Thailand: Scale-up Nation 2030

Accelerating the Innovation Economy

A White Paper

October 2020

Natcha Thawesaengskulthai
Vice President for Strategic Planning, Innovation & Global Engagement,
Department of Industrial Engineering, Faculty of Engineering,
Chulalongkorn University, Bangkok, Thailand
E-mail: natcha.t@chula.ac.th

Caroline Hyde
Head of International Relations & Outreach, Cambridge Enterprise
E-mail: Caroline.Hyde@enterprise.cam.ac.uk

David Gill
CEO, St John's Innovation Centre, Cambridge
E-mail: degill@stjohns.co.uk

First published in 2020

Chulalongkorn University Press
254 Phyathai Road, Pathumwan, Bangkok 10330 Thailand
Tel: +66 2218 3549 – 50, +66 2218 3563
Email: cuprint@chula.ac.th
Website: www.cupress.chula.ac.th/

"The **Innovation Club** is an informal association of leaders dedicated to enabling **innovative start-ups** to scale and **go global**, transforming Thailand's **economy and society** through **sustainable growth.**"

Innovation	"Practical implementation of new ideas"
Entrepreneurship	"Growing the pie: creating significant value for customers, stakeholders"
Innovation & Entrepreneurship	"Scalable, successful exploitation of new ideas"
Scaling	"Adding revenues exponentially, but resources incrementally"
Sustainable	"Ecosystem: developing its own momentum through recycling resources (talent, funding, infrastructure)" "Economy: thriving while limiting depletion of natural resources" "Society: wide distribution of benefits from innovation and growth"

CONTENTS

Foreword by the Authors 03
Elevator Pitch 04

Executive Summary 06
1. Innovation Club: Changing Mindsets, Transforming the Economy 10
    Steering Group 11
    Annual Convention 11
    Executive Team 12
    Innovation Dashboard 12
2. Ecosystems: Context and Definitions 16
3. Ecosystem Case Studies & Lessons: 23
    Silicon Valley 23
    Cambridge 25
    Israel 26
    What Can We Learn? 29
    Challenges for Ecosystems 30

SingularityU Thailand Partners Event – Summary Presentation 32
About the Authors 35
Further Reading 37

FOREWORD BY THE AUTHORS

> "The prosperity and happiness of the nation and the people are not the achievement of any single person – it is a cooperative effort."

The Late King Rama IX, His Majesty Bhumibol Adulyadej
Royal Speech, Dusit Palace, 4th December 4, 1998

All three of us have worked for many years as practitioners in innovation and entrepreneurship. We were delighted to be approached by a group of stakeholders based in Bangkok who understood intuitively that Thailand now has the opportunity to build on its achievements in the start-up sphere and who sought practical recommendations for the next phase of the national entrepreneurial journey.

This White Paper grew out of our regular interactions over three months. The global pandemic meant that the Cambridge team could not undertake any fieldwork in Thailand, but the combination of Chula's embedded knowledge with previous research and frequent video conferencing nevertheless allowed us to work constructively, combining local and international experience to understand current Thai needs and opportunities.

Our discussions – summarised in the following White Paper – revealed that Thailand has indeed successfully grown an active start-up economy, but that wider social and economic benefits can only be achieved by rebalancing the focus of education, training, policy and investment towards creating more scale-up firms. Research in other countries shows that a small minority of high-growth firms delivers the majority of economic and employment growth.

No single intervention can accelerate Thailand's transition to become a 'Scale-up Nation' by 2030. Numerous improvements – increases in risk funding, changes to employee share option regulations, training and mentoring of entrepreneurs – will be required in the next few years. The list of actions is not static; it will evolve as early measures impact the economy and new, unmet needs are identified.

But to ignite active engagement among a wide range of stakeholders, leading to concrete action, we have set out what we consider to be the changes most likely to accelerate Thailand's transition from a start-up to a scale-up nation by 2030. Public debate will no doubt uncover ideas we have not yet considered, improve some that we have, and establish good reasons for not implementing others. We welcome wide discussion of the ideas in this White Paper over the coming weeks.

Assoc.Prof. Dr. Natcha Thawesaengskulthai
Vice President for Strategic Planning,
Innovation & Global Engagement,
Chulalongkorn University

Caroline Hyde
Head of International
Relations & Outreach
Cambridge Enterprise

David Gill
Chief Executive Officer
St John's Innovation Centre
Cambridge

1st October 2020

ELEVATOR PITCH

> “Club (noun): an organization of people with a common purpose or interest, who meet regularly and take part in shared activities.[1]”

Thailand has much to celebrate for having created a vibrant start-up economy over the past decade. Its next challenge is to make scaling-up the norm for ambitious, talented entrepreneurs. Unless a higher proportion of start-ups can be helped to scale, the economy risks being caught in a modern variant of the ‘middle-income trap’.

International experience shows that a disproportionate amount of economic growth is created by a minority of scale-up firms, often fewer than one in ten of all businesses. Scaling is not the same as gradual growth: scale-ups are built to **add revenues exponentially** but resources only incrementally, often after significant initial injections of risk capital and assistance for capacity building. Scale-ups may move rapidly to automating delivery processes and develop specialist competencies hard to replicate, so as to solve major problems for paying customers and society – often through **exporting.**

Scaling:
growing exponentially
while adding resources
incrementally.

Adapting to Thailand’s circumstances the experience of leading technology clusters around the world (Silicon Valley, Cambridge and Israel), this paper proposes the creation of an **informal ‘club’** of senior leaders volunteering their energy and wisdom to shaping an **entrepreneurial ecosystem** designed to accelerate Thailand’s transition to a scale-up nation. Drawn from among established businesses, investors, academia and the public sector, club members will pursue the development of a new culture and the creation of sufficient inherent momentum through **‘recycling’ critical resources** (entrepreneurs, investment, incubators) so that external intervention such as reliance on government support, philanthropic funding or imported expertise is no longer essential. The club has already attracted a number of founder-members.

Since creativity is favoured by serendipity or the chance coming together of practitioners from different specialisms, each year a **high-level convention** will debate new challenges and propose fresh solutions as Thailand progresses towards becoming a dynamic innovation-based economy. Like the club, the convention is to be focused on results, efficient rather than ceremonial.

Successful ecosystems benefit from clear **coherence between institutional capabilities and market opportunities.** Digital skills and infrastructure are the enablers underpinning all other areas of future innovation. An initial appraisal of the overlap between existing technical strengths and market readiness indicates that maximum impact will occur through concentrating on three overarching categories: Food & Agriculture; Health; and Sustainable Development, which includes inclusive communities. For Thailand, entrepreneurship is expected to continue to **solve fundamental social challenges**, as pioneered by the late King Rama IX.

Starting as soon as possible with a **baseline study** of Thailand’s existing innovation infrastructure as a future benchmark, ***policy recommendations*** designed to bring the country up to international best practice (in key areas such as access to risk capital, employee share options, government procurement, exporting, management education and attitudes to risk) ***are set out in section 1*** and will be worked up in detail for implementation.

The Innovation Club looks forward to working with the Government of Thailand to refine these policy proposals and bring them into practice as soon as practical for the benefit of the national economy.

---

[1] https://dictionary.cambridge.org/dictionary/english/club

Key Policy Areas – Summary	
1	Access to angel funding.
2	A transformation in the availability of venture capital.
3	Reviewing the effectiveness of existing entrepreneurship training.
4	Developing government procurement programs for innovative smaller firms.
5	Increasing private sector investment in research and development.
6	Ensuring scale-ups engage in foreign markets early.
7	Establishing a restricted number of sectors on which Thailand can beneficially focus.
8	Comparing intellectual property management with foreign benchmarks.
9	Employee share options.
10	Reviewing impact of bankruptcy laws.
11	Assessing effectiveness of visa regulations.
12	Regulation and compliance simplification.
13	Encouraging inward investment.
14	Increasing exchange programmes at student, professional and policy-maker level.

EXECUTIVE SUMMARY

> “Where Silicon Valley strives to breed unicorns, the Frontier raises Camels—organizations that can capitalize on opportunity but also can survive in a drought. Frontier Innovators do not focus on growth at any cost; they focus on sustainability and resilience. Frontier Innovators also cross-pollinate. They leverage diverse lived experiences, often across multiple geographies, industries, and sectors, to build their businesses. They tap global networks for capital and resources”

Alexandre Lazarow, Out-Innovate (2020)

Thailand: from Start-up to Sustainable Growth

This paper sets out proposals for accelerating Thailand's transition from a start-up to a scale-up economy, with significant benefits for jobs, growth and society. While a shortlist of key measures for immediate consideration forms part of this review, the fundamental insight is that the evolving complexity of successful ecosystems requires dynamic adaptation to changing circumstances and long-term collaboration by a wide range of stakeholders.

