Singapore the top performing country in 2018 for quality of labor force; the World Economic Forum's 2019 Competitiveness Index also ranked Singapore first globally in terms of overall competitiveness; while the Global Innovation Index and Human Development Index ranked Singapore eighth and ninth, respectively in 2019.

While the government has put entrepreneurship and start-up support at the core of national policies and

strategies, it is important to note that today's start-up ecosystem has been built off of decades of efforts to embed Singapore into global value chains, and methodically make it an increasingly competitive player in key industries both regionally and globally. The ecosystem has benefitted tremendously from this foundation, characterized by transparency and openness, global connectivity in logistics and financial industries, a strong human capital base and a prevalence of MNCs and a long-term focus on research and innovation. These natural assets helped provide a base on which the ecosystem could come to fruition.

⁶⁰ The Table 1 provides an overview on how the Singapore's GDP has exponentially grown during the last years. World Bank Data, 2020.

Figure 4 Singapore's rankings in global indices and economic data



⁶¹ Schwab, Klaus. "The Global Competitiveness Report 2019". World Economic Forum, October 8, 2019. http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

⁶² Legatum Prosperity Index. Singapore ranks first in terms of investment environment, market access and infrastructure, health, education. Legatum Institute, 2020, accessed March 12, 2021. https://prosperitysite.s3-accelerate.amazonaws.com/6915/8634/9288/The_Legatum_Prosperty_Index_2019_Overview.pdf Please note that the 2020 data is already available where Singapore scales up to the 15th overall position: <https://www.prosperity.com/rankings?pinned=SGP&filter=>

⁶³ Doing Business 2020. "Comparing Business Regulation in 190 Economies". World Bank Open Knowledge Repository World Bank, 2020, accessed March 12, 2021. <https://openknowledge.worldbank.org/bitstream/handle/10986/32436/9781464814402.pdf?sequence=24&isAllowed=y>

⁶⁴ Michelle Jamrisko, Wei Lu, and Alexandre Tang. "Bloomberg Innovation Index", February 3, 2021. <https://www.bloomberg.com/news/articles/2021-02-03/south-korea-leads-world-in-innovation-u-s-drops-out-of-top-10>

⁶⁵ World Bank Data, 2020.

⁶⁶ "Global Innovation Index 2020" Cornell University, INSEAD and WIPO, September, 2020. Table A: 10 best-ranked economies by income group. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

⁶⁷ Pedro Conceição. "Beyond Incomes, Beyond averages, Beyond Today". 2019 Human Development Index Ranking United Nations Development Programme, December 9, 2019. <http://hdr.undp.org/sites/default/files/hdr2019.pdf>

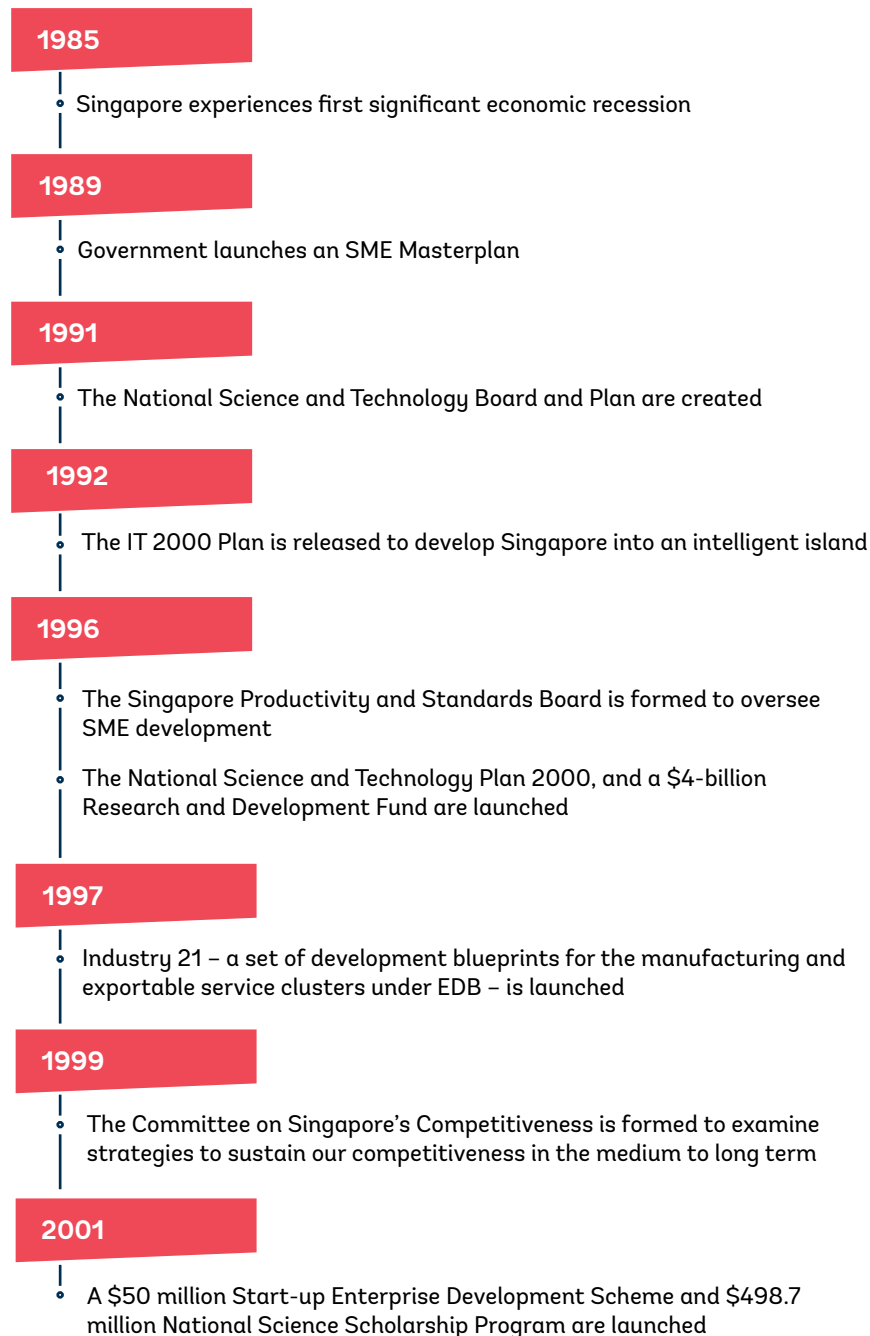
Growing focus on ecosystem support from 1990 onward

Just as the government has driven the development and implementation of national strategy since the country's beginning, its leadership has been significant in shaping Singapore's start-up ecosystem. While the government made the decision to progress up the global value chain and focus on knowledge and innovation-intensive industries in the mid-1980s, the late 1990s and the start of the new Millennium saw the beginning of targeted strategies and policies for entrepreneurs and start-ups themselves. As seen in Figures 4 and 5, for over 30 years the government has taken an increasingly active and

targeted approach to spurring innovation and entrepreneurship in Singapore. A mixture of financing schemes, research funding, and other policies and programs characterize Singapore's multi-faceted strategy supporting its start-up ecosystem. In many ways, this progression represents an evolution from a national focus on building a business-friendly environment that is globally integrated, the core policy agenda for the first half of the country's history, to one concentrating heavily on improving conditions for global competition through supporting innovation and start-ups directly.

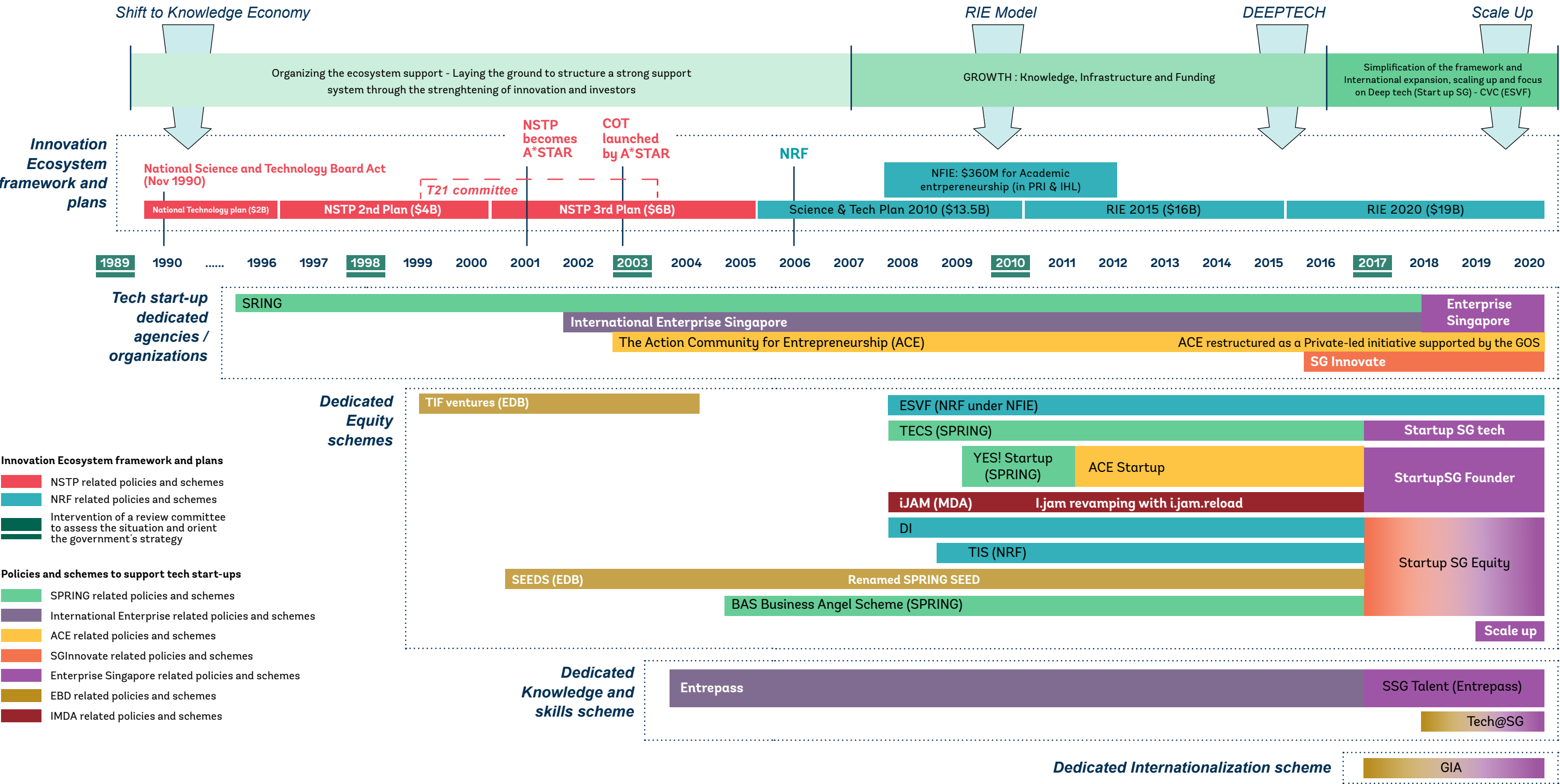


Figure 5 Key policies and strategies in the ecosystem's early days⁶⁸



⁶⁸ Lee Hsien Loong, Prime Minister. "Making a Living, Ensuring Growth, Hard work, social stability and visionary economic policies made it possible for our small city-state to stay relevant and sustain growth in uncertain times". Public Service Division, Prime Ministers Office, Government of Singapore, 2015, accessed March 12, 2021. <https://www.psd.gov.sg/heartofpublicservice/our-institutions/making-a-living-ensuring-growth/>

Figure 6 Timeline of Singapore public frameworks, dedicated agencies and schemes to support tech start-ups⁶⁹



⁶⁹ World Bank team desk research on government agencies and national policies.