Global experience shows that thriving ecosystems are 'chaotic' (in a positive sense): no one is in overall charge. But they nevertheless need benign, flexible leadership in their formative years. Those willing to serve are likely to come from numerous stakeholders and will exchange ideas or know-how as much through serendipity as formal frameworks. What they have in common is a shared aspiration for the ecosystem to flourish for the benefit of all.

International research confirms that a disproportionate amount of growth – in jobs and income – is created by a minority of firms, perhaps as few as 10% of all businesses. Scaling is not the same as gradual growth: scale-ups are built to add revenues exponentially but resources only incrementally, often after significant initial injections of risk capital and assistance with management development for capacity building. Scale-ups may move rapidly to automating delivery processes and develop specialist competencies hard to replicate, so as to solve major problems for paying customers – often through exporting.

10% of companies generate more than 50% of growth.

Thailand has made clear progress in recent years in creating a start-up culture, especially among young graduates, but unless a higher proportion of start-ups can be helped to scale, the economy risks being caught in a modern variant of the 'middle-income trap'. Resources invested in accelerators and young entrepreneurs have enabled some progress additional to traditional sectors such as agriculture and manufacturing; but for most, limited growth (especially through exports) implies continuing support from the public sector or foreign investment.

Sustainable ecosystems develop a new culture and sufficient inherent momentum through recycling resources so that external intervention such as reliance on government support, philanthropic funding or imported expertise is no longer essential. A key goal for Thailand is sustainability through recycling serial entrepreneurs, seasoned investors, risk capital, specialist advisers, bespoke infrastructure (such as incubators) or other key assets, whose impact is amplified at each cycle.

To realise an economic transformation through multiple scale-ups and provide the leadership required to develop a supporting ecosystem, this White Paper proposes the creation of an innovation club. A club is 'an association dedicated to a particular interest' - in this case, leaders volunteering time, wisdom and other resources to carry out a collaborative programme of economic transformation.

Catalysing Transformation: the Innovation Club

As the central forum to identify problems, create solutions and action them, the innovation club project will help accelerate Thailand's shift from a focus on start-ups to one on scale-ups through several interrelated initiatives:

- By facilitating a **steering group** of volunteer practitioners engaged in innovation at board level: an ad hoc coalition of practitioners brought together by the shared practical mission to transform the economy. The organisations represented on the steering group are likely to become 'foundation members' of the overall project, sponsoring its ongoing programmes. Leading international universities and other authorities active in promoting growth through innovation will be invited to join to provide an external view and track progress. The steering group is at the heart of the concept of the innovation club.
- Through hosting an **annual convention** addressing critical questions in a practical way. This will bring together on a cross-functional basis senior decision-makers in the innovation ecosystem to review progress and identify areas for improvement. It is intended to be an intensive, focused working session addressing high-level issues.
- By setting up a **working executive** of secondees from foundation members, academia or government to ensure the actions decided on by the leaders are taken forward in a functional way between meetings of the steering group.
- By establishing an **innovation dashboard**, with a baseline survey to be conducted in 2021. The goal is to develop a dashboard of key indicators of practical use for government, investors, entrepreneurs, advisers and researchers over the longer term.

Together, these initiatives are designed to bring together multiple stakeholders in the innovation economy. Over time, the club may develop a venue where entrepreneurs, corporate edge teams, venture investors and government can co-exist and exchange ideas informally: efficiency in 'recycling' such invaluable human resources is a hallmark of successful, self-sustaining regional economies. The club's other core mission is to instil in the emerging scale-up ecosystem cultural values fundamental to long-term success, such as collaboration, transformation and internationalisation.

Further details are set out in Section 1 below.

Learning from Other Ecosystems?

In the nineteenth century, co-location of enterprises in the same sector was understood to bring benefits to all participants, through shared working practices, access to skilled labour and external expertise. But such advantages became less compelling in post-industrial times. In the late twentieth century, the focus among policy makers shifted to regional innovation systems: high-growth geographies such as Northern California were seen to house critical components of a knowledge economy - venture funds, business incubators and research-intensive universities. Countries from Chile to Wales sought to grow a version of Silicon Valley. However, such 'input driven' models paid little attention to how varied elements come alive together to enable the applied creativity of innovation to happen. They were lists of ingredients with neither a recipe nor chefs: an unintelligible 'black box'.

Partly in reaction to this top-down, policy-driven approach, a new interpretation emerged whose focus was start-up entrepreneurs. While this represented a considerable advance in favouring decentralisation and serendipity, and identifying the need to develop a creative culture, it underplayed the role of other actors such as government and provided only limited insight into the contribution made by entrepreneurs 'recycling' themselves as angels, dealmakers and mentors.

Entrepreneurial ecosystems now recognise the centrality of entrepreneurs while also taking account of the critical role of other actors and institutions. The policy emphasis shifts from start-ups to growth firms, from quantity of

activity to quality of outcome, from simplicity of centralised governance to adaptive complexity (no-one is 'in control', but many lead by example) enabling momentum and self-sustainability once public development funding is exhausted and the founding generation has retired.

Ecosystems are described more fully in Section 2 below.

Why Now? Why Here?

Put simply, the groundwork has been prepared. Thailand has benefited from a decade of **public investment in innovation** infrastructure, such as science parks. Active bodies have included:

- The Ministry of Digital Economy and Society, through the Digital Economy Promotion Agency (DEPA) and the Electronic Transactions Development Agency (ETDA); and
- The Ministry of Higher Education, Science, Research and Innovation, through the National Innovation Agency (NIA), the National Science and Technology Development Agency (NSTDA), Thailand Science Research and Innovation (TSRI), among others.

From 2018, Thailand embarked upon a strategy of transformation, moving to become an innovation-driven economy under the Thailand 4.0 policy, which highlighted opportunities and investment trends in ten targeted industries, divided into two broad categories:

- The initial five 'S-Curve industries'[2] : Next-Generation Automotive, Intelligent Electronics, Advance Agriculture and Biotechnology, Food Processing and Tourism.
- Followed by five further 'S-Curve industries': Digital, Robotics and Automation, Aviation and Logistics, Biofuels and Biochemicals and Medical.

Thailand scores reasonably well in international surveys of innovation and entrepreneurship: 44th out of 129 in the 2020 Global Innovation Index (GII), and 22nd for market sophistication. Bangkok is ranked in the 51-60 range of ecosystems by Startup Genome, scoring 8/10 on talent, implying high potential – provided that low-scoring issues such as funding (5/10), performance (3/10) and market reach (3/10) are addressed. Similarly, global expenditure on research and development (GERD) by business in Thailand is a major strength in the GII; but on a more granular analysis, minimal funding reaches high-potential Thai firms as opposed to overseas start-ups or corporate R&D programmes.

Global Innovation Index (GII)
- Overall position 44th.
- Market sophistication 22nd.

Startup Genome
- 8/10 for talent.
- 5/10 for funding.
- 3/10 for market reach.

Universities have considerable **'convening power'** – the ability to bring together many smaller groups whose combined influence is greater than the sum of their individual sway. The late Senator Daniel Patrick Moynihan of New York is credited with saying that the way to create a great city is to create a great university and wait 200 years. Chulalongkorn University (founded 1917) is accelerating this timetable by a century, developing a comprehensive innovation and entrepreneurship ecosystem[3], with to date some 180 start-ups with over THB15,000M (US$475M) market value around campus.

Focus facilitates **greater coherence between institutional capabilities and market opportunities**: success may therefore be related to the fact that Chula takes a more strategic approach than the national Thailand 4.0 policy, concentrating on four research and innovation areas only, in which it has inherent research strengths – not the ten included in the general programme.

---

[2] Describing the mathematical arc that companies typically go through as they enter the marketplace and undergo cycles of growth and stagnation.

[3] CU Innovation Hub (CU-IHub), Intellectual Property Management Office (CUIP), Siam Innovation District (SID), CU Enterprise (CUE), School of Integrated Innovation (SCII), Technopreneurship and Innovation Management Program (CUTIP)

For assessing the performance of science-parks, incubators and other government-funded entrepreneurship initiatives run by universities, a new **balanced scorecard** methodology is required, taking account of both financial and non-financial results. Likewise, to mirror the uncertainties inherent in new ventures, more **flexible approaches to government procurement and risk-tolerance in public-private funding** schemes are required.

Balanced scorecard: financial, non-financial, tangible, cultural, long and short term measures.

For Bangkok beyond the campus, another essential ingredient is **a sense of place**, generally far smaller than a country, and often a city region. In a world of instant electronic communication, the demise of physical locations has frequently been forecast. But a striking aspect of successful ecosystems is the stickiness of what are sometimes called **'spiky' areas**: the evolving critical mass of resources (research, people, finance), networking, culture and magnetism as a home for creative people whose skills allow them to choose where to locate. Bangkok has been developing 'spikiness' for a generation. Places with essential attributes beyond dedicated physical space (such as incubators) continue to draw creative entrepreneurs even in times of social distancing.