National Framework for Innovation and Enterprise

As discussed, public policy has played a major role in influencing Singapore's start-up ecosystem since the 1990s. In many ways, the emphasis on start-up growth was a next natural step following the preceding decades' concentration on building a business-friendly environment and gradually moving up the world's economic value chain. Global linkages, with a strong presence of industry titans, local talent, expertise in asset management and a strong education sector provided the basic ingredients for a start-up ecosystem. The government founded the National Science and Technology Board in 1990 (NSTB became A*Star in 2002) and the National Research Foundation was formed in 2006, under the Prime Minister's Office, to support the Research, Innovation and Enterprise Council. The government also successively launched six 5-year plans, led by different government agencies, and the purpose of these plans was to align Singapore's research with industry demand so it can be translated into tangible outcomes with economic and social impact (see table 3).⁷⁰

One important component of this strategy has been deep engagement with the

investment community. The first initiative, Technopreneurship 21 (T21), was critical in directing Singapore into an ecosystem that could compete for funding at the international level. The flagship scheme of T21 was the Technopreneurship investment Fund (TIF), a \$1 billion fund of fund established in 1999 and managed by EDB that was designed to spur the VC industry. The TIF was essentially a co-investment program aiming to attract leading international VC to set their regional Hub in Singapore and professionalize the sector in Singapore in order to crowd private sector investments into promising start-ups. It allowed the government to rapidly built up its own VC expertise by participating as limited partners in top-tier venture funds around the world, in the US, Europe, Israel and India (For example NSTB-linked venture funds were among the very early investors in tech giants such as Alibaba and Baidu), but the impact on local start-ups was not as high as expected given that most of the investments were made overseas due to a small pipeline of local quality start-ups. It shed light on the fact that the ecosystem needed holistic support that would also to nurture the entry of early stage, technology-enabled start-ups.

Table 3 Overview of national science, technology and innovation plans (1995 – 2025)

Strategy	Budget
National Technology Plan 1995	\$2 billion
National Science & Technology Plan 2000	\$4 billion
Science & Technology 2005 Plan	\$6 billion
Science & Technology 2010 Plan	\$13.5 billion
Research, Innovation and Enterprise 2015 Plan	\$16 billion
Research, Innovation and Enterprise 2020 Plan	\$19 billion
Research, Innovation and Enterprise 2025 Plan	\$25 billion

⁷⁰ Poh, Lim Chuan. "From Research to Innovation to Enterprise: The Case of Singapore. Global Innovation Index 2016. Winning with Global Innovation, World Intellectual Property Index, 2016, accessed March 12, 2021. Chapter 10, page 133. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2016.pdf

In 1996 the government founded the Standards, Productivity and Innovation Board under the Ministry of Trade and Industry with a mission to “lower technical barriers to trade, provide quality assurance for products and services and promote industry use of Singapore and international standards”. It worked as an agency for enterprise development and helped enterprises to enhance the competitiveness in Singapore market, operating with three core focus areas: productivity and innovation; standards and quality; and small and medium-sized enterprises (SMEs) and the domestic sector. It was also the national standards and conformance body. Eventually, in 2018, Standards, Productivity and Innovation (SPRING) would be merged with IE Singapore to form Enterprise Singapore.

A significant policy measure took place in 2008 when the National Framework of innovation and Enterprise (NFIE) allocated \$ 254 million over 5 years (2008 – 2012) to develop innovation and entrepreneurship with a key focus on

academic entrepreneurship and the creation of enterprise support structures.⁷¹ One of the objectives of the NFIE was to commercialize leading-edge technologies developed by the public research institutes and institutes of higher learnings through the creation of high-technology ventures. It included the creation of Universities Innovation Funds established in each university to fund entrepreneurship education, technology incubators, entrepreneurs-in-residence and other programs, to promote commercialization of university technologies.

In 2010 the Research Innovation & Enterprise (RIE) plan began to take an ecosystem-wide approach, funding initiatives across the board (See Figure 6).⁷² Taking inspiration from studying Israel’s model to support innovation and entrepreneurship, Singapore’s government launched a series of funds and other initiatives including the Early Stage Venture Fund, Technology Incubation Scheme, and Disruptive Innovations.⁷³

Figure 7 Research Innovation and Enterprise Ecosystem⁷⁴

<div> <div>Prime Minister's Office</div> <div>Research, Innovation and Enterprise Council Scientific Advisory Board Supported by NRF</div> </div>						
Ministries	Trade & Industry			Education	Education	Other Ministries & Agencies + NRF
R&D Funding Bodies	Economic Development Board	Enterprise Singapore	A*STAR	Academic Research Council	National Medical Research Council	
R&D Performers	MNCs Corp Labs	SMEs Startups	Research Institutes	Universities	Hospitals	Other Government Labs

Source: National Research Foundation, 2020. ©Government of Singapore.
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⁷¹ Research, Innovation and Enterprise Council (REIC) Launches a Comprehensive National Framework to Grow Innovation and Enterprise, National Archives of Singapore, 2008. <https://www.nrf.gov.sg/about-nrf/national-research-foundation-singapore/nrf-milestones>

⁷² World Bank team interview in Singapore, 2020.

⁷³ Ibid.

⁷⁴ National Research Foundation (NRF), RIE Ecosystem. <https://www.nrf.gov.sg/about-nrf/rie-ecosystem>

The current RIE 2025 plan (See box 3) was announced in December 2020 by the National Research Foundation and committed \$18.8 billion for investment in R&D. It emphasizes public research performers' connection with the private sector with one of its key priorities being to support the scaling of start-ups. In 2019 and 2020, the budget allocated to technology such as cell therapy manufacturing or food production and to deep tech start-ups was respectively increased by approximately \$352 million and \$211 million.

Box 3

Key focus areas of RIE 2025⁷⁵

Expand the scope of RIE to address a broader spectrum of national needs:

The scope of the RIE domains will be expanded to include new areas of strategic importance, namely Manufacturing, Trade & Connectivity; Human Health & Potential; Urban Solutions & Sustainability; and Smart Nation & Digital Economy.

Enrich the scientific base: NRF will introduce mechanisms to systematically review the basic science capabilities and identify potential peaks of excellence that will differentiate Singapore Internationally.

Scale-up Innovation & Enterprise (I&E) platforms to drive technology translation, and accelerate enterprise innovation: Support existing platforms to move into adjacent areas with high-growth potential, and build-up the pool of local inventors and entrepreneurs with both technology and business development expertise.

Governance and streamlining

An additional important component of the government strategy to support the ecosystem has also been the formulation of numerous review committees, many of which have focused on specific industries, allowing the government to help streamline efforts to support the industry while also specializing within it. Based on inputs from those committees, political leaders in the cabinet office adjusted their strategy and

mandated or created the corresponding implementing agencies to roll it out (there have been more than seven government bodies that supported the ecosystem as shown in Table 3). There is today a comprehensive set of supporting schemes available to the tech-start-up ecosystem through numerous agencies and ministries (as shown in Figure 5).

⁷⁵ National Research Foundation, "RIE2025 Press Release". Government of Singapore, December 11, 2020. https://www.sgpc.gov.sg/sgpcmedia/media_releases/pmo-nrf/press_release/P-20201211-2/attachment/RIE2025%20Press%20Release.pdf

Table 4 Singapore evaluation committees focusing on technology and entrepreneurship

Committee	Date
Economic Planning Committee	1985-86, 1989-91
Committee on Competitiveness	1997-98
T21 Committee	1999-2003
Economic Review Committee	2002-03
Economic Strategies Committee	2009-10
Committee on the Future Economy	2017

These committees have a number of concrete measures attributed to them. For example, the first of these committees, the Economic Planning Committee launched the National Technology Plan to promote R&D, enhance science and technology talent and support infrastructure. Likewise, the 2002-2003 Economic Review Committee created the Action Community for Entrepreneurship (ACE) in 2004, the Ministerial Committee in R&D Policy (2004-2006), and the National Research Foundation in 2006. Additionally, 2017's Committee on the Future Economy led to several key outcomes to enhance the local ecosystem as well as its presence abroad: 1) the creation of Start-upSG; 2) merger of SPRING and International Enterprise Singapore to create Enterprise Singapore; 3) Global Innovation Alliance; 4) regulatory sandboxes; and 5) ICE71, among other accomplishments.

Just as the committees have helped to provide opportunities to reflect and adjust policies, other efforts from the government have also helped to provide better coordination between the various initiatives supporting the ecosystem. Over three decades of creating and adjusting policies and schemes to nurture the tech start-up ecosystems resulted in a comprehensive, yet complex supporting

system fragmented between various agencies and mechanisms that was hard to read for entrepreneurs or supporting organization willing to benefit from those measures.

Start-up SG, an initiative of Enterprise Singapore, simplified and united many previous schemes under the same umbrella. It also allowed Singapore to advertise its ecosystem abroad more easily. Today, Start-up SG offers numerous schemes and tools such as its open directory to support every stakeholders of the ecosystem, from first time entrepreneurs and start-ups at every stage, to investors, incubators and accelerators. Additionally, Digital Industry Singapore (DISG), a consortium between the Infocomm Media Development Authority (IMDA), Economic Development Board, and Enterprise Singapore was established in 2019 to streamline engagement and function as a single interface for the technology industry. DISG provides a number of industry specific support schemes for digital industry firms, including start-ups.

Regarding the IMDA specifically, it was established in 2016 as a result of a merger of the Infocomm Development Authority (IDA) and the

Media Development Authority (MDA). IMDA is a statutory government board, which operates under the Ministry of Communications and Information. The entity is mandated to promote the country's digital and media sectors as well as guide the regulation surrounding it. SMEs Go Digital, Digital Economy Framework for Action, and TechSkills Accelerator are several of IMDA's initiatives supporting this outcome. Also, in 2016, A*STAR began doubling down on understanding and improving the pathways between the academic community and industry. These efforts entailed increased evangelization in the marketplace, as well as direct funding support to start-ups.⁷⁶

Growing focus on deep-tech

A growing trend in government support for the ecosystem has been a concentration on deep-tech sectors. In many ways, this interest in honing the country's deep-tech competitiveness is born from the recognition that its start-up ecosystem's next phase of growth will be to deepen its global hold, moving beyond Singapore's borders.⁷⁷ Additionally, focusing on select deep-tech sectors can help Singapore build its resilience against systemic development challenges such as water and food access. To effectively build a segment of the ecosystem supporting deep-tech, the government is taking steps

to improve the amount of capital and talent being channeled towards it.

In early 2020 the government announced that it would commit \$300 million to Start-up SG Equity focused on deep-tech sectors including advanced manufacturing, pharmabio and medtech, and agri-food tech. The schemes will invest directly into companies as well as VC funds focusing on deep-tech.⁷⁸ Through Start-up SG Equity, the Singapore government co-invests with qualified third-party investors into eligible start-ups. It aims to attract roughly \$570 million in private-sector investments for deep tech start-ups over the next decade.⁷⁹ Seeds Capital and SGInnovate have been appointed to manage the funds under Start-up SG Equity⁸⁰, which had its investment cap increased from S\$4 million to S\$8 million in deep-tech start-ups, starting in Q2 2020⁸¹.

SGInnovate's strategy encompasses the main segments of the ecosystem that the country seeks to improve in order to become more competitive in deep tech sectors globally: investment, talent, and network development. For example, SGInnovate's Deep Tech Nexus was launched in 2017 to help entrepreneurs build products derived from scientific research. Additionally, SGInnovate has invested in 26 deep tech companies, adding to a growing

⁷⁶ World Bank team interview in Singapore, 2020.

⁷⁷ Cordon, Miguel. "Singapore sets aside additional \$215m for deep-tech start-ups". Techinasia, February 18, 2020. <https://www.techinasia.com/singapore-allots-additional-215m-investments-deeptech>

⁷⁸ Enterprise Singapore. "Enhancements to Start-up SG Equity". Start-up SG Equity. Ministry of Trade and Industry, August 20, 2020. <https://www.enterprisesg.gov.sg/-/media/esg/files/media-centre/media-releases/2020/aug-2020/esg-enhances-startup-sg-founder-programme-to-groom-new-startups-to-seed-next-lap-of-innovation-in-singapore.pdf?la=en>

⁷⁹ Cordon, Miguel. "Singapore sets aside additional \$215m for deep-tech start-ups". Techinasia, February 18, 2020. <https://www.techinasia.com/singapore-allots-additional-215m-investments-deeptech>

⁸⁰ Ibid.

⁸¹ Enterprise Singapore Media Factsheet, accessed March 12, 2021. <https://ssn-core-prod-files.s3.ap-southeast-1.amazonaws.com/2020-03/ESG%20Media%20Fact%20Sheet%20on%20Start-up%20SG%20Equity%20at%20MTI%20COS.pdf>

trend in deep tech investment nationally: from 2010 to 2019 the number of deep tech VC investments in Singapore grew by over 30X, with an aggregate value of \$2.6 billion.⁸² SGInnovate also runs the annual Deep Tech Summit, a large global gathering for entrepreneurs, investors, and other stakeholders within the sector.⁸³ SGInnovate has focus areas including medtech, artificial intelligence, IoT, Robotics, quantum computing, cybersecurity, and blockchain.⁸⁴

SEEDS Capital, the investment arm of Enterprise Singapore, is another significant intervention to facilitate investments in deep-tech start-ups. To date, Seeds Capital has appointed over 40 VC firms as co-investment partners and is working with more than 500 firms which have global market potential and focus on national strategic industries and emerging technologies.

There is also acknowledgment that collaboration with universities will be critical to this process.⁸⁵ To date, universities have been active in spurring R&D. Since 1995, an estimated \$43.3 billion has been

invested in hard sciences and engineering. Moreover, as of 2017, Singapore was home to over 35,000 research scientists and engineers.⁸⁶ Likewise, Singapore has increased its number of patents over the past several decades. From 1996 to 2000, the US Patent and Trademark Office granted 943 to Singaporean inventors, but from 2011 to 2016 the number grew to 7171.⁸⁷ A notable gap, however, has been the supply of talent that can readily work in deep tech sectors, namely once R&D is commercialized into proper companies.⁸⁸ To develop talent in deep tech sectors SGInnovate runs the Summation Programme, an apprenticeship that matches students with deep tech start-ups. The program began in 2018, with 23 students.⁸⁹ The NUS as well has committed to the deep-tech movement, launching a program in 2019 to create 15 student-founded deep tech start-ups annually.⁹⁰ Lastly, SGInnovate also operates the Infinity Series to help place students in deep tech companies.⁹¹ NUS Enterprise has also been implementing the Lean LaunchPad Singapore program since 2013, which has been scaled-up with Nanyang Technological University

⁸² Hseien-Hui. "How to Spot Deep Tech Winners in Singapore". Preqin, June 23, 2020. <https://www.preqin.com/insights/research/blogs/how-to-spot-deep-tech-winners-in-singapore>. Preqin defines deep tech as artificial intelligence, blockchain, medtech, healthtech, fintech, deep learning, and machine learning in their estimate

⁸³ Infocomm Media Development Authority. Announcement at Infocomm Media Business Exchange. Government of Singapore, September 18, 2018. https://www.np.edu.sg/media/Documents/Releases-Advisories/2018/AFirstinSoutheastAsia_SGInnovatePresentsFINAL.pdf

⁸⁴ SGInnovate. "Deep Tech Solutions Applied With Deep Insights, for Deep Impact", 2020. <https://www.deeptechsummit.com/>

⁸⁵ World Bank team interview in Singapore, 2020

⁸⁶ SGInnovate. "Deep Tech Investments: Realising the Potential" SGInnovate Insights, September 2, 2019. https://cdn2.hubspot.net/hubfs/3032335/investments/deep-tech-investments-realising-the-potential.pdf?__hstc=113141851.1567654249666.1567654249666.1567654249666.1&__hssc=113141851.2.1567654249666

⁸⁷ Ibid.

⁸⁸ Ibid.

⁸⁹ SGInnovate Talent Program, accessed March 12, 2021, <https://www.sginnovate.com/talentprogrammes>

⁹⁰ Pillai, Sharanya. "NUS to invest S\$1.5 million to co-create 15 deep-tech start-ups". Business Times, January 18, 2019. <https://www.businesstimes.com.sg/garage/news/nus-to-invest-s15-million-to-co-create-15-deep-tech-startups>

⁹¹ Ibid.

(NTU), Singapore University of Technology and Design (SUTD) & Singapore Management University (SMU), with the contributions from NRF. The program has been successfully taught at several U.S. top universities and has its origins in the Innovation Corps program used by the National Science Foundation in the U.S.

Beyond SGInnovate, SEEDS Capital, Start-up SG Equity, and Start-up SG Tech grant scheme, there have been other initiatives supporting deep tech in the country that have been established in the past decade. For example, since the late 2000s, accelerators have been set up to generate new solutions in cleantech, demonstrating how deep tech

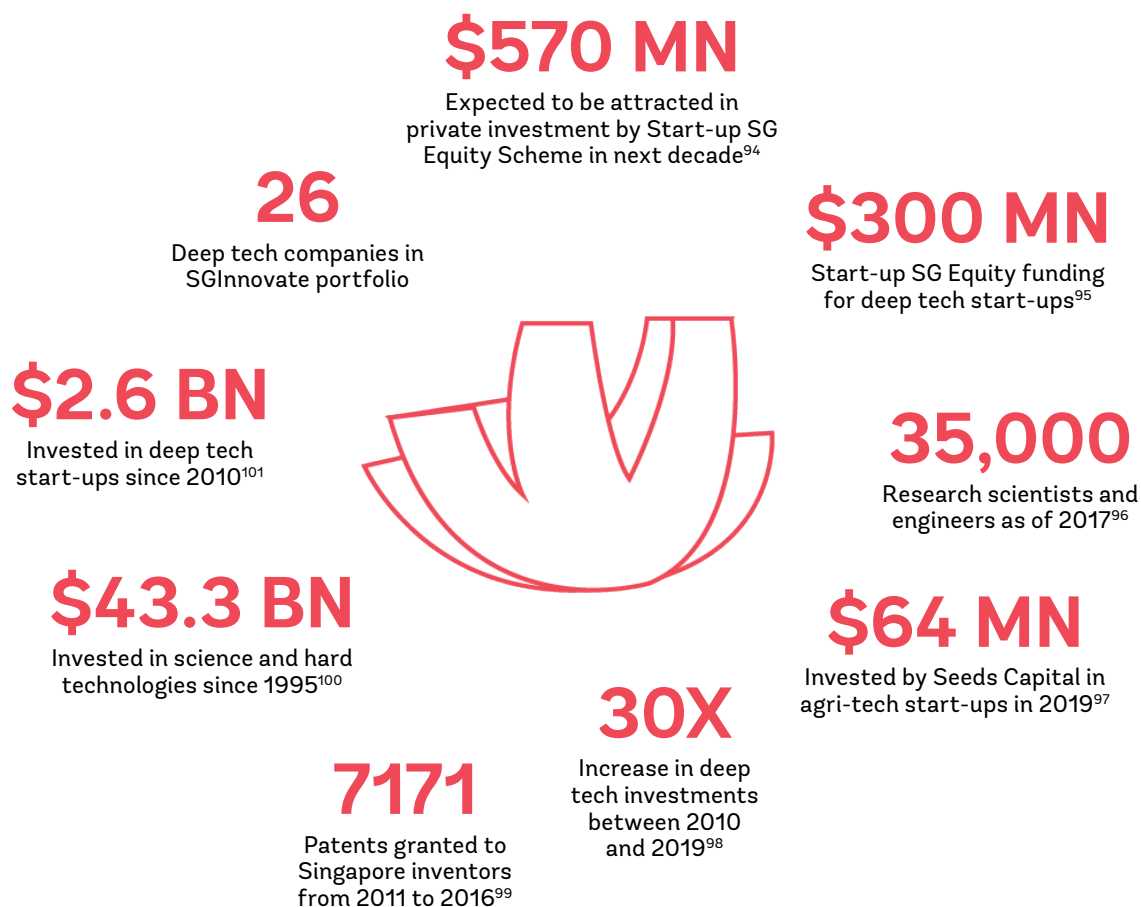
can help confront systemic environmental challenges in the country.⁹² To date Singapore has relied heavily on foreign countries for water access, given the absence of domestic water sources, making innovations in water technology a high priority for the country's survival. The country is applying a similar mindset to the agriculture sector due to Singapore's growing population and erratic weather. As such, food tech start-ups are becoming increasingly common, to help develop food domestically.⁹³ In 2019, SEEDS Capital, along with a collection of other funds and accelerators like Big Idea Ventures, invested \$64 million into Singapore-based early-stage agri-tech start-ups.



⁹² SGInnovate. "Deep Tech Investments: Realising the Potential". SGInnovate Insights, September 2, 2019. https://cdn2.hubspot.net/hubfs/3032335/investments/deep-tech-investments-realising-the-potential.pdf?__hstc=113141851.ffa41905044c63b124f7c7a7c4033d59.1567654249666.1567654249666.1567654249666.1&__hssc=113141851.2.1567654249668

⁹³ Ibid.

Figure 8 Highlights of Singapore's deep tech activity to date



⁹⁴ Cordon, Miguel. "Singapore sets aside additional \$215m for deep-tech start-ups". Technasia, February 18, 2020. <https://www.technasia.com/singapore-allots-additional-215m-investments-deeptech>

⁹⁵ Enterprise Singapore. "Enhancements to Start-up SG Equity". Start-up SG Equity. Ministry of Trade and Industry, August 20, 2020. <https://www.enterprisesg.gov.sg/-/media/esg/files/media-centre/media-releases/2020/aug-2020/esg-enhances-startup-sg-founder-programme-to-groom-new-startups-to-seed-next-lap-of-innovation-in-singapore.pdf?la=en>

⁹⁶ *ibid.*

⁹⁷ *Ibid.*

⁹⁸ Hseien-Hui. "How to Spot Deep Tech Winners in Singapore". Preqin, June 23, 2020. <https://www.preqin.com/insights/research/blogs/how-to-spot-deep-tech-winners-in-singapore>

⁹⁹ *Ibid.*

¹⁰⁰ SGInnovate. "Deep Tech Investments: Realising the Potential". SGInnovate Insights, September 2, 2019. https://cdn2.hubspot.net/hubfs/3032335/investments/deep-tech-investments-realising-the-potential.pdf?__hstc=113141851.1567654249666.1567654249666.1567654249666.1&__hssc=113141851.2.1567654249666

¹⁰¹ Hseien-Hui. "How to Spot Deep Tech Winners in Singapore". Preqin, June 23, 2020. <https://www.preqin.com/insights/research/blogs/how-to-spot-deep-tech-winners-in-singapore>. Preqin defines deep tech as artificial intelligence, blockchain, medtech, healthtech, fintech, deep learning, and machine learning in their estimate.



Key characteristics of Singapore's start-up ecosystem

As mentioned earlier in the report, before Singapore's government began to build the institutions, partnerships and general momentum to create the country's start-up ecosystem, it had already invested decades-worth of funding and planning to build the foundations for its economy. Its resulting investment climate, internationalized economy, excellence in corporate governance, education, public sector cohesion and responsiveness all prepared it to ascend the global economic value-chain into knowledge and innovation-intensive sectors. Accordingly, when the government initiated a national strategy to move the country into more knowledge-intensive and innovation-driven industries and services, establishing a start-up ecosystem became the next natural step. It is important to keep in mind that significant policy efforts, industrial development, fortifying of global business linkages and other strategic moves were made in Singapore's early years that facilitated the creation of today's ecosystem, and only once that enabling environment was in place did the ecosystem begin to come to fruition.

Having said that, emerging markets intent on learning from, and emulating Singapore's success can focus efforts on specific policy areas that, while not a quick win, can help to shape long-term policy strategy. The following section is a collection of key characteristics that both distinguish the Singapore start-up ecosystem, as well as provide policymakers from other countries with a glimpse of specific measures they can pursue.

Government leadership from day one

Singapore's government has committed decades of policy building efforts towards enhancing the local business environment, supporting the creation of its start-up ecosystem. To that end, the government has demonstrated immense leadership from day one, and has been quick to address gaps and pass advantageous policies. The government has played an essential role in both directly shaping the country's business environment as well as launching a wide variety of policies and programs. Additionally, the government

is recognized for its responsiveness and agility in reacting to changes in the market. Interviews with local players in the ecosystem highlighted the speed at which the government can enact policies and other measures to support the local business environment. One example is the Ministry of Trade and Industry's pro-enterprise panel, an inter-government body that convenes different government agencies in an effort to streamline regulations affecting businesses.¹⁰² The panel has also created the First Mover Framework and New Idea Scheme. The framework provides entrepreneurs access to public sector support, while the scheme helps government agencies implement new business ideas.¹⁰³

Through the time of the COVID-19 pandemic, the government has continued to remain active, iterative, and responsive. During this time two highly targeted programs for tech start-ups, the Special Situation Fund for Start-ups¹⁰⁴ (SSFS), and an enhanced Start-up SG Founder program¹⁰⁵ were established. The SSFS, launched in June 5, 2020, served as a financing scheme to help high-growth start-ups sustain their operations throughout the pandemic. On August 17, 2020 the Deputy Prime Minister Heng Swee Keat announced a S\$150 million

funding allocation to enhance the Start-up SG Founder program, further supporting first time entrepreneurs. Enhancements to program included a new Venture Building programme, which was rolled-out in collaboration with local universities (NTU, NUS, SMU, SUTD and the Singapore University of Social Sciences, SUSS). In addition, there was an increase of the pre-seed grant amounts from S\$30,000 to S\$50,000 for eligible start-ups. To help start-ups to navigate various public and private sector support schemes related to COVID-19, Enterprise Singapore and ACE created an online one stop database of available support programs and relevant information.¹⁰⁶

Additional efforts were made to support non digital businesses in the digitization of their operations. Support to self-employed individuals was also provided. In this effort, the government launched the E-Commerce Booster Package, which covers 90% of the costs associated with starting operations on an existing e-commerce platforms.¹⁰⁷ Similarly, the government has also launched \$1.2 billion in the form of the Self-Employed Person Income Relief Scheme, which provides monthly support to self-employed individuals (such as gig-workers) and support for training.¹⁰⁸

¹⁰² World Bank team interview in Singapore, 2020.