Successful ecosystems flourish when early-stage and **established firms** can meet easily. Thailand already benefits from numerous world-class but home-grown corporations (such as Charoen Pokphand Group, Bangkok Dusit Medical Services, Siam Commercial Bank, Kasikorn Bank, Thaibev, and Muang Thai Life Assurance). Interaction between successful conglomerations and high-potential newer firms will benefit from further curation through the club initiative.

Case studies of established ecosystems and their histories form Section 3 below.

After Covid-19: a Need and an Opportunity

Ecosystems have been one of the most effective means of embedding innovation and entrepreneurship in an ever-widening range of regions across the world. Far from curbing the momentum, the Covid-19 pandemic has accelerated the opportunities for ecosystem growth in developing countries. The global need for new solutions (innovation) to meet major, pressing problems with limited resources against tight constraints (entrepreneurship) has never been greater.

Whereas much innovation in Silicon Valley and its western followers has focused on consumer experience (social networks, games, fitness devices, photo-editing apps), developing country **entrepreneurs are accustomed to providing platforms to solve fundamental social challenges** such as basic financial services, healthcare in inaccessible locations, renewable energy and water treatment in areas without elementary utilities. Entrepreneurial success in less industrialised countries is often more socially inclusive and more respectful of societal norms.

Finally, every successful ecosystem needs an inspiring mission and a unique offering capable of tackling major challenges for the next generation. Thailand is fortunate in being able to build on a rare tradition of **responsible and inclusive innovation pioneered by His Majesty King Bhumibol Adulyadej** (1927-2016), whose patents in water aeration and rainmaking demonstrate a practical commitment to balanced and sustainable development, impacting the lives of millions, long before the United Nations' Sustainable Development Goals were established in 2015.

1. INNOVATION CLUB: CHANGING MINDSETS, TRANSFORMING THE ECONOMY

> “Place matters both psychologically and politically… Place is a fundamental identity that takes us beyond ourselves and beyond the present, connecting us with an enduring community… Even in an age of social media, physical proximity enables a higher quality of human interaction: the mutual trust which is essential for much of modernity is often built through the tacit knowledge of another person that come only come from repeated face-to-face meetings.”

Paul Collier and John Kay, Greed is Dead (2020)

Scaling-up Thailand’s Economy

A comparison with older international examples suggests that Thailand is close to an inflexion point in the evolution of its entrepreneurial ecosystem where numerous government-led initiatives of the past decade can deliver the platform for sustainable momentum, provided that some structural weaknesses are addressed. Put simply, Thailand is ready to move from a focus on start-ups to an emphasis on scale-ups: high potential companies usually defined as achieving growth of 20% or more in either employment or turnover year-on-year for at least three years, with a minimum number of 10 employees at the outset of the period. Most economic growth derives from scale-ups; doubling their numbers can transform the economy and society.

To provide context, the Startup Genome score for Thailand is worth analysing. Although potential is high, as indicated by a score of 8/10 on ‘talent’, other scores show that concerted action is required now to address fundamental blockages: 5/10 on ‘funding’ implies some serious impediments to growth; 3/10 on ‘performance’ should be an alarm call for policy-makers; and 3/10 for ‘market reach’ is a warning that exports are not robust. The detailed descriptors reveal areas to be addressed:

- Performance: “A combination of leading, lagging, and current indicators that capture economic outcomes in a startup ecosystem. Startup Genome analyzes Ecosystem Value, Exits, Software Startup Output, Growth-Stage Success, Speed to Exit, and Early-Stage Success to quantify a startup ecosystem’s performance”.
- Global market reach: “the extent to which startups sell to customers not only outside their home country but also outside the immediate continental region. The latter, captured as Rest of World customers, filters out geographic bias”.

No ‘silver bullet’ allows a scale-up economy to emerge. Instead, numerous initiatives – public, private or combined – must be tried out over a period of years on an iterative basis, learning from measured outcomes and adjusting policy in the light of experience. Fortunately, Thailand can accelerate its transition by learning from and adapting international experience.

To initiate this process, this White Paper proposes a series of concerted initiatives:

1. **To facilitate a steering group of senior volunteer practitioners engaged in innovation.**
2. **To host an annual convention identifying and addressing critical issues in a practical way.**
3. **To set up an executive team of secondees to action the decisions of the Steering Group.**
4. **To establish an Innovation Dashboard, with a baseline survey to be conducted in 2021.**

Innovation Club Steering Group

Serial entrepreneur and co-author of *The Startup Owner's Manual*, Steve Blank, famously described a start-up as "a temporary organization designed to look for a business model that is repeatable and scalable." The role envisaged for the steering group is similar.

At the heart of the club concept is a **steering group** of volunteer practitioners engaged in innovation at board level: an informal coalition of leaders brought together by the shared practical mission to transform Thailand's economy and society through a rigorous focus on enabling emerging, high-potential firms to scale. It will review the national innovation landscape critically to identify and adapt best international practice to the Thai market. It is intended to be a reflection group with the gravitas to ensure action is taken. Leadership from the private sector, informality in design and a focus on internationalisation will distinguish the club from previous attempts in Thailand (such as the "Pracharath" initiative launched in 2015) to forge collaboration across government, industry and academia.

The steering group would meet twice a year or as often as is useful. Several countries have benefitted from steering groups to address innovation policy issues in the recent past. In the UK, for instance, the ministry responsible for industry convened an expert group for several years to address problems with access to finance, especially on the part of new technology-based firms; the group was no longer required once a national Business Bank was created. For a decade after the 1992 recession, the Governor of the Bank of England convened an annual round table with the CEOs of major banks and leading researchers to address the difficulty of funding smaller firms adequately.

Once momentum is sufficient for the ecosystem to develop a life of its own, the steering group can be superseded by a wider membership organisation. At that point, networking and research activities would be paid for out of the annual affiliation fees charged to a much wider membership body. Over time, separate organisations specific to each major sector represented (Food & Agriculture; Health; Sustainable Development) may be expected to spin out of the original network. With wide membership, annual fees would be low, encouraging start-ups to join and benefit from interaction with successful role models and advisers.

The organisations represented on the steering group are likely to become 'foundation members' of the wider membership organisation, sponsoring its ongoing programmes. Leading international universities and other authorities active in promoting growth through innovation will be invited to join to provide an external view and track progress.

Ecosystems at big city or national level become disjointed as they contain too many sectors, investors and support organisations to be coherent unless interactions are facilitated or curated. Size can also make existing, successful dealmakers inaccessible to 'new entrant' entrepreneurs. The opportunity to bring together key actors in the innovation process in one location significantly enhances creativity through informal encounters across functional lines. Over time, the club may develop a venue where entrepreneurs, corporate edge teams, venture investors and government representatives can co-exist and exchange ideas informally.

Annual Convention

An annual convention will be held to bring together on a cross-functional basis key leaders in the innovation ecosystem to review progress over the year, identify areas for improvement and encourage dialogue with practitioners and policy makers in other countries, whether in South East Asia or further afield. Initial proposals for topics to be addressed at the first annual convention are set out under ***Policy Proposals*** at the end of Section 1. Proposals can be defined by the steering group each year for future events. The convention – attended by key decision makers – will be focused on identifying high-level, practical solutions to strategic issues.

A similar exercise was carried out in Cambridge from the late 1990s, at the time of a resurgence in interest in entrepreneurship associated with the dot.com boom. Two experienced dealmakers or 'animators' (a long-standing business angel and the director of a science park) obtained commercial sponsorship to hold the first annual Enterprise Conference in 1997 at St John's College, with only some 40 practitioners in attendance. But subsequent interest was such that events were held every 18 months until 2010 with 300+ attendees, by which time the Enterprise Conference had achieved its goal of bringing the numerous different constituencies of the fast-expanding innovation community together, along with speakers from other successful clusters (Boston, Silicon Valley, Leuven, Sophia Antipolis) to share best practice.

The convention is for practical use not ceremonial display. It will exist to achieve tangible results: 'signal' not 'noise'. Ideas discussed at the Cambridge Enterprise Conferences – such as the use in the US of Small Business Innovation Research grants from government to stimulate innovation and cooperation – led to more detailed proposals for similar schemes being adopted by the UK government.

Executive Team

To ensure that actions decided on by the steering group are taken forward between meetings, a small (three or five person) **working executive** of secondees from foundation members, academia or government is proposed. Secondees are likely to be fast-track graduate recruits led by a more experienced manager. Shared experience working for the club will help create a future cohort of driven, like-minded high-flyers who have forged bonds across sectors and industries as a foundation for future constructive collaboration for the greater benefit of Thai society.