¹⁰³ Ministry of Trade and Industry, Singapore. "Pro-Enterprise Panel", accessed March 12, 2021. <https://www.mti.gov.sg/PEP/First-Mover-Idea>

¹⁰⁴ Enterprise Singapore, <https://www.enterprisesg.gov.sg/financial-assistance/investments/investments/special-situation-fund-for-startups>

¹⁰⁵ Enterprise Singapore, June 5, 2020. [https://www.enterprisesg.gov.sg/media-centre/media-releases/2020/june/edbi-and-seeds-capital-to-provide-s\\$285-million-in-financing-to-promising-startups-to-tide-through-covid-19-period](https://www.enterprisesg.gov.sg/media-centre/media-releases/2020/june/edbi-and-seeds-capital-to-provide-s$285-million-in-financing-to-promising-startups-to-tide-through-covid-19-period)

¹⁰⁶ ACE, 2020. "Collated Resources and Support for Start-ups." <https://ace.org.sg/covid-19/>

¹⁰⁷ Lai, Leila. "Enterprise Singapore launches e-commerce help package for retail SMEs". Business Times, April 3, 2020. <https://www.businesstimes.com.sg/sme/enterprise-singapore-launches-e-commerce-help-package-for-retail-smes>

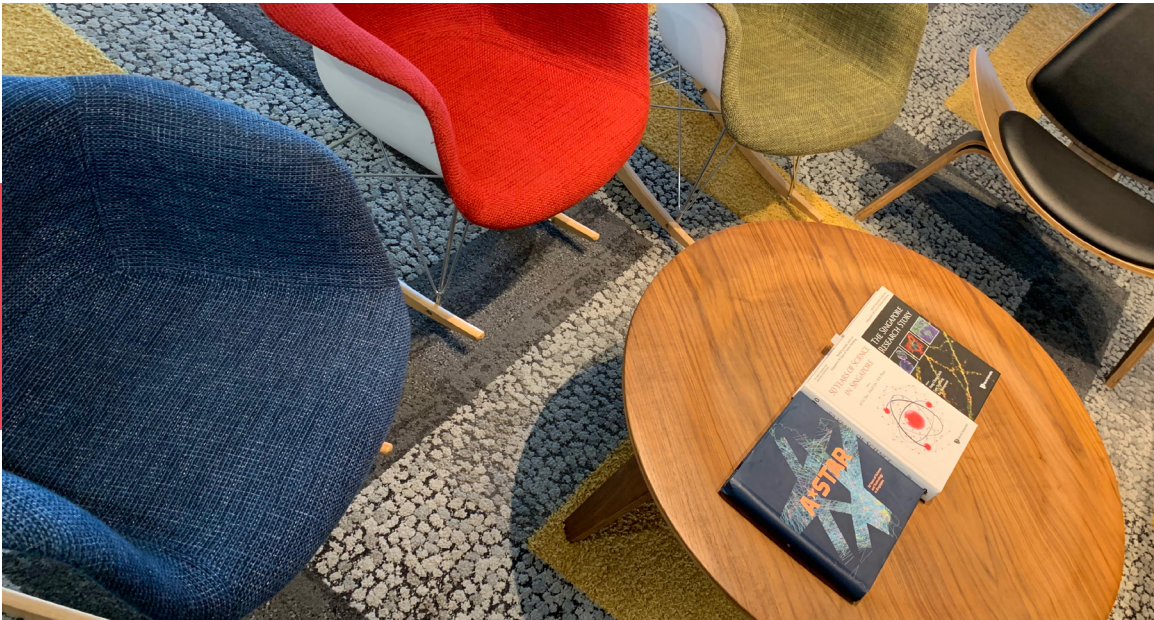
¹⁰⁸ Ho, Olivia. "Self-employed persons to get \$9,000 in cash under Supplementary Budget to cope with Covid-19 outbreak". The StraitsTimes, March 26, 2020. <https://www.straitstimes.com/politics/self-employed-persons-to-get-9000-in-payouts-under-supplementary-budget-to-help-singapore>

Box 4

Lee Kuan Yew and government leadership

In a 2002 speech at Singapore Management University, Lee Kuan Yew spoke of the need for Singapore to change its culture, values and mindset in order to increase entrepreneurial activity and mindsets in the country. Lee emphasized education and youth as critical to doing so. Beyond supporting the country's young people, Lee is also credited with guiding Singapore's economic development agenda and approach to efficient governance throughout his rule, which helped lay the foundation for today's start-up ecosystem. Lee's legacy of supporting entrepreneurship in Singapore continues on through current Prime Minister, Lee Hsien Loong. Prime Minister Lee has further encouraged behavioral changes surrounding the adoption of new technologies and related skill sets. During the annual May Day message in 2015, Prime Minister Lee launched the SkillsFuture initiative, which focuses on adopting new technologies to current business activities, and equipping workers with the necessary skills to leverage them. In his 2017 National Day Rally Speech, he called for a more simplified and integrated e-payment system, which further catalyzed the country towards becoming a cashless society.

Source: Singapore Management University. Mr. Lee Kuan Yew: An Entrepreneurial Culture for Singapore. (2002). Ho Rih Hwa Leadership in Asia Public Lecture Series; U-Wen, Lee. Productivity growing too slowly: PM Lee. Business Times, 2015; Ko, Valerie. Singapore lagging behind other cities in e-payment use: PM Lee. Today Online, 2017.



Strong university network that has a catalytic role in the ecosystem

Singapore is home to several world-class universities with specializations in engineering, technology and other sciences. Its university system is widely recognized for creating both a pool of highly talented individuals that can feed directly into competitive labor markets, and strong research and application capabilities. The Economist Intelligence Unit's 2019 Worldwide Educating for the Future Index ranked Singapore the fourth best globally, a rise in three spots from the previous year.¹⁰⁹ The World Bank Human Capital Index has ranked Singapore at the top of its rankings since the initial creation of the index.

The government of Singapore has consistently engaged several universities as well as A*STAR in its efforts to build strong linkages between researchers, students, start-ups and industry. Innovation and start-up challenges and other incubation programs through these academic institutions has encouraged new cohorts of aspiring entrepreneurs to start companies. The Lean LaunchPad and the Venture Building Programme that were introduced earlier are prime examples of how university networks have been leveraged systemically. While many universities encourage entrepreneurship as a valid career option and have established co-working and office spaces

for start-ups, initiatives like NTU's NTUitive and the Separation Technologies Applied Research and Translation (START) Centre also have further developed programs to support the commercialization of research, which has helped facilitate the launch of 40 to 50 new companies per year.

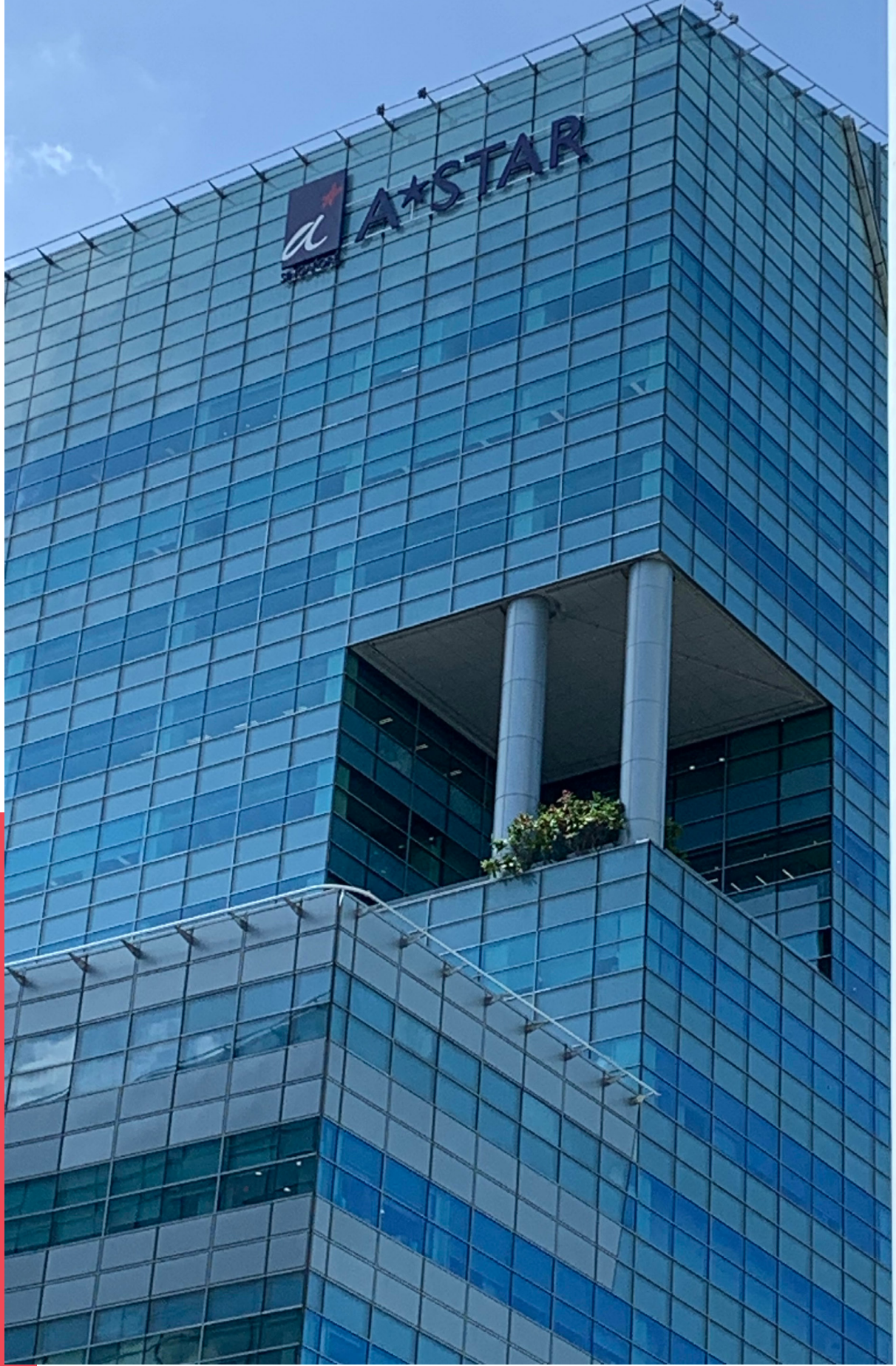
A noticeable indicator of how the country's academic sector is embedded in the ecosystem is NUS's role and mission. In addition to being a leading university in the country, its R&D work, and various programs to support entrepreneurship through funding, competitions, incubation and championing developments such as Block71 all cement NUS's indelible role in the ecosystem.

NUS has also taken a lead role in ensuring the Singapore's ecosystem has international linkages and relevance. University programs such as the SUTD Overseas entrepreneurship exposure through European Innovation Academy or the NUS Overseas Colleges (NOC) program immerses university students in established start-up ecosystems around the world with the hope of cultivating a mindset of innovation and entrepreneurship (there are about 400 undergrads placed around the globe at the moment via NOC). Since the inception of NOC in 2001, alumni have gone on to start well-known Singapore-based start-ups such as Carousell, Shopback, PatSnap and Zopim.¹¹⁰ A recent survey also found that a third of NOC alumni have attempted to start their own companies.¹¹¹ As of

¹⁰⁹ Economist Intelligence Unit. "Worldwide Educating for the Future Index 2019", From Policy to Practice., The Economist, 2019, accessed March 12, 2021. <https://educatingforthefuture.economist.com/the-worldwide-educating-for-the-future-index-2019/>

¹¹⁰ Wong, Poh Kam, Ho Yuen Ping, Ng Su Juan Crystal. "Nurturing Entrepreneurial Talent: The NUS Overseas Colleges Program, Findings from the inaugural survey of NOC alumni". NUS Enterprise Research Report, National University of Singapore, July, 2019. https://www.academia.edu/40006218/Nurturing_Entrepreneurial_Talent_The_NUS_Overseas_Colleges_Program_Findings_from_the_inaugural_survey_of_NOC_alumni

¹¹¹ Ibid.



2020, NOC has established a presence in the US, China, Germany, Vietnam, Japan, Israel, Switzerland, Sweden, and Canada.¹¹²

Just as Singapore has sent its students abroad to build international skill sets that could be leveraged in the ecosystem, Singapore has also focused on attracting promising students from other countries, such as China. For example, the NUS Technology Access program concentrates heavily on bringing in students from abroad, and it offers a PhD program for foreign students wherein they create joint intellectual property with NUS staff, and ultimately a license agreement can be established for the use of that intellectual property by private sector enterprises.

The Campus for Research Excellence and Technological Enterprise (CREATE) has established 15 joint research programs between Singapore's local universities and 9 top overseas institutions (including Massachusetts Institute of Technology, Swiss Federal Institute of Technology in Zurich, and Shanghai Jiao Tong University). As of 2019, CREATE laboratories have collectively produced over 5,500 publications in leading academic journals and worked with more than 100 companies. The research outcomes have also led to 23 spin-off companies. Additionally, through programs such as SkillsFuture, the country has placed a strong emphasis on upskilling, which allows individuals to continuously build their skill sets, thereby keeping pace with changing needs in the market. Within this program specifically, the participation has increased from 35% to 50%, on

par with other advanced economies. Additionally, in interviews with A*STAR, team members discussed their talent has linkages to roughly 60 different countries.

Global linkages and positioning

The government has also emphasized building global linkages to make the country a mainstay in international business, which has also helped its ecosystem and supports start-ups' ambitions to scale through cross-border innovation and commercialization opportunities. Despite its limited market and population size, Singapore has become a regional base for numerous global tech giants including Google, Facebook, Microsoft, LinkedIn, and Stripe, which all have offices in the country. In fact, according to data from Singapore's Economic Development Board, 59% of technology multinational corporations have regional headquarters based in Singapore, adding to the country's profile as a regional business hub.¹¹³ These large companies also help enable more potential synergies with local start-ups that can leverage their know-how and networks. To strengthen linkages with the start-up ecosystem, the government has been encouraging the establishment of corporate venture funds and corporate start-up programs, as well as vertical programs that convene several firms within a specific industry like maritime, or cyber security with linkages to U.S. and Israeli companies (the section below provides more details about industry specialization). This strategy includes activities such as the Open Innovation Network and National Innovation Challenges, making it easier for

¹¹² National University of Singapore, NUS Overseas Colleges, 2020. <https://www.nus.edu.sg/nusbulletin/school-of-business/undergraduate-education/special-programmes/nus-overseas-college-program-noc/>

¹¹³ Economic Development Board (EDB), Government of Singapore, 2020. <https://www.edb.gov.sg/en/our-industries/industries-and-key-activities/headquarters.html>.

start-ups to testbed or develop solutions/ technologies together with participating government agencies or with large corporates based in Singapore.

Beyond attracting international tech corporations, the government is collaborating with a large range of partners that support other nodes in the ecosystem. Accelerators from other countries have set up operations in Singapore, including German Accelerator, which took advantage of the country's business- friendly environment, large population of German businesses, and the lifestyle Singapore can offer to foreign professionals and their families.

As part of this process of global positioning, Singapore is also exporting elements of its own ecosystem. Block71, a heavily populated tech hub within the Launchpad @ One-North (see Box 1 for more details), has opened offices in San Francisco and Indonesia, and is actively exploring other countries for expansion by teaming up with existing local entities with a wide network and a strong understanding of the local market.¹¹⁴

Furthermore, to strengthen Singapore's connections to major innovation hubs around the world, the Global Innovation Alliance (GIA) was launched in 2017 to create more opportunities for students, entrepreneurs and businesses to gain overseas experience, connect and collaborate with their overseas counterparts, including partners like

German Accelerator.¹¹⁵ ESG is also proactively supporting internationalization efforts of Singapore based start-ups. Firms expanding to Indonesia and other targeted countries can have significant parts of their costs covered through resources allocated under ESG's Go Global theme. There are also bilateral and multilateral innovation efforts with Israel, Germany, France, Shanghai as well as the EUREKA Network (which has presence in over 45 countries as of 2020¹¹⁶). Programs such as these have helped Singapore attract global participation in major start-up events, such as SWITCH, which was introduced earlier, as well as Slingshot (an international competition for promising start-ups). In 2020, Slingshot received 3,417 applications across 134 countries.

Beyond supporting innovation and entrepreneurship, Singapore has also signed 24 free trade agreements with several nations including the US, EU, ASEAN and China, making trade across borders simple and hassle-free. The presence of global companies and educational institutions has enabled Singapore to leverage these relationships to promote mutually beneficial cross-border entrepreneurial efforts.¹¹⁷

Industry specialization

Keeping in line with the government's historic industrialization approach, the government is supporting specific sectors, namely deep-tech sectors, as mentioned earlier. In this regard, the public sector

¹¹⁴ World Bank team interview in Singapore, 2020

¹¹⁵ Enterprise Singapore, <https://www.enterprisesg.gov.sg/industries/hub/startup/global-innovation-alliance>

¹¹⁶ Eureka Network, <https://www.eurekanetwork.org/>

¹¹⁷ Kantelia, Max. "Innovation in the Lion City, Emerging technologies are shaping the future of entrepreneurship in Singapore". The Business Times, September 4, 2019. <https://www.businesstimes.com.sg/magazines/the-sme-magazine-septemberoctober-2019/innovation-in-the-lion-city>



is taking a lead role in beginning the specialization process, which could ultimately incentivize the private sector to follow suit. Additionally, multiple institutions and programs have been established with sector-specific focuses: CATALYST (innovation hub for the Medical and Health Technology ecosystem), PIER71 (Port Innovation Ecosystem Reimagined @ BLOCK71), ICE71 (Innovation Cybersecurity Ecosystem at Block71), SEEDS Capital (the investment arm of Enterprise Singapore has sector specific windows including a co-investment program for maritime technology start-ups), DxD Hub (Diagnostics Development Hub that co-creates and transfers new diagnostics IP to industry), NAMIC (National Additive Manufacturing Innovation Cluster hosted at NTUitive) and GROW (agrifoodtech impact fund and accelerator) are several examples.

In addition to the deep tech specialization, fintech is another area where Singapore's ecosystem is becoming increasingly specialized. For example, the Monetary Authority of Singapore (MAS) has created a legal framework for blockchain and cryptocurrency. In 2018, along with the Singapore Exchange (SGX) the MAS announced a collaboration with Anquan Capital, Deloitte and Nasdaq to explore safe and efficient trading across different blockchain platforms.¹¹⁸ The Infocomm Media Development Authority (IMDA) also launched a Blockchain Challenge in 2018 to provide seed funding to budding

projects and promote the development of blockchain solutions beyond fintech.

In 2018, Tribe Accelerator, the nation's first government-backed blockchain accelerator by locally based venture capital firm Trive Ventures, added 10 start-ups to its pilot program, half of which were founded in Singapore.¹¹⁹ By helping these blockchain projects fast-track their product development and encouraging the adoption of blockchain solutions in the wider market, such accelerator programs can promote greater awareness of the everyday uses of blockchain, propelling the industry forward in the long run. Furthermore, as a way to advance the industry from within, Singapore-based projects are also engaging with the blockchain ecosystem by offering support and funding to budding projects and developers, and universities as well are offering courses on blockchain.

Substantial and growing investment activity

Singapore is a regional leader in terms of venture capital activity.¹²⁰ Initially, multinational corporations were the main providers of risk capital to start-ups in Singapore. With MNC's playing this role, VC firms were of little necessity, though in the 1990s the VC community in the country began to grow.¹²¹ The government played an active role in this capacity as well through serving as a co-investor through public sector entities such as Temasek

¹¹⁸ MAS. "MAS and SGX partner Anquan, Deloitte and Nasdaq to harness blockchain technology for settlement of tokenised assets". Monetary Authority of Singapore (MAS), August 24, 2018. <https://www.mas.gov.sg/news/media-releases/2018/mas-and-sgx-partner-anquan-deloitte-and-nasdaq-to-harness-blockchain-technology>.

¹¹⁹ Kantelia, Max. "Innovation in the Lion City, Emerging technologies are shaping the future of entrepreneurship in Singapore". The Business Times, September 4, 2019. <https://www.businesstimes.com.sg/magazines/the-sme-magazine-septemberoctober-2019/innovation-in-the-lion-city>.

¹²⁰ Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>.

¹²¹ OECD Reviews of Innovation Policy, "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>.

Holdings and TIF Ventures, in addition to directly creating VC funds.¹²²

Though innovative fund structuring regulations and tax incentives such as the Variable Capital Company (VCC) legal structure combined with the announced \$5 billion private markets placement program, Singapore is further catalyzing international investment and incentivizing fund managers to open operations in Singapore.¹²³ In recent years US funds such as 500 Start-ups and Sequoia Capital have increased their presence in Singapore, while regional players such as Golden Gate Ventures, Jungle Ventures, and Rakuten Ventures have deepened in-country activity as well.¹²⁴ Additionally, corporate venture funds are coming to fruition, including CapitaLand Limited, Challenge Ventures, DeClout Limited, Garena Ventures, PSA unboXed, Razer Ventures, SPH Fund, Wilmar International Limited, and YCH Group Pte Ltd.¹²⁵ Increased investment activity has also come in the form of recent acquisitions that have taken place in the past several years. For example, Google, Zendesk and Sephora all acquired Singapore start-ups.¹²⁶ In addition to VC funds, Singapore is also home to several notable angel investment networks and platforms, such as the Business Angel Network of Southeast Asia (Bansea) which has operated for twenty years and now counts over 140 members. Angel Central is another example of a local entity that is supporting early-stage investments. It is also

notable that certain entrepreneurs who have exited their companies have also themselves become investors, helping promote a sense of cyclicity in the ecosystem.

In light of COVID, there are concerns and question marks globally about the venture capital industry. While some VC's in Singapore are confident that business will continue as usual, and others have recently raised funds that are ready to deploy, uncertainty remains and the full fallout, or limited effects of COVID on the country's VC activity remain to be seen.¹²⁷ Initial reports that reflect the numbers from the early stage of the pandemic, from the first half of 2020, indicate that although investors have been cautious, investments to start-ups had continued at relatively healthy levels. While seed level investments are not likely to reach the 2019 numbers, the overall start-up funding had reached S\$3.3 billion, which is just over half of the total funding amount in 2019 (S\$6.5 billion).¹²⁸ In addition, with 72 investments, Singapore had recorded the highest number of deals among Southeast Asia region during the second quarter of 2020.¹²⁹ As noted earlier, the government has introduced a temporary funding scheme, SSFS, until October 31, 2021. EDBI, the corporate investment arm of Economic Development Board, and SEEDS Capital are responsible for administering the S\$285 million SSFS for co-investment deals with private investors on a 1:1 basis.

¹²² Ibid.

¹²³ Singapore Venture Capital Association (SVCA), November 14, 2019. <https://www.mas.gov.sg/news/media-releases/2018/mas-to-place-up-to-us5-billion-with-private-equity-and-infrastructure-fund-managers>

¹²⁴ Cornu and Bongom. "Map of the Money 4.0" B2B Enterprise, September 19, 2016. <https://www.linkedin.com/pulse/map-money-40-arnaud-bongom/>

¹²⁵ Ibid.

¹²⁶ Ibid.

¹²⁷ Machado, Kenan. "Covid-19 be damned, Asia's top VC says it's open for business". Techinasia, April 21, 2020. <https://www.techinasia.com/covid19-damned-asias-top-vc-theyre-open-business>

¹²⁸ PWC, "Tech start-ups funding trends and outlook: Singapore. Preparing for a bigger leap forward?" Paper, 2020, accessed March 12, 2021. <https://www.pwc.com/sg/en/financial-services/assets/tech-startup-funding-trends-and-outlook.pdf>

¹²⁹ Wirdana, Ardi. "Startup Investments in SE Asia limping back after lull amid COVID-19 crisis". DealStreetAsia, November 10, 2020. <https://www.dealstreetasia.com/stories/start-up-funding-pick-up-214754/>

Box 5

Role of the private sector

While the government has been a critical catalyst from day one in building and shaping Singapore's start-up ecosystem, private entities are playing a significant role as well. The country's investment landscape continues to grow, due to myriad factors, including – foreign funds entering the country, entrepreneurs exiting their companies and becoming angel investors, high net worth individuals joining angel syndicates, and corporations creating venture capital funds.