A starting point for the executive will be to devise and commission the initial baseline analysis of Thailand's innovation landscape.

To the extent that projects require funding, this will come from the sponsorship of the 'foundation members' of the steering group.

Baseline Analysis & Innovation Dashboard

Any evaluation of ecosystems requires a flexible approach (or balanced scorecard) taking account of long and short-term objectives, or financial and non-financial results. To inform such a nuanced understanding, one of the central tasks of the steering group will be to commission analysis of the current innovation landscape in Thailand in general and Bangkok in particular. Using this baseline evaluation, changes can also be tracked on a regular basis in future years to further inform key decisions affecting the ecosystem. The initial study can usefully form the basis of a summary and analysis of Thailand's existing innovation ecology. The goal would be to develop a **'dashboard' of key indicators** of practical use for government, investors, entrepreneurs, advisers and researchers over the longer term.

In addition to providing a holistic picture of innovation in Thailand today, specific indicators to be considered as part of the **baseline study** include:

1	Volumes and trends in angel funding, including identifying regulatory and taxation hurdles faced by private investors.
2	Volumes and trends in venture funding, comparisons with (a) other South East Asian countries and (b) best practice in other economies.
3	Numbers of business start-ups each year, business closures, trends in growth in sales, employment and funding.
4	Regulatory ('red tape') hurdles faced by private-sector firms.
5	Overview and analysis of government grants for tech start-ups; international comparison.
6	Review of government procurement programmes impacting high-potential small firms.
7	Overview of bank-small firm relations, including lending volumes, trends and costs.
8	Snapshot of numbers and effectiveness of accelerators, incubators and science parks.
9	Analysis of quality of university-business interaction.
10	Review of university technology transfer policies.
11	Benchmark attitudes to risk, uncertainty and failure.
12	Map existing research strengths (academic and commercial) compared with competitors.
13	Map which research strengths are already being deployed successfully in Thailand.
14	Identify issues holding back exports and other cross-border activity.
15	Catalogue programmes enabling young entrepreneurs to gain experience in other countries.
16	Overview of government schemes supporting foreign sales/partnerships.
17	Snapshot of computer literacy, access to IT/internet facilities across demographic groups and geographies.

In addition to innovation-specific indicators, to provide a frame of reference, the dashboard will track Thailand's performance according to third-party indicators covering gross domestic product, equality (Gini index), transparency, democracy and economic freedom.

Finally, as the innovation dashboard is developed, the steering group can **encourage informative coverage of the innovation and entrepreneurship worlds** in mainstream media to facilitate evidence-based public understanding and attract foreign commercial interest.

Policy Proposals – for Discussion

Detailed policy proposals (and changes in commercial practice) will emerge from the longer-term engagement of the steering group with the issues faced by Thailand's entrepreneurial innovators. The annual convention will provide insight and momentum to the work of the steering group. The following are proposed as leading topics to be considered:

1. **Access to angel funding,** essential for identifying and coaching the highest potential candidates. With the right practitioner champions (people who understand business building) policy interventions can make a significant difference: tax breaks, changes to how grants are made, review of bankruptcy laws. The UK's twenty-year experience with programmes such as the Enterprise Investment Scheme and Venture Capital Trusts provides a relevant example capable of being adapted to Thailand's circumstances.
2. **A transformation in the availability of venture capital.** Without significant risk funding, growth in innovation sectors is not possible. Israel's government policy intervention (Yozma) in the 1990s, creating a world-leading venture industry almost from zero, will repay careful study.
3. **Reviewing the effectiveness of existing entrepreneurship training.** Are current programs, from hackathons to mentorships, suitable for scale-up firms? What more is needed?
4. **Developing government procurement programs for innovative smaller firms.** One successful way of building up new market entrants and circumscribing the dominance of foreign corporations may be to implement a Thai version of the US Small Business Innovation Research scheme, under which a proportion of government procurement is reserved for small firms each year. Departments (Health, Defence, Education) put out calls for new solutions to solve thematic problems. Successful firms benefit not just from the financial award but also from the experience of working with a major agency as paying customer.
5. **Increasing private sector investment in research and development.** Overall, in 2017 Thailand invested 1.007% of its GDP in research, of which one fifth came from the public sector. While there is no 'linear model' of innovation according to which investment in research invariably translates into new products, without money being turned into knowledge, knowledge cannot be turned back into money. R&D intensity in OECD countries averaged 2.38% in 2018, with Korea at 4.528%, Japan 3.275% and China 2.142%.
6. **Ensuring scale-ups engage in foreign markets early** by developing a Global Business Innovation Programme. After rigorous selection, cohorts of high-potential innovative firms operating in the same sector (such as aerospace or robotics) are prepared by expert advisers for an overseas mission, during which they will meet possible investors, customers and partners – often at trade fairs, and possibly selected by consular staff on the ground.
7. **Establishing a restricted number of sectors on which Thailand can beneficially focus.** Successful ecosystems profit from clear coherence between institutional capabilities and market opportunities. Digital skills and infrastructure are the enablers underpinning all other areas of future innovation, on top of which an initial appraisal of the most dynamic overlap between existing technical strengths and market readiness or need in Thailand suggests that a more focused approach than the 10 'S-curve industries' covered by the national Thailand 4.0 policy would concentrate resources on the following three overarching categories:

    1. Food & Agriculture;
    2. Health; and
    3. Sustainable Development (including Inclusive Communities and Smart City).

1. Food & Agriculture
2. Health
3. Sustainable Development (including Inclusive Communities and Smart City)

8. **Comparing the regulation and practice of intellectual property management with foreign benchmarks.** Implementing the Bayh-Dole Act in the US took several iterations in the 1980s. Intellectual property created with Federal Funds by universities and other non-profits can be retained for commercialisation by the university, subject to some basic conditions. Thailand introduced legislation in 2018 for a similar intellectual property regime. Its implementation requires careful consideration and guidance for universities to maximise potential benefits.
9. **Employee share options.** Thailand is at a disadvantage when compared with many of its competitors in not having a tax regime that allows employees in scale-ups to be partly compensated by means of share options without having to pay personal tax on merely notional gains – a common international practice to align the reward of new recruits with the risk they take in joining inherently risky new ventures.
10. **Impact of bankruptcy laws:** reviewing how Thailand's insolvency regulations affect attitudes to risk among potential entrepreneurs, with international comparisons.
11. **Effectiveness of visa regulations:** assessing how well the Smart Visa programme operates.
12. **Regulation and compliance:** ease of setting up a new company and red tape generally; formal and informal barriers to business.
13. **Encouraging inward investment.** Thailand's innovation economy at the start-up level is vibrant but difficult for outsiders to navigate. A simplified guide to innovation support in Thailand in English is needed, as is reflection on which types of investment are preferred: can Thailand build world-class companies without selling out to foreign acquirers before full potential has been reached?
14. **Increasing exchange programmes at student, professional and policy-maker level** with other ecosystems around the world. No other ecosystem can be copied but ideas can be adapted to Bangkok's conditions – and student entrepreneurs can come back inspired.

2. ECOSYSTEMS: CONTEXT AND DEFINITIONS

> “By almost any measure the international economic landscape is not at all flat. On the contrary, our world is amazingly 'spiky'. In terms of both sheer economic horse-power and cutting-edge innovation, surprisingly few regions truly matter in today's global economy. What's more, the tallest peaks—the cities and regions that drive the world economy—are growing ever higher, while the valleys mostly languish.”

Richard Florida, The World is Spiky (2005)

Innovation

Innovation matters because it makes our lives better, increasing the availability of everything from food to medicine to housing to finance and consumer goods. Without practical improvements such as the green revolution in agriculture during the 1950s and 1960s, global population could not have increased from three billion in 1960 to five billion in 1987. Now embedded in the economic strategies of many countries, for much of history ‘innovation’ was not integral to humanity. As the economist William Baumol (1922-2017) put it, pre-Industrial Revolution society had virtually no goods at their disposal that had not been available in ancient Rome; per capita incomes since have gone up by several hundred percent.

Though often closely connected, ‘innovation’ need not be synonymous with ‘technology’. A useful working definition of innovation - covering public and third sector activities as commercial applications – is ‘the practical implementation of new ideas’.

The political economist responsible for making the concept a cornerstone of modern policy thinking, Joseph Schumpeter (1883-1950), almost in passing identified the critical connection between ‘entrepreneurs’ and ‘innovation’. The status quo, market equilibrium – the ‘circular flow’ – can only be disrupted by entrepreneurs, whose function is to carry out ‘new combinations’, which he defines sufficiently broadly for the parallels with modern classifications of innovation (product, process, business model) to be striking.