As mentioned elsewhere in this report, Singapore is a regional leader in terms of venture capital activity. Since 2014, Singapore has accounted for well over half of total aggregate value of deals in the ASEAN region as well, and in 2019 Singapore invested approximately 75% of total VC dollars in the region, solidifying its leadership role amongst its neighbors (Prequin Markets in Focus: Private Equity and Venture Capital in Southeast Asia. Prequin, 2019). Local and foreign funds, including corporate venture capital vehicles comprise the landscape. Map of the Money, a research initiative that tracks pre-seed, Seed, Series A, Series B, Series C and Growth Stage investment rounds in Singapore has identified over 100 active investors at present. Funds from the US such as Sequoia Capital, 500 Start-ups, and B-Capital have all established offices in Singapore. Similarly, funds such as Wavemaker Partners have offices in Singapore and the US. Additionally, Golden Gate Ventures, Insignia Venture Partners, Jungle Ventures, and corporate venture capital funds including Innov8 Singtel have become leaders within the country as well as throughout the region.

The local private sector has also played a pivotal role at the early stages of the start-up process. Founded in 2001, BANSEA is the oldest angel network in Asia, and one of many within Singapore. It boasts collaborations and network sharing opportunities with angel networks in five other nearby countries, and also has deep ties with peer groups in the US and EU. Lastly, while the government has created large infrastructure projects such as the LaunchPad @ One-North, private entities – ranging from the start-ups themselves to funds, accelerators and other ecosystem players inhabit these real estate zones. Put differently, while the government has been the chief player in laying the groundwork for the enabling environment, and has often stimulated new initiatives, trends, opportunities, etc. the private sector's role is substantial and growing, and plays a key role in capturing, as well as building on, government-sparked momentum.



Challenges to ecosystem growth

Singapore's business environment, and the start-up ecosystem that it has created in the past two decades have captured the fascination and admiration of the global community. A mixture of targeted national policies supporting start-ups, funds, accelerators and unicorns, coupled with an already long roster of global corporations that have significant presences in Singapore have helped solidify the country's position amongst some of the more dynamic start-up ecosystems internationally.¹³⁰ The experience of Singapore provides unique insights into how a government can construct a sound environment for start-ups.

The previous sections have covered the most salient features of the country's start-up ecosystem, as well as addressed the government's prominent role in ensuring that start-ups, investors, and other members of the ecosystem have an enabling environment, as well as ample resource access, in which to operate. However, Singapore's ecosystem is not without its challenges. In this section we explore a few of the most prominent hurdles that the country faces on its pathway to advance its start-up community. Many of these challenges are not unique to Singapore. As Singapore navigates these challenges with the same focus, iteration, and whole-of-government collectivism that it used to address previous challenges there will be a great deal of attention from other countries to learn from Singapore's successes.

Singapore has shown a unique ability compress development time frames as a global city-state.

In many ways, the advantages and successes within the ecosystem also provide insight into challenges that it still faces. For example, the government's leadership in shaping as well as contributing directly to many ecosystem milestones also doubles as a potential challenge that must be addressed. Put differently, as discussed below, such noticeable government involvement can also lead to over-dependency on the public sector. Likewise, while the country's talent pool makes it attractive for employers and is a testament to its strong academic sector, there are nevertheless challenges that need to be addressed to ensure that start-ups can easily attract and retain the talent they need. Lastly, while Singapore is a regional leader in terms of VC and PE activity, its population of funds is still growing and diversifying, as are the types of investments that these funds are making.

Singapore has been able to establish a globally recognized start-up ecosystem in a shorter amount of time than arguably any other country in the world. Identifying its strengths, as well as assessing the lingering challenges that are linked to these strengths will ensure that the country can continue to build an increasingly competitive ecosystem.

¹³⁰ Start-up Genome. "Global Start-up Ecosystem Report, 2019", May, 2019. <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>

Limitations on the public sector as a catalyst

The government has been the chief catalyst for building the ecosystem, it is important that the public sector does not create dependencies or crowd out the private sector. Start-ups in Singapore were increasingly relying on government support in the last decade: 69% of start-ups were participating in government schemes in 2017, an increase from the 19% in 2010.¹³¹ A prevalence of government funding can have multiple negative repercussions on the ecosystem. First, it might be propping up foundering companies that should in fact cease operations. A 2017 report from NUS observes that the overall higher survival rates of start-ups in Singapore is not necessarily an indication of a healthy ecosystem. Put differently, many companies that should be closing down may in fact be receiving undeserved support for the government. Moreover, the study also suggests that the government funding tends to go towards company's producing simple innovations rather than producing brand new technologies based on substantive R&D that have the potential to scale rapidly. In this regard, while Singapore's university system has growing R&D activity, it might not be translating into fast-growth, innovative companies. Instead, the NUS study suggests that there is a preference to invest in relatively lower risk, lower growth start-ups.¹³² Of course, growing emphasis on deep-tech sectors, as discussed later in this report, signify that the government is taking steps to

move into more innovative verticals.

These trends may be creating a mixture of dependency on government funding that may not necessarily lead to company scaling at its potential velocity, as it may prolong current operations. As a result, the start-up community is comprised of smaller firms that has modest growth levels rather than faster-growing firms that can have a more notable impact on the economy. The prevalence of government support also introduces the question of what would happen should the public sector curtail involvement in the ecosystem, which could lead to a series of closures of both start-ups as well as accelerators and other institutions supporting them. The NUS study found that of the surveyed start-ups, over 52.7% of those founded in 2010 were still in operations in 2015, and 59.6% of high-tech start-ups were still in operation, relative to survival rates in the US and UK, which were 48.7% and 41.8%, respectively.¹³³ While factors beyond government support can also help to explain the relatively higher survival rates in Singapore, there still remains a case for faster time to failure, which can allow better business ideas to come to the surface, and also for entrepreneurs to learn from failures and build more successful companies.

Lastly, government involvement could create challenges for investors. Interviews with some investors suggested that while government financing to start-ups has been important, it has at times led to

¹³¹ Wong Poh Kam, Ho Yuen Ping, Ng Su Juan Crystal. Growth Dynamics of High-Tech Start-ups in Singapore A Longitudinal Study: Final Report 2017. Kam et. Al, National University of Singapore, Entrepreneurship Centre, 2017, accessed March 12, 2021. https://www.academia.edu/40044173/Growth_Dynamics_of_High_Tech_Start_ups_in_Singapore_A_Longitudinal_Study_Final_Report_2017

¹³² Ibid.

¹³³ Ibid. Note, "High-tech start-ups" are defined as "Singapore-incorporated firms with individual ownership of more than 50%, employing at least one worker and classified as belonging to sectors with high R&D expenditure and employment intensity"

skewing valuations and complicating the investment process.¹³⁴ This is not the intent of the government but common impact on valuations of companies receiving public fund and support globally. Similarly, while the government has taken significant steps to prioritize certain industry verticals, questions remain as to whether or not investors are able to deploy capital into those verticals.¹³⁵ For example, while the government is increasingly supportive of deep-tech industries, in order to maximize the potential of its deep-tech strategy, the government must ensure that investors in Singapore are able to identify relevant investment opportunities in deep-tech verticals. As such, if the government provides more funding and policy incentives to support deep-tech industries if Singapore's VC community is not aligned with investing in those sectors, then efforts to support deep-tech could be more costly than supporting sectors aligned with the focus of the VC community.

There are signs that the government is aware of the limits of the private sector as well as the risks of government interventions in building a start-up ecosystem. The government aims to remain agile in its initiatives and policies to avoid challenges mentioned above. For example, since 2017 it has included validation from private sector partners to be part of the support criteria and made

changes to the co-funding ratios in the SSG Equity and SSG Founder programs, by raising private sector contributions. By gradually reducing support from areas where private capital is increasing the government is able to redirect its resources to interventions that are riskier and take longer to attract private investments and support.

R&D has long been a priority for the government, and Singapore continues to enhance efforts to fully utilize and commercialize outputs

In the past two decades Singapore's R&D activity has increased considerably, as discussed earlier in this report. Gross Expenditure on R&D rose from \$0.8 billion in 1991 to \$9.3 billion in 2018, a 10% compound annual growth rate (CAGR).^{136,137} Additionally, research from the Ministry of Trade and Industry has also suggested that R&D investments boosted firms' productivity.¹³⁸ However, there is ongoing discussion as to the level of impact that R&D activities in the country have had on increasing start-up activity. Research from the NUS suggests that at least until recently local ecosystem investors preferred to invest smaller amounts across less innovative companies as opposed to making large investments

¹³⁴ World Bank team interview in Singapore, 2020.

¹³⁵ Ibid.

¹³⁶ Economic Survey of Singapore. "Returns to research and development among firms in Singapore", Ministry of Trade and Industry, Government of Singapore, Third Quarter 2019. https://www.mti.gov.sg/-/media/MTI/Resources/Economic-Survey-of-Singapore/2019/Economic-Survey-of-Singapore-Third-Quarter-2019/FA_3Q19.pdf

¹³⁷ National Research Foundation, Agency for Science, Technology and Research Singapore, "National Survey of R&D in Singapore 2018", December, 2019. <https://www.a-star.edu.sg/docs/librariesprovider1/default-document-library/news-events/publications/national-survey-of-r-d-2018.pdf>

¹³⁸ Economic Survey of Singapore. "Returns to research and development among firms in Singapore", Ministry of Trade and Industry, Government of Singapore, Third Quarter 2019. https://www.mti.gov.sg/-/media/MTI/Resources/Economic-Survey-of-Singapore/2019/Economic-Survey-of-Singapore-Third-Quarter-2019/FA_3Q19.pdf

into deep-tech, this was also observed during stakeholder interviews.¹³⁹ Having said that, in 2017 Singapore's government identified four deep tech sectors that Singapore needs to build including data science and artificial intelligence (AI), cybersecurity, the Internet of Things (IoT), and future communications infrastructure such as 5G mobile networks.¹⁴⁰ The government's increasing focus on deep-tech, as well as continued support for R&D and commercializing it, can help to spur new investment into start-ups operating in these sectors.

The success of R&D activities is typically measured through the level of commercialization, market linkages, venture funding, and/or other resources to ensure that the technology can translate into the private sector. The Open Innovation Network and National Innovation Challenges are examples of recent initiatives of how Enterprise Singapore, NRF and A*STAR have proactively strengthened the linkages between R&D and what the market demands. They encourage corporates to share challenge statements and invite start-ups and innovative companies to develop innovative solutions to address the challenge statements. NAMIC and DxD Hub introduced earlier are additional platforms that aim to facilitate commercialization. The ability to monitor results and track the outcomes of these

initiatives will be necessary to evaluate the effectiveness and success of the policy measures.

Singapore's university system is recognized for its ability to produce strong talent, yet Singapore is not spared from the challenges of the global talent crunch

Singapore's world class university system is renowned for the highly educated workforce that it provides. Yet given the country's small size there is inevitably a limited talent pool. Like many other developed economies, the presence of large corporations that can pay larger salaries and provide the perspective of greater career trajectory, can make it challenging for start-ups to attract and retain talent. While large corporations can find synergies with start-ups, and in general they can help in attracting investment into the country that can benefit start-ups as well, entrepreneurs may find it difficult to offer.¹⁴¹ Given the frontier nature of deep-tech, the ecosystem is finding it difficult, at least initially, to source the necessary skill sets to build deep-tech companies. In fact, a 2020 survey identified talent retention as a top challenge for Singapore's science and technology industry, followed by the ability to find talent locally, as well as attract talent from abroad.¹⁴² To that end, previous

¹³⁹ Wong Poh Kam, Ho Yuen Ping, Ng Su Juan Crystal. "Growth Dynamics of High-Tech Start-ups in Singapore A Longitudinal Study". Final Report 2017. Kam, et al. National University of Singapore, Entrepreneurship Centre, 2017, accessed March 12, 2021. https://www.academia.edu/40044173/Growth_Dynamics_of_High_Tech_Start_ups_in_Singapore_A_Longitudinal_Study_Final_Report_2017

¹⁴⁰ Infocomm Media Development Authority. "Singapore's Digital Economy gunning for four key areas". Government of Singapore, June 27, 2017. <https://www.imda.gov.sg/news-and-events/impact-news/2017/06/singapores-digital-economy-gunning-for-four-key-areas>

¹⁴¹ OECD Reviews of Innovation Policy. "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

¹⁴² SGInnovate. "Understanding the Science and Technology Talent Landscape in Singapore". SGInnovate, February 4, 2020. <https://www.sginnovate.com/pressroom/singapore-viewed-competitive-global-science-and-technology-rd-hub-next-decade-sginnovate>

studies have also suggested that while the country has demonstrated a steadily growing commitment to R&D, the training of students and young professionals in R&D subjects deserves more attention.¹⁴³ While the situation is steadily improving, the IMD World Competitiveness Yearbook often places Singapore behind most of the advanced OECD countries in terms of availability of skilled labor.¹⁴⁴ In general, the process for becoming a permanent resident remains a challenge and while there are certainly some entrepreneurs and employees who have established a long-term presence in the country, it is a rarity, thus creating an additional challenge in attracting the best and brightest minds to Singapore.