The distinction between invention and innovation is the recognition of the key role of *implementation*. While novice academic entrepreneurs in particular often assume that patenting scientific discoveries is the road to material success, formal intellectual property is at most a necessary but not a sufficient condition of concrete, commercial attainment.

The distinction between invention and innovation is implementation.

As Lord Broers - one of the ‘godparents’ of the acceleration of Cambridge as a leading technology cluster and Vice Chancellor of the University – explained in a 2005 public lecture, when Ralph Waldo Emerson reputedly said the word would beat a path to the door of a person who made a better mousetrap, at least this formulation recognised that the mousetrap had to be made and could not simply be an idea or a patent; the effort of manufacturing and delivering a better mousetrap is immense.

Entrepreneurship: Growing the Pie

If part of Schumpeter's wisdom was to realise that innovation needs entrepreneurs, agreeing what is an 'entrepreneur' was less straightforward. Before the modern age, 'entrepreneur' was often synonymous with anyone undertaking business activity, including those running what today would be called life-style businesses (one simply enabling the founders or their successors to maintain a desired level of income), or commodity producers or even arbitrageurs.

However, in most analyses of entrepreneurial ecosystems, 'entrepreneurs' are more simply understood as people for whom running their own undertaking is a positive career choice: they are 'opportunity' entrepreneurs not 'necessity' entrepreneurs of last resort for whom other employment options were closed:

1. They are exploiting an innovation, broadly defined: not necessarily technology-based, possibly also adopting a new business model.
2. And – crucially – they aspire to scale their business.

> Entrepreneurial mindset: an approach to management that pursues opportunity without regard to resources controlled.

While in their development phase, clusters will necessarily see a flourishing of start-ups, the great majority of which have limited ability to grow (lack of management talent, lack of market potential, limited founder ambition) the success of the ecosystem as a whole will hinge on focusing on quality over quantity as part of what UK academics Prof Ross Brown and Prof Colin Mason called in 2017 the law of small numbers: 'only a handful of entrepreneurial successes are needed to have major benefits for the ecosystem in terms of spillover effects such as role models, serial entrepreneurs, angel investors, venture capitalists, board members, advisors and mentors'.

In addition to their ability to act like yeast in dough, entrepreneurs tend to share a creative mindset famously characterised by Prof Howard Stevenson of Harvard Business School as early as 1983 as 'an approach to management that we define as follows: the pursuit of opportunity without regard to resources currently controlled.'

Entrepreneurial Ecosystems – Not Just Clusters or Regional Economics

In recent years, thinking about clusters and related phenomena has made considerable strides in terms of the clarity and usefulness of such concepts for both policy makers and investors:

Agglomerations: the original analysis of spatial agglomeration in Victorian England by Alfred Marshall (1842-1924) identified how firms in the same locale derived numerous (financial and non-financial) benefits from proximity with each other provided they are in the same sector. Marshall teased out the importance of tacit knowledge in distinguishing clustering from mere co-location. Skilled labour, supporting trades, firms specialising in different stages of production all lead to shared rules and conventions so that 'the mysteries of the trade become no mysteries; but are as it were in the air'. Implicit values and complementary skills bind clusters together. Jane Jacobs (1916-2006) broadened the concept by arguing that knowledge can spill over between unrelated sectors within cities, with ideas developed in one industry being applied in others. Either specialisation or diversification of externalities could favour regional innovation.

Economic geography and centralised regional innovation systems: renewed interest in clusters as development tools was evidenced in the influential work of Michael Porter at Harvard Business School in the 1990s and AnnaLee Saxenian's pioneering comparative study of Route 128 around Boston and Silicon Valley in 1994. The upshot was much attention being given in policy circles to 'input-driven theories': in a desire to produce the 'next Silicon Valley', government agencies in numerous countries sought to identify and supply the necessary components: venture capital, incubators, specialist advisers, training schemes. The importance of central 'anchor' organisations such as large multinational firms, or a university, was frequently noted. But the 'what' did not explain the 'how'. Alexandre Lazarow in his recent (2020) account of 'frontier ecosystems' quotes Chris Heivly, co-founder of MapQuest: 'If building an ecosystem was as easy as finding the right ingredients, wouldn't everyone have done it already?'

Rainforests: partly in reaction to this emphasis on inputs, cluster-related thinking moved on to an emphasis on spontaneity and decentralization. In their influential 2012 manifesto Victor Hwang and Greg Horowitt see entrepreneurial ecosystems as complex organisms. In contrast to traditional policy makers whose approach to ecosystem development they compare to how established corporations would set up a factory or plantation (emphasising predictability, precision and production), start-up ecosystems develop organically, cannot be planned and rely on unpredictability, randomness and serendipity. Key to success is fostering the right culture and enabling entrepreneurs themselves to grow their ecosystem. Values and behaviours in the rainforest model emphasise the creative, cooperative and aspirational view of entrepreneurs. However, the rainforest approach underplays the planning, investment and coordination required to ensure the necessary infrastructure and related systemic or framework conditions.

> Pay it forward, because you can't pay back what you owe your mentors.

Entrepreneurial ecosystems: perhaps it is not a coincidence that some of the most stimulating recent thinking on ecosystems has come from the 'grey' practitioner rather than academic literature. In particular, in his 2010 article in the *Harvard Business Review* – 'How To Start An Entrepreneurial Revolution' Daniel Isenberg set out nine prescriptions for creating an entrepreneurship ecosystem (see Exhibit 1 below). And in 2012, serial entrepreneur-investor and co-founder of pioneering seed accelerator TechStars, Brad Feld, painted a beguiling picture of start-up communities led by entrepreneurs, based on his extensive hands-on experience in Boulder, Colorado.

Exhibit 1: Creating an Ecosystem. Summarised from: Isenberg (2010)

Daniel Isenberg's Nine Prescriptions for Creating an Entrepreneurship Ecosystem	
1	**Stop emulating Silicon Valley,** an ambition that is doomed to fail. The Bay Area benefited from a unique constellation of circumstances and has some 80-years of history.
2	**Shape the ecosystem around local conditions.** Identifying unique local strengths (especially those likely to provide enduring comparative advantage) is challenging and often requires numerous iterations in conjunction with a generation of entrepreneurs.
3	**Engage the private sector from the start** – including successful members of the diaspora.
4	**Favour the high potentials:** where resources are limited the focus should be 'on ambitious, growth-oriented entrepreneurs who address large potential markets.'
5	**Get a big win on the board:** a small number of successes can have a transformative impact on the collective imagination of the ecosystem.
6	**Tackle cultural change head-on:** several initiatives will likely be needed, to develop a positive image of entrepreneurship (a respected alternative to working for government or large corporations) and to attenuate bankruptcy laws.
7	**Toughen the roots of high-potential new ventures:** while lack of risk capital is one obvious block to growth, entrepreneurs must learn the discipline of managing on calibrated budgets, and the ingenuity that goes with this discipline.
8	**Don't over-engineer clusters, help them grow organically:** few if any clusters have been grown from scratch and success is more likely to flow from building the nucleus of an existing cluster.
9	**Reform legal, bureaucratic and regulatory frameworks:** in particular, simplifying bankruptcy and employment laws, and making setting up a new business administratively easy.

Entrepreneurial ecosystems soon became the subject of insightful academic analysis to refine their utility as policy instruments. Erik Stam of Utrecht University (2015) defined 'the entrepreneurial ecosystem as a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship' - the key point being that this innovation 'will eventually lead to new value in society'. The entrepreneurial ecosystem framework also restored in a thoughtful form the role of government that the rainforest lens had minimised, with government and the private sector working more cooperatively, each specialising in what it does best.

With this framework, entrepreneurship is now no longer treated as a 'black box'. Entrepreneurs and their supporting infrastructure are the key components of the ecosystem. Furthermore, entrepreneurship is fundamentally a 'localised phenomenon', facilitated by the support and local characteristics of the ecosystem: place matters, given the tight adaptation of key players and their environment. The propensity of entrepreneurs to 'recycle' themselves (in new start-ups, as angels, as dealmakers) is a good indication of how vibrant and sustainable an ecosystem has become.

Role of Universities in Entrepreneurial Ecosystems

The entrepreneurial ecosystem model ties in closely with recent analysis of the role of universities as key players in regional economies. Conventional or 'input based' models tended to consider universities as drivers of tech clusters through easily measured, tangible contributions such as numbers of patents or numbers of spin-outs. However, even a cursory overview of the most dynamic innovation clusters such as Boston, Cambridge and the Bay Area will show that their respective anchor universities (MIT, Cambridge and Stanford or UC Berkeley) are remarkably 'hands-off'.