While some Singaporean start-ups have been successful in acquiring talent from abroad, regulations and bureaucratic hurdles which constrain the free flow of international talent into Singapore, may further hinder start-ups' efforts to find the necessary skills, and could lead both employees as well as entrepreneurs to settle in neighboring markets. According to interviews with players in the ecosystem, there have been a variety of experiences and challenges surrounding the immigration process when entrepreneurs are attempting to recruit from abroad, or foreign entrepreneurs are seeking to establish operations in Singapore.¹⁴⁵ The government has taken many steps to ease this challenge but political economy

aspects of providing jobs for locals remains a challenge. The government has established EntrePass and Tech@SG schemes to attract global talent and facilitate a smooth establishment of operations, one entrepreneur said that founders were able to obtain EntrePasses, but meeting the renewal requirements was challenging due to minimum business spending and local employment targets. In some cases, entrepreneurs discussed how an affiliation with an established institution such as Block71 was helpful in the entry process, though the circumstances change if companies do not have such relationships.¹⁴⁶ As an extension to the Tech@SG programme, EDB and ESG are also launching a Tech.Pass in January 2021 to attract experienced entrepreneurs and tech product leaders to the country.

Increased regional competition as Singapore's neighbors build and grow their own start-up ecosystems

Singapore's history is shaped largely by global business linkages, making it impossible to discuss the country's current economy without highlighting the ways in which it has benefitted from globalization. Indeed, regional integration is nothing new to Singapore. Given the country's relatively small domestic market, the Singaporean economy is dependent on regional and global markets for growth.¹⁴⁷

¹⁴³ OECD Reviews of Innovation Policy. "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

¹⁴⁴ Yearbook. "IMD World Digital Competitiveness Ranking". International Institute for Management Development 2020, accessed March 12, 2021. <https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2020/>

¹⁴⁵ World Bank team interview in Singapore, 2020.

¹⁴⁶ Ibid.

¹⁴⁷ OECD Reviews of Innovation Policy. "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

Likewise, internationalization opportunities are a key feature of its start-up ecosystem, enabled by both the country's proximity to large Asian markets as well as the local presence of multinational corporations. However, as neighboring countries such as Vietnam and Indonesia have begun establishing their own start-up ecosystems, regional competition has substantially increased. A start-up attempting to scale from Singapore into a neighboring market will now find it more difficult than it may have faced in years past. Taking note of this, Singapore's 2020 budget features specific allocations for enhancing regional and global connectivity for its ecosystem.¹⁴⁸ Lastly, interviews with stakeholders suggested that the Singapore brand, in terms of its entrepreneurship ecosystem, can also affect how it is positioned vis a vis its neighbors. For example, the country has traditionally garnered recognition for being a global business hub, which does not necessarily equate with it being seen as a hub for quality products and innovation.¹⁴⁹ Regional competitors such as Japan and South Korea may be more easily viewed as producers of cutting-edge technology products, Singapore will need to continue to actively brand itself as the place for deep-tech, biomedical, financial and other innovations on the global stage.¹⁵⁰

Despite Singapore's growth as the domicile of VC and PE funds as

well as family offices the country is not yet free of funding gaps

Consensus suggests that the launch of the T21 fund marked the official beginning of Singapore's VC industry. Indeed, the fund attracted several leading global VC's, even though it achieved only decent returns.¹⁵¹ Singapore still ranks below the global average for early-stage funding, both in terms of the standard amount received by younger start-ups and the total aggregate funding at early-stages, when compared with over 50 ecosystems globally.¹⁵² According to the 2019 global Start-up Genome report, the average early-stage funding size for start-ups stood at \$284,000, versus an average of \$202,000 in Singapore. Additionally, the average amount of early-stage funding across ecosystems globally was approximately \$837 million, versus \$540 million in Singapore. Additionally, funding for later-stage companies may also be harder to come by in the country. A lack of exit opportunities may disincentivize later-stage investments. Across Southeast Asia as a whole, compared to the US and EU, IPOs in the region are still comparatively rare and most exits happen through acquisition.¹⁵³ And while there may be more acquisition activity vis a vis IPOs, M&A activity in Singapore is also relatively rare, and local corporations minimally active in acquiring start-ups.¹⁵⁴ The

¹⁴⁸ KPMG. "A Time Move to Forward", Singapore Budget 2020., accessed March 12, 2021. https://assets.kpmg/content/dam/kpmg/sg/pdf/2020/02/KPMG_Singapore_Budget_2020_Report.pdf

¹⁴⁹ World Bank team interview in Singapore, 2020.

¹⁵⁰ Ibid.

¹⁵¹ Ibid.

¹⁵² Start-up Genome. "Global Start-up Ecosystem Report, 2019", May, 2019. <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>

¹⁵³ Randolph, Sean. "Singapore and the Bay Area: Leveraging Emerging Opportunities in Southeast Asia". Bay Area Council, Economic Institute, January, 2020. <http://www.bayareaeconomy.org/files/pdf/SingaporeAndTheBayAreaJanuary2020.pdf>

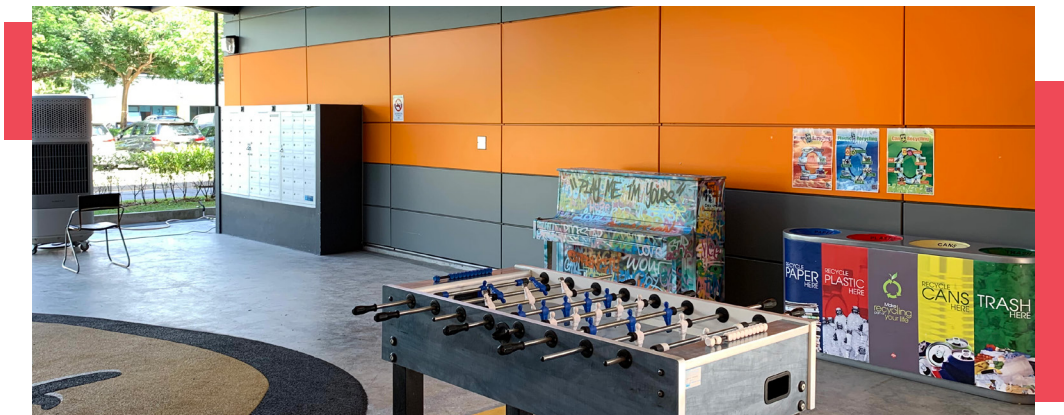
¹⁵⁴ Golden Gate Ventures. "Southeast Asia offers big exits (Just Not through IPOs)", March 1, 2016. <https://goldengate.vc/news/southeast-asia-offers-big-exits/>

country's small market size can also pose challenges for investors seeking to grow their portfolios exclusively in Singapore. Interviews with local investors explored how many funds have had to expand their mandates to neighboring countries as Singapore alone will not provide enough deal flow.¹⁵⁵

Funding gaps may also be more acute for specific sectors. For example, as deep-tech is a relatively new sector for the ecosystem, adequate funding for start-ups in this sector might be lacking. The government has also allocated funding for the 2020 budget focusing on strengthening its local VC community.¹⁵⁶ From a regulatory standpoint, the country can also explore several strategies to improve outcomes for VC's. For example, improving the tax regime, the exit environment, and allowing foreign funds to register as fully independent limited partnerships can all help to increase investment flows.¹⁵⁷ These

measures could all create a more friendly environment for current VC's and also attract others to be created, or to expand operations into Singapore from abroad.¹⁵⁸ There is an increase in government involvement in building a more VC-friendly environment, and also growing the overall size of Singapore's VC community, which is still smaller than neighbors China, Hong Kong, South Korea, India and Japan.¹⁵⁹

Lastly, policy moves targeting funds helped the country in assuming this leadership position. Tax incentives, added flexibility for structuring of funds such as the new Variable Capital Company (VCC) legal structure combined with the announced \$5 billion private markets placement program all likely helped, and may indeed attract more fund managers to the country in the future.¹⁶⁰ These efforts are seeding initiatives for the ecosystem until a critical mass of investment funds and deal flows across asset classes can be achieved.



¹⁵⁵ OWorld Bank team interview in Singapore, 2020.

¹⁵⁶ KPMG. "A Time Move to Forward", Singapore Budget 2020. Accessed March 12, 2021. https://assets.kpmg/content/dam/kpmg/sg/pdf/2020/02/KPMG_Singapore_Budget_2020_Report.pdf

¹⁵⁷ Lin, Lin. "Venture Capital in Singapore: The Way Forward" Paper. Journal of Business Law, July 18, 2019. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3216265&download=yes

¹⁵⁸ Ibid.

¹⁵⁹ Ibid.

¹⁶⁰ Preqin. "Markets in Focus: Private Equity and Venture Capital in Southeast Asia". Preqin, September 3, 2019. <https://www.preqin.com/insights/research/reports/preqin-markets-in-focus-private-equity-venture-capital-in-southeast-asia>

Further questions facing the ecosystem



The above challenges highlight several large-scale hurdles that the ecosystem faces. Government involvement, talent acquisition and retention, investment availability, and increased regional competition are all lingering issues that face the ecosystem. In addition to these challenges, below we highlight a series of other important areas that have been observed through our research and interviews, which could create additional impediments on the scaling of the ecosystem.

Female entrepreneurs are in the minority

According to Start-up Genome's global report, on average female entrepreneurs make up roughly 14% of an ecosystem's population. Singapore is slightly below this number at 13%. It also lags behind other global ecosystem hubs in terms of female representation, including New

York, London, Beijing, Silicon Valley, and Los Angeles.¹⁶¹ Furthermore, the Dell Women's Entrepreneur Network ranked Singapore 21st out of 50 major metropolitan areas in terms of supporting female entrepreneurs.¹⁶² Indeed, Singapore is not alone in terms of its lack of female entrepreneurship across the ecosystem. However, it arguably has an opportunity as well to take a leadership role in supporting both current and aspiring women entrepreneurs that others can emulate.

Access to data and validation of impact

There is minimal data available on the ecosystem, as well as the degree to which efforts to support start-ups have achieved developmental impact.¹⁶³ For example, as discussed throughout this report, there have been numerous government initiatives and large sums spent in order to

¹⁶¹ Start-up Genome. "Global Start-up Ecosystem Report, 2019", May, 2019. <https://startupgenome.com/reports/global-startup-ecosystem-report-2019>.

¹⁶² Dell & Crunchbase. "Dell 2019 Women Entrepreneur Cities (WE Cities) Index" Dell Women's Entrepreneurs Network, September 23, 2019. https://i.dell.com/sites/csdocuments/CorpComm_Docs/en/Dell-WE-Cities-2019-Executive-Summary.pdf

¹⁶³ World Bank team interview in Singapore, 2020.

create new funds, programs, real estate, and other initiatives, yet the specific results and how these efforts have led to tangible development outcomes is still unclear. While some studies have attempted to quantify the number of start-ups and jobs created, among other relevant statistics, numbers around firm performance, growth, impact, and other necessary data necessary to evaluating the efficiency and output of the ecosystem are more difficult to ascertain. Indeed, Singapore's high rankings in global indices are a testament to its sustained progress across different development dimensions. Yet, without knowledge on the specific outcomes of individual efforts and impact that the funding has achieved, pinpointing the precise areas for improvement is difficult. Development practitioners and policymakers, as well as investors face difficulties when operating without such insights. One investor interviewed said that, given data constraints, they are forced to primarily rely on U.S. forecasts from several years ago to make predictions for the local market.¹⁶⁴

Prioritizing sectors

The government's growing emphasis on deep-tech is aligned with global trends and signifies an ambition to specialize in high-growth tech verticals that can also help the ecosystem deepen its international linkages. Indeed, this prioritization signifies the public sector's responsiveness to shifting markets globally, and ability to maintain pace with start-ups and VC's in other leading ecosystems. Much like other