Put simply, leading entrepreneurial universities tend to be more permissive in how intellectual property is diffused, or how faculty engage with firms both big and small. While this approach may generate fewer spin-outs in the narrow sense companies set up by the university with its own resources to exploit IP it has generated, it is far more conducive to vibrant start-up activity: new, high-potential firms not sponsored by the university but set up by entrepreneurs with either a direct university connection (eg, current post-docs) OR indirect connection only (ranging from co-location to recruitment of graduates).

Examining 'emerging leaders', in her analysis of 200 university ecosystems Ruth Graham identified two distinct groups, with the insight that the 'bottom up' model is more robust and likely to lead to sustainable regional economic benefit:

The 'bottom-up model' is 'community-led, catalysed by students, alumni and entrepreneurs in the regional economy'. It responds to economic and societal challenges, and is triggered by a desire to stimulate regional economic growth through the creation of a vibrant localised entrepreneurial ecosystem. Investment is focused on regional rather than institutional capacity; universities often downplay the importance of IP ownership and start-up affiliation, regarding these as secondary to the overarching goal of developing the broader ecosystem. This model faces difficulties when the university seeks to regulate and institutionalise its entrepreneurship profile.

Bottom-up model of university ecosystem: focus on regional economic growth, not institutional capacity.

The 'top-down model' is university-led and works through established university structures. It is a fully institutionalised approach typically triggered by the desire to realise income from university research, driven by and focused on a strong and ambitious technology transfer office. Building on established university research strengths, this model offers a robust and fully institutionalised approach. The danger is that only university-protected IP is seen as worthwhile. Student, alumni and regional entrepreneurial communities are often marginalised. (derived from: Graham 2014, p. ii).

Support for Graham's findings can be found in the analysis of Mike Cohen (2012, 2016), Director of Innovation Ecosystem Development at UC Berkeley, which reviews universities in terms of: key innovation drivers; the type of leadership provided within the university; and the strategies required for sustainable competitive advantage. This framework measures university competitive performance:

1. As an entrepreneurial institution.
2. In terms of human talent, based on graduate Engineering and Business Schools.
3. On the basis of how decentralized the leadership of the ecosystem is.

A strong positive correlation emerges between decentralization and sustainable competitive advantage for the university innovation ecosystem. But where Schools at tier-1 universities do not have significant innovation and entrepreneurial activities, the tech transfer office may need to step in with accelerator or venture functions provided by (private sector) third parties such as venture funds. Developing a decentralized ecosystem alongside excellent standards of teaching and research can become a source of sustainable competitive advantage for the university. Conversely, universities with high academic standards but limited local innovation ecosystems will find themselves at a competitive disadvantage, with entrepreneurial students being drawn after graduation to more compelling innovation ecosystems. Not only can universities drive regional economic vitality, but they can also benefit from it.

Animators and Dealmakers

The importance of networks to clusters of all types has long been recognised. Saxenian's comparison of Boston and Silicon Valley identified depth and breadth of networking across organisations as one of the key advantages in the Valley (another being more flexible employment laws). In addition to the opportunities for serendipity and 'local buzz' - or 'industrial atmosphere' to use Marshall's phrase - one factor making the networked economy truly dynamic as opposed to simply busy is the value added by 'connectors' through their ability to identify creative linkages between previously unrelated players and their willingness to provide insight without necessarily expecting personal returns as opposed to returns to the wider ecosystem.

Connectors are often people actively involved in the stewardship of new firms, who both live and invest in the cluster, catalyse new firm formation and remain highly instrumental in developing not only the growth of individual firms' but also the vigour of the cluster as a whole. While such stewards are often closely identified with serial entrepreneurs or business angels, in vibrant ecosystems a number of different categories interact at various levels, separating the 'dealmakers' from the 'animators'. In addition to angels (mainly dealmakers) the following are crucial as animators:

1. Entrepreneurially engaged academics, crucially those actively occupied with innovation as a praxis and not teaching it as part of for-credit academic courses in Economics, Business Schools or Sociology (a comparison can be made here between teaching how to play a musical instrument versus teaching musicology).
2. Managers of network organisations, who often have deep sector expertise and broad connections outside the cluster, including internationally. Internationalisation to be effective as a strategy for new firms needs to be baked in from the start, rather than added on later.
3. Professional intermediaries, such as those who run regional innovation hubs, science parks and incubators. While in densely connected clusters, key people like dealmakers are often two degrees of separation away from aspiring founders, dealmakers often rely on animators with a professional responsibility to act as gatekeepers or 'shapers' of introductions. One leading Cambridge angel/dealmaker is known to declare 'email bankruptcy' on a regular basis as the only practical way of dealing with the thousands of unsolicited approaches received each month. Animators act as additional filters to reduce the cognitive overload on dealmakers.

Dealmakers and animators are also responsible for nurturing the culture of an ecosystem, inherited in embryonic form from the original founders, such as tech transfer officers, first generation creator-entrepreneurs or builders of science parks. Serial entrepreneur and investor Brad Feld and others 'worked very hard' to build in to how business is done in Boulder a philosophy of helpfulness (a variation on the Rainforest theme of 'pay it forward' to the next generation, because you can't pay back the earlier generation of successful dealmakers who provided you with invaluable helped in your early days – tangible or intangible):

> “A group of us have worked very hard to incorporate this give-before you-get philosophy into the Boulder startup community. You rarely hear the words, “What’s in it for me?” around Boulder; rather, it’s “How can I be helpful?” Introductions flow freely, as do invitations. As I travel around the country, I hear people talking about how easy it is to engage with people in Boulder and how good karma flows freely. This is give before you get hard at work.”

Brad Feld, Startup Communities: Building an Entrepreneurial Ecosystem in your City (2012)

Culture: Explaining the ‘Secret Sauce’?

The importance of a cooperative culture points to another key characteristic of entrepreneurial ecosystems in contrast to earlier forms of cluster. Crucially, as ecosystems evolve, they are likely to include a wider range of sectors – to move away from Marshall’s nineteenth century industrial view (of sharing skilled labour, supporting trades and acting within implicit conventions) or Michael Porter’s view that clusters succeed because of the intense rivalry between firms.

Encouraging numerous, varied sectors within an ecosystem provides several advantages:

1. Much practical entrepreneurial wisdom is sector-agnostic. The experience a graphene entrepreneur has in scaling her business enables her to act as mentor and role model for novices in dissimilar sectors.
2. In emerging sectors, new entrants rarely compete directly for customers: while similar research can underpin the technology of several new firms, each will usually have been formed to solve a specific problem within an industry. Pioneering new entrants collectively enlarge a new market. St John’s Innovation Centre in Cambridge regularly houses some 80 companies, several of whom at any given time may be working in the same broadly-defined area (such as software debugging or radio-frequency identification), possibly emerging in different waves from adjacent research groups at a university. But on closer inspection, competition for customers is limited because each new entrant has identified a new niche in an expanding market - a variation on ‘blue ocean strategy’.

However, the multiplicity of new entrants keeps each nimble and competitive as none is yet dominant: creative tension prevails. And cooperative culture has rational boundaries, resembling a complex round of many-sided interactions that can be summarised as ‘doing well by doing good’ – not philanthropy. Looking at frontier ecosystems, Alexandre Lazarow takes Gojek as a case study of a successful scale-up, originally launched as a moped taxi service to be ordered via a smartphone in Indonesia, that by entering numerous new markets (financial services, food delivery, online commerce) significantly increased the employment opportunities of its drivers, much to the satisfaction of its founder, Nadiem Makarim; but it did so through having attracted commercial and financial interest from major international organisations such as Tencent, JD.com and Sequoia Capital.

Such cooperative culture can be created by key ecosystem players and enforced by example. To cite Brad Feld in Boulder again, ‘If, over time, the relationship is one way (e.g., I’m giving, but getting nothing) I’ll often back off my level of give because this belief doesn’t underlie a fundamentally altruistic approach.’ (Feld, 2012, p. 147). Nevertheless, entrepreneurial motivation often transcends the here and now. One serial entrepreneur described the drive motivating many founders in Israel in remarkable terms:

“But there is also no denying that the country has extraordinary innovators who are bound together not by religion, money, or stature, but rather by their desire to save lives and make the world a better place.” Avi Jorisch, *Thou Shalt Innovate (2018).*

Innovators are bound together by their desire to save lives and make the world a better place

3. ECOSYSTEM CASE STUDIES & LESSONS

> "One could calculate probabilities, but one could not make any definite predictions. Thus, the future of the universe is not completely determined by the laws of science, and its present state, as Laplace thought. God still has a few tricks up his sleeve."

Stephen Hawking (Public Lecture, 1999)

No two innovation ecosystems are directly comparable as each emerges with different attributes to address different challenges. But understanding the often subtle, even counterintuitive, narratives of other clusters provides a reflective backdrop for planning a new one.