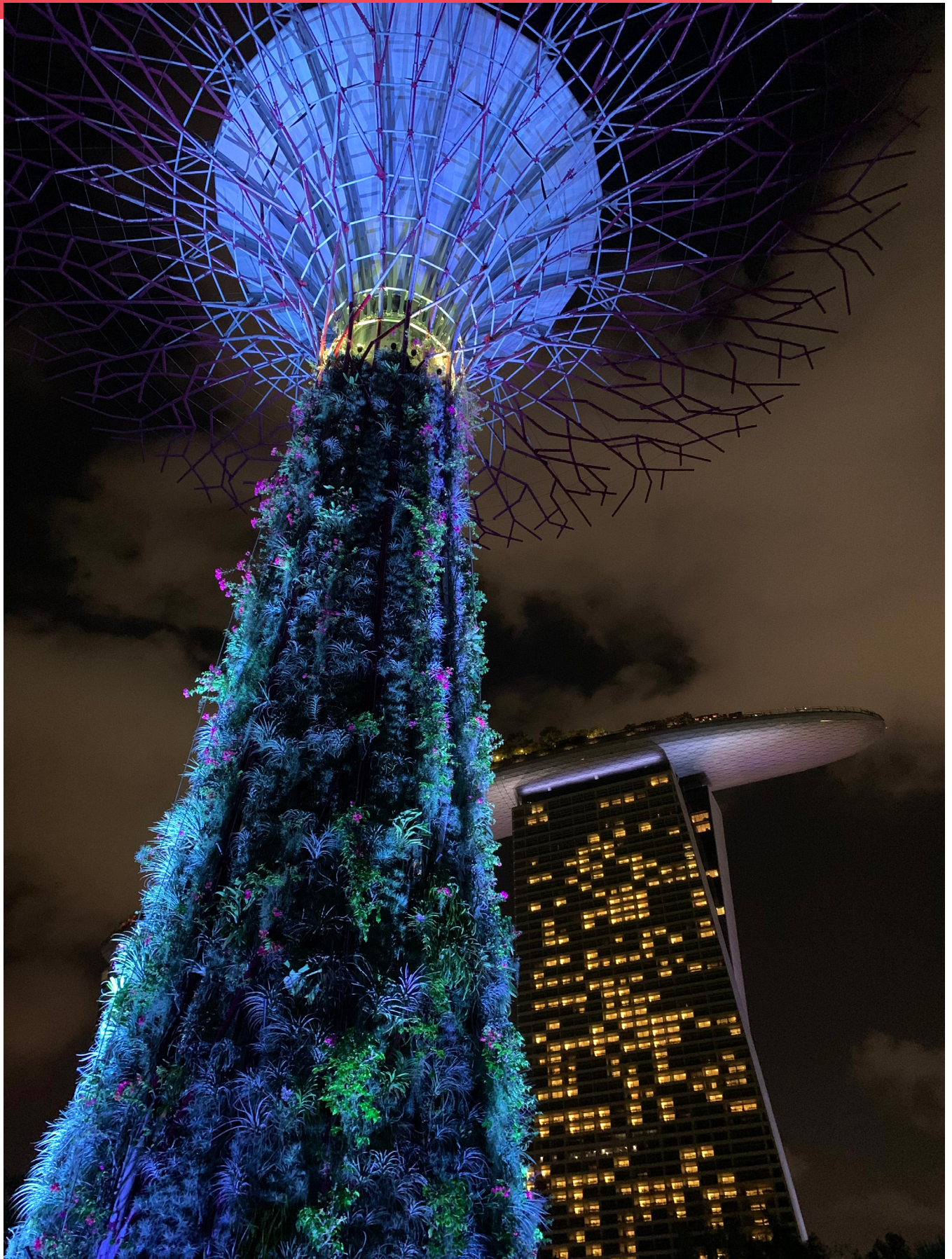
examples in the history of Singapore's ecosystem, the government is plugged in to important developments that hinge on both R&D advancements as well as commercialization efforts. ESCO, operating in the biotech space, is one example of a deep-tech company that has already expanded operations to many companies.

Simultaneously, interviews with ecosystem leaders in Singapore explored how the focus on these sectors is, in essence, an investment with an indeterminate timespan for success.¹⁶⁵ When assessing the future prospects of this strategy, it is important to keep in mind that the deep-tech field is still maturing globally, and Singapore's specific role within the deep-tech fields will need to remain agile to the shifting winds of international markets. The research underpinning deep-tech innovations often takes years to bear fruit and requires substantial funding along the way.¹⁶⁶ Even after commercialization deep tech start-ups may face unique challenges. Deep-tech focused funds are still coming to fruition, suggesting that VC's in Singapore may not yet be fully prepared to absorb incoming deals and capitalize on opportunities derived within deep-tech. The development of the deep-tech fund ecosystem should continue hand and hand with the deep-tech R&D and commercialization. The successful IPO of Nanofilm at the end of October, 2020, which raised the company to a unicorn status with the S\$1.7 billion valuation definitely gives hope to both existing and aspiring deep-tech funds as they weigh their future options.

¹⁶⁴ Ibid.

¹⁶⁵ Ibid.

¹⁶⁶ SGInnovate. "Deep Tech Investments: Realising the Potential". SGInnovate Insights, September 2, 2019. https://cdn2.hubspot.net/hubfs/3032335/investments/deep-tech-investments-realising-the-potential.pdf?__hstc=113141851.ff641905044c63b124f7c7a7c4033d59.1567654249666.1567654249666.1567654249666.1&__hssc=113141851.2.1567654249666





Conclusion

Since Singapore experienced its first economic recession in 1985, the government has built a robust, dynamic strategy supporting innovation and its start-up ecosystem, as a key element of its efforts to move up the global economic value chain and provide high quality jobs for its citizens. A growing number of policies, committees, and agencies, including increasingly large government investment schemes, have been deployed to support the country's start-ups. Indeed, this multi-faceted strategy has stayed true to the country's historic focus on industrial specialization and job creation, while also ensuring that Singapore builds progressively knowledge-intensive sectors. Over the past several decades its community of investors, university programs for R&D and entrepreneurs, accelerators, unicorns, and start-ups has grown. Steadily, its ecosystem has also garnered recognition globally.

This report has covered some of the main characteristics of its start-up ecosystem,

as well as the challenges it still faces. Additionally, it has explored in brief the events leading up to the creation of the ecosystem during Singapore's first decades. We conclude with several key takeaways that emerging markets can use to understand the story of Singapore's start-up ecosystem.

Singapore's start-up ecosystem is a deliberate effort of a larger, sustained government effort to make the country economically competitive globally.

The government's policies and strategies to support start-ups, and thereby establish and grow the start-up ecosystem, began to appear prominently in the late 1980s. However, significant planning and development took place before then to improve Singapore's business environment and make it an economically competitive country. For example, a focus on enhancing quality of human capital, focusing on R&D, attracting foreign MNCs, building an efficient and agile government, were all precursors to building today's ecosystem. As such, the current start-up ecosystem is the result of decades of economic development efforts that eventually led to targeted start-up support schemes, but began with broader, different objectives.

The government has led the creation of the ecosystem and has also identified areas where other entities could enter.

Singapore's government has actively cultivated the ecosystem both in country and abroad. It has also steadily identified gaps in the ecosystem and taken bold steps to address them. For example, the current experience in supporting specific deep-tech verticals demonstrates this role. Recognizing a global trend surrounding deep-tech verticals, and in parallel observing how its own ecosystem lacked substantial expertise technological domain, Singapore's government prioritized deep-tech in its national strategy. It also engaged multiple nodes of the ecosystem in this process, helping universities, funds, accelerators and start-ups themselves to enter deep-tech verticals.

Support for science and technology, as well as entrepreneurship, is embedded throughout government ministries.

Enhancing Singapore's performance in science and technology verticals has been a key focus of the government's efforts for several decades, which, as discussed in this report has featured policies, strategies and committees that preceded the start-up ecosystem's creation. While some ministries indeed allocate more spending to supporting these sectors as well as the ecosystem than others, policies supporting these areas are not formulated in isolation. Rather, science and technology are

themes embedded throughout government ministries.¹⁶⁷ Thus, while the government remains the primary enabler for the country's start-up ecosystem, it has infused support for it throughout the entire national economic plan, which can help ensure that ministries are coordinating.¹⁶⁸

Singapore's academic sector plays a lead role, both in terms of education and direct support to the ecosystem.

While Singapore's academic sector is first and foremost tasked with educating its youth, examples such as NUS demonstrate how the country's educational institutions provide far more to the start-up ecosystem than talent. To date, NUS has supported the ecosystem both in and outside of the country, championing incubation and community initiatives such as Block71, supporting R&D, building linkages abroad to other ecosystems via the NUS Overseas College programme, and helping to cultivate an entrepreneurial mindset amongst students, in addition to other viable contributions.

Singapore's story from day-one was one of globalization, and its ecosystem, has adopted this mentality as well.

The country's start-up ecosystem is constantly creating footholds in other markets and also helping other countries' ecosystems to establish a presence in Singapore. These efforts manifest themselves in a number of ways – global accelerators, universities, and corporate

¹⁶⁷ OECD Reviews of Innovation Policy, "Innovation in Southeast Asia", April 24, 2013. <https://www.oecd.org/sti/inno/innovation-in-southeast-asia-2012-9789264128712-en.htm>

¹⁶⁸ Ibid.

VC's from MNC's, to name a few, all have a presence in Singapore, just as ESG's partnerships with accelerators with in-market networks abroad – under the GIA programme, NUS Block71, and other entities have pronounced presence abroad. The country has also created talent exchange programs to facilitate the movement of Singapore students as well as foreign students out and into the country, respectively.

The country's ecosystem is driven with a forward-looking mindset to maintain pace with global tech and entrepreneurship trends.

From attracting international leaders in the VC and accelerator space, to serving as the home for big name tech corporations, and establishing a foothold in the global deep-tech sector, Singapore has remained consistently aware of, as well as connected to, key tech and entrepreneurship trends globally. Important to note as well is that while new funds and other organizations may be the surface-level symbols of this connectedness, they are also underpinned by a decades-

long commitment to R&D and a healthy academic sector, both important pieces for Singapore to establish a strong foundation for innovative firms to thrive.

Singapore constantly evaluates its strategies, adjusts priorities as needed and operates with agility to address evolving challenges.

Despite the country's global competitiveness, in this report we have identified several challenges that Singapore will need to address to ensure that its start-up ecosystem continues to grow and compete globally. Talent, funding gaps, and increased regional competition, to name a few, are all areas requiring new solutions. While there are common themes that have influenced Singapore's development strategy throughout its history – global linkages, a business-friendly environment, etc. – its approach to supporting its start-up ecosystem has evolved over time. To this day the government still initiates new strategies and remains quick to respond to challenges at home as well as new opportunities from abroad.

Appendix:

List of individuals interviewed

Organization	Type	Name	Role
Skills Future Singapore	Government Agency	Michael Fung	Deputy Chief Executive (Industry), Chief Human Resource Officer and Chief Data Officer
ESG	Government Agency	Marcus Wong	Development Partner
E27	Media and News agency	Mohan Belani	Chief Executive Officer and Co-Founder
NUS Entrepreneurship Centre	University	Wong Poh Kam	Director
NUS Enterprise	University	Freddy Boey	Deputy President of Innovation & Enterprise at NUS enterprise
JTC Corporation	State Owned Enterprise	Poh Cai Ling	Assistant Director
Ministry of Health	Government	Cheong Wei Yang	Deputy Secretary (Special Projects)
A*ccelerate	Government Agency	Philip Lim	Chief Executive Officer (and Chief Risk Officer of A*STAR)
SeedPlus	VC Fund	Tiang Lim Foo	Partner
NTUitive	University	Lim Jui	Chief Executive Officer
		Adil Dhalla	Managing Director, START Centre
ESCO Ventures	Corporate VC Fund	XQ Lin	Founder and Managing Partner
Angel Central	Angel Group	Huang Shao-Ning	Partner and Chief Angel
Action Community for Entrepreneurship (ACE)	Ecosystem Catalyzer	Edmas Neo	Executive Director

Organization	Type	Name	Role
Block 71 / NUS Enterprise	Start-up Hub / Ecosystem Catalyzer	Gang Chern Sun	Programme Director
Wig Holdings	Start-up	Jennifer Zhang	CEO
KleenSoil	Start-up	Lin Xuanhao Lu Di	Co-founder Co-founder
PS Love	Start-up	Peck Ying Tan Caleb Leow	Co-founder Co-founder
Aimazing	Start-up	Jun Tin	CEO
SG Innovate	Government owned investment fund and ecosystem catalyzer	Steve Leonard	Chief Executive Officer
Big Idea Ventures	VC Fund	Christian H. Cadeo	Managing Partner
Confetti Fine Foods	Start-up	Betty Lu	Founder and Chief Executive Officer
Level Life	Start-up	Avinash Aswani	Co-Founder
Singapore Tourism Board	Government Agency	Poh Chi Chuan	Executive Director, Digital Transformation
German Accelerator	Start-up Accelerator	Claus Karthe	Founder and Chief Operating Officer South East Asia
Golden Gate Ventures	VC Fund	Jeffrey Paine	Founding Managing Partner
Accelerating Asia	Start-up Accelerator	Amra Naidoo	Co-Founder, Partnerships and Operations Director