Case Study 1: Silicon Valley

The origins of Silicon Valley as a centre for commercialising technology go back further than is often assumed. Stanford University, opened in 1891 by railroad magnate Senator Leland Stanford and his wife Jane in memory of their recently-deceased son, originally stood in 8,000 acres of land that had been part of the Stanfords' stud farm. The founders intended that graduates of the new seat of learning should be 'useful' as well as 'cultured' in the conventional sense associated with university education.

Now renowned as a major research powerhouse (85 of whose affiliates have won the Nobel prize as of October 2020) with an endowment in excess of $27bn in 2019, during its first 50 years or so Stanford struggled financially – especially during the great depression of the 1930s – and was only a respected regional academy until the combination of new leadership from the 1950s and the rise of government spending on technology during the Cold War propelled it to eminence and a pivotal role in the development of the most extensive tech cluster in the world.

Stanford's new leadership was personified by its President from 1948, Wallace Sterling, and Provost, Frederick Terman. A Stanford graduate, Terman returned in 1925 to teach in the successful but rundown and underfunded Engineering Department after completing his PhD at the Massachusetts Institute of Technology (MIT). His wartime experience on the campus of Harvard University directing the secret Radio Research Laboratory (developing electronic countermeasures to radar and enemy communications) brought home to him the how valuable government patronage could be alongside the cooperation with industry that he had been nurturing in California since the 1930s.

Federal grants and contracts increased at Stanford more than sevenfold during the 1950s to over $10.5m, corporate support grew more than tenfold to $1.7m and gifts by a similar factor to $18.5m – a variety of funding ensuring continued autonomy despite the growing importance of government programmes. And alongside cooperation with industry (which sharpened his students' dedication to solving problems both practical and original), Terman initiated a policy of 'steeples of excellence'; as he put it, 'Academic prestige depends on high but narrow steeples of academic excellence; it is not possible to cover all the bases.' Research eminence and teaching distinction were core components of Terman's drive to revolutionise Stanford, as much as his cooperation with industry.

Even in the 1930s, Terman had played a role in encouraging former students William Hewlett and David Packard to return to Palo Alto (the town next to Stanford University) to set up what is now HP, Inc, the multinational information technology company with revenues in excess of $58bn in 2019 (and still based in Palo Alto). In the 1950s, he led the development of the Stanford Industrial (now Research) Park on University land, which soon became home to a range of established research-intensive corporations, including Varian Associates (founded in Palo Alto in 1948), General Electric and Lockheed.

Terman was not alone in transforming this mainly agricultural region into a tech cluster. In 1956, the co-inventor of the transistor (for which he shared the Nobel Prize for Physics that same year), William Shockley, left Bell Laboratories in New Jersey to set up the Shockley Semiconductor Laboratory in Mountain View, near where his mother lived in Palo Alto. His increasingly autocratic management style led a cohort of his most talented employees ('the traitorous eight') to resign to set up the rival Fairchild Semiconductor, funded by Sherman Fairchild and initially run as a division of his Fairchild Camera and Instrument Corporation.

All eight 'defectors' would move on from Fairchild to form numerous other foundational enterprises of the expanding cluster over the next 20 years: for instance, Gordon Moore and Robert Noyce set up Intel in 1968, and Eugene Kleiner joined with former HP executive Tom Perkins to establish one of the emblematic Valley venture firms (later Kleiner Perkins Caulfield and Byers – investors in Amazon, AOL, Genentech, Google, Netscape, Twitter and many others) in 1972.

While venture capital in its modern form originated in the Boston area in the years immediately after the Second World War with the formation of American Research and Development Corporation by Georges Doriot of Harvard Business School and Karl Compton of MIT, it took root in the receptive soil of California in the 1960s, starting with Davis and Rock in San Francisco in 1961. Today Sand Hill Road – a thoroughfare less than three miles long running along the western edge of the Stanford Campus – is home to the highest concentration of venture management funds in the world, but before 1969 most investors were based in San Francisco, 30 miles to the north.

Then Thomas Ford built 3000 Sand Hill Road, four discrete office buildings that would attract leading investors such as Mayfield, Sequoia and Institutional Ventures in addition to Kleiner Perkins. Further buildings followed in the 1970s, soon filled thanks to the incentives of co-location, adjacency to Palo Alto (and a country club and other attractive suburbs) – and Ford's consummate networking and understanding of client needs. Ford had been legal counsel for the Stanford University business office and director of land development, in which guise he was instrumental in the inception and expansion of Stanford Research Park. In 2019, the Valley and San Francisco together accounted for 40% US venture investment by value (nearly $42bn), much of which was in 'megadeals' each in excess of $200m. Angel investment in the two locales combined was $422m – more than the level of institutional venture funding in some mid-tier European countries.

Explanations of the success of tech clusters invariably emphasise the role of prominent entrepreneurs such as Steve Jobs of Apple, Larry Page and Sergey Brin of Google or Mark Zuckerberg of Facebook. This approach understates the foundational function of less obviously 'heroic' pioneers such as Terman, Ford - or Anthony "Dutch" Hamann, the City Manager of San Jose from 1950 to 1969. During his tenure San Jose, 50 miles to the south of San Francisco, grew from some 100,000 inhabitants and 17 square miles to 450,000 inhabitants and 150 square miles, with the annexation of 1,400 neighbouring communities. In 1940, orchards had covered 100,000 acres of Santa Clara Valley (the area around San Jose), a figure reduced to 25,000 at the time of Harmann's retirement. This transformation enabled numerous tech firms to set up in Santa Clara and provided homes for the influx of new workers.

Shortly after Harmann left office, Santa Clara ceased to be called (as a tribute to its orchards) 'the Valley of the Heart's Delight' and became known as 'Silicon Valley', a name first used by journalist Don Hoefler in Electronic News (part of Fairchild Publications; many Valley connections overlap) in January 1971. It took a while for the term to become popular.

The title 'Silicon Valley' was first used in 1971 for Sant Clara County and the new name was slow to catch on.

Study 2: Cambridge

Today, the Cambridge tech cluster is acknowledged as one of the most important in Europe. The headline figures explain why. According to the University of Cambridge's own data as at October 2020, centred around a small university city of some 130,000 inhabitants were more than 5,100 knowledge-intensive firms, employing over 69,100 people with combined revenues of £18bn. Cambridge has the highest rate of patent applications per head in the UK. The cluster has spawned at least 15 companies each with a realised price in excess of $1bn (trade sale or IPO – not untested private company valuations).

The serendipity with which Cambridge evolved is striking, with neither masterplan nor active government intervention. If the cluster now is known as one grounded in 'deep science' (business to business solutions rather than digital or business to consumer products), the University only started to develop science and engineering departments in the later 19th and early 20th centuries. Supporting a cluster of start-ups or spin-outs was impossible until the 1970s and the relaxation of strict planning regulations enabling the creation of a range of specialist science parks and incubators, now catering for most sectors and stages of entrepreneurial development.

> Cambridge evolved with neither a masterplan nor active government intervention.

While no single event triggered the transformation of the backwater college town into a tech 'phenomenon', the creation of Cambridge Consultants in 1960 by recent graduates motivated to put the 'brains of the university at the disposal of industry', followed by the formation in 1978 of Acorn Computers by Dr Hermann Hauser KBE FRS (shortly after completing his PhD studies at the Cavendish Laboratory), were important milestones. Acorn Computers became famous for making the BBC Micro, the computer on which a generation of school pupils learned information technology, and after its demise in 1985 numerous Acorn 'alumni' went on to found or work for other start-ups emerging in a new climate more appreciative of entrepreneurship.

By the 1990s, two tech start-ups emerged every week, including chip-designer ARM (an Acorn spin-out, acquired by SoftBank in 2016 for $23.4bn), and Autonomy (creator of unstructured pattern-recognition software based on Bayesian inference and bought by police forces, banks and law firms – sold to HP in 2011 for $11.7bn).

Risk funding is more readily available now than during the early days of the cluster. In 1997, Dr Hauser co-founded Amadeus Capital Partners, a pioneering tech venture fund in the UK, and continues to be an influential 'dealmaker' and philanthropist in Cambridge. The founding generation established a collaborative culture that still prevails today, with successful entrepreneurs and investors notably generous with their time and accessibility to succeeding cohorts of innovators. 'Pay it forward' is a common approach to support received: each generation accepts the wisdom of helping its successors in the same that it was itself assisted previously.

The University of Cambridge has a strong research pedigree (121 associates were Nobel laureates as of October 2020) but a permissive rather than directive approach to technology transfer. Academics are not obliged to commercialise research, nor are they obligated to use Cambridge Enterprise (the University technology transfer office) to do so. But if they do work with Cambridge Enterprise, remuneration terms are generous. Despite the high number of start-ups across the region, University spin-outs - in the narrow sense of companies formed to commercialise university IP with university funding - are relatively rare, perhaps no more than twenty or so each year. But these spin-outs are generally high value, attracting considerable commercial follow-on funding (some £2bn since 1995).

Commercial success associated with leading academics often derives from ‘deep science’ or curiosity-driven research, not projects with obvious near-market applications. Humira® (the best-selling drug in the world, used to combat numerous inflammatory conditions) emerged out of Cambridge Antibody Technology Ltd, founded by three research scientists from the Laboratory of Molecular Biology in 1989. The discovery at the LMB in 1975 of monoclonal antibodies earned César Milstein and Georges Koehler a Nobel Prize for Physiology or Medicine (1984). One of the co-founders of CAT, also a research scientist at the LMB, Sir Greg Winter, pioneered phage display of monoclonal antibodies for human therapeutic use, earning the 2018 Nobel Prize in Chemistry.

The development of the Cambridge cluster happened in several waves. During the 1960s and 1970s, limited physical infrastructure (such as science parks) was available to support new technology-based firms. Venture capital was inconspicuous until the 1990s. A national push by central government from 2000 to support university entrepreneurship (pioneered by Minister for Science, Lord Sainsbury, later Chancellor of the University) was enthusiastically received by the University’s Vice Chancellor, Sir Alec (now Lord) Broers.

Many (not for credit) student entrepreneurship programs – now thriving and taken for granted – date from those years. In parallel with these public/third sector developments, at the same time Cambridge Angels was established by a score of successful tech entrepreneurs, a powerful if discreet club key to recycling both funding and entrepreneurial talent, and new venture funds such as IQ Capital and Martlet Capital.

In keeping with having no central masterplan, Cambridge does not impose targets on its researchers (such as numbers of papers published or patents filed each year) but does monitor success keenly. Targets are often subject to ‘Goodhart’s Law’ (named after a former member of the Bank of England Monetary Policy Committee): when a measure becomes a target, it ceases to be a good measure – because individuals ‘game’ the policy to produce high scores without necessarily achieving the underlying goals.

> When a measure becomes a target it ceases to be a useful measure.

In addition to providing numerous role models of leading academics prominent in the entrepreneurial world, perhaps the University’s biggest contribution to the cluster has been its ethos, communicated through its mission statement; not to win the most prizes or generate the highest commercial rewards but: “The mission of the University of Cambridge is to contribute to society through the pursuit of education, learning and research at the highest international levels of excellence.”

Case Study 3 – Israel

During the 1980s, the prospect of Israel becoming a leading tech cluster would have seemed far-fetched. Inflation frequently ran at over 300% and a stock market crisis in 1983 led to nationalisation of the four largest banks. But the economic reforms introduced during this decade, moving Israel towards markets and away from state control (of prices, wages, rents and employment protection), set the foundations for the transformation of the 1990s, a combination of policy and market adaptation to unpredictable external events.

The most significant unplanned change was the influx of more than 900,000 immigrants from the former Soviet Union during the 1990s, representing an increase in Israel’s population of about 20%. Many of the new arrivals were highly qualified – engineers, doctors and scientists – able in principle to contribute to high-value sectors of the economy where Israel was short of expertise. As a result, Israel has 135 engineers per 100,000 population, compared with 85 in the US.

But most, coming from a state-planned economy, lacked awareness of commercial life. To help with economic integration, Israel set up a national network of technology incubators, where experienced advisors worked with new arrivals to turn ideas into marketable products. Incubator managers, as recipients of grant funding, instilled discipline in new teams, respect for timetables and budgets, understanding of regulations and accounting issues, protection of intellectual property rights – and the need to move on after the initial two-year residence in an incubator.

Also during the 1990s, Israel embarked on one of the most ambitious and successful government programmes in the world to jump-start a thriving venture capital industry. Objectives and planning were clear from the outset and pursued single-mindedly:

1	Yozma ('project' in Hebrew) involved $100m funding from the Office of the Chief Scientist (OCS) being invested via a fund-of-funds into hybrid (public-private) venture funds without government intervention in the operation of the funds.
2	Yozma had a single, unambiguous objective: to create a successful, domestic venture industry in Israel.
3	Government funding would only be 40% of the total raised, so aggregate funding would be at least $250m.
4	The target was to create 10 new funds, enough to ensure a competitive market.
5	Learning from US experience, funds would conform to the established (international) 'limited partnership' structure, ensuring tax transparency for institutional investors.
6	The focus was to be explicitly on early-stage investments.
7	Each fund had to have at least one experienced foreign investor to ensure learning from best practice elsewhere (and encouraging an international perspective from the outset).
8	Government created momentum, pushing for investments to be made as soon as possible.
9	The abilities of prospective fund managers formed a critical part of the decision to award mandates.
10	The limited number of funds (10) provided competitive pressure to apply promptly.
11	The mechanism for privatising the funds was built in from the outset.
12	The upside was leveraged for managers, who had the right to buy the government's 40% share (at cost plus interest) within 5 years.

As a result, in the five years from launch in 1993, the Yozma Program created ten private sector venture funds, providing a critical mass of experienced investors who formed the backbone of the Israeli venture industry, now second only to the US in terms of size and success in absolute terms – and more successful on a per capita basis. The fund-of-funds was also privatised in 1998. Leading fund managers also became leading 'dealmakers' of the Israeli high-tech industry.

A missing piece of the puzzle crucial to make sense of the success of Yozma is that government policy did not create venture funds without numerous entrepreneurial firms already looking for investment. Tech start-ups had proliferated for unusual reasons. In addition to the challenge of the influx of Russian scientists (turned into an opportunity thanks to the incubator program) Israel was simultaneously making a virtue out of another pressing necessity. As a small country surrounded by mainly hostile neighbours, Israel had from its creation in 1948 maintained high defence spending, including in research and development. A focus on technological advantage (surveillance, detection, communications) arose from its limited physical size and population and equally restricted access to natural resources, such as oil and gas.

Many innovations first deployed in a military context could be repurposed for civilian use, with greater markets. Furthermore, the very nature of the 'citizen army' and its culture of creative problem-solving in conditions of urgency and improvisation were highly conducive to fostering an entrepreneurial mind-set – and instinctive teamwork, often across barriers of age, income or profession (ranks in the Israeli Defence Force would not necessarily reflect status in civilian life). Specialist units became incubators of entrepreneurial talent: Unit 8200, responsible for signals intelligence; the Talpiot program, for cadets also pursuing physics, maths and computer science degrees; the Havatzalot program for cadets studying Middle Eastern political sciences; and Unit 81, which supplies intelligence technology.

Capacity meets opportunity: innovations created out of defence necessity are repurposed for mass civilian use.

As a result, Israeli entrepreneurial 'nodes' are more likely to relate to shared national service experience than time spent at university, an unusual characteristic in entrepreneurial ecosystems. That said, for a country of only 9.2 million people, Israel supports an above-average number of research institutes of international standing, including the Weizmann Institute of Science (in the world top 150, according to the Academic Ranking of World Universities), and the Technion – Israel Institute of Technology (number 85 in the ARWU).

Much university instruction is carried out in English, underlining the implicit internationalism of an otherwise fiercely autonomous country. Recognising the small size of their domestic market and limited ability to export to their immediate neighbours, many Israeli start-ups establish themselves as Delaware corporations, able to raise finance, recruit labour and export round the world while maintaining research and strategic direction in Israel. Israel is among the top three countries of origin for companies listed on NASDAQ, and the list of major overseas corporations with R&D facilities in Israel is extensive (Alphabet, Intel, Cisco, Oracle Microsoft and Motorola among many others). Israel's international perspective is deepened by the extent of its diaspora, often used to assist with overseas placements for young entrepreneurs, especially in the US.

What Can We Learn?

Successful ecosystems are fickle friends for policy makers and investors alike. First, the story of each cluster depends on unique, unrepeatable circumstances: the coming together of transistor technology and Cold War investment in the case of California; decades of application to deep science meeting a post-war push towards industrial modernisation in Cambridge; mass skilled immigration, development of a venture sector and the opportunities of economic and military necessity in Israel.

Secondly, it is all too easy to be seduced by the 'hardware' or tangible input factors such as the presence of research universities, venture funds, science parks or photogenic initiatives such as accelerator programmes. A focus on inputs – ingredients - masks the critical role of 'chefs' (founding figures such as Terman at Stanford; Hauser and Broers in Cambridge; serial angel investor Yossi Vardi, venture fund founder Ed Mlavsky and successive Chief Scientists including Orna Berry in Israel) and the 'recipe': how and why people and circumstances coalesced at a given moment in history to enable the embryonic attributes of a region to attack major problems which that emerging cluster was uniquely well-placed to solve. Vision, ferocious commitment and a contagious sense of practical purpose reaching far beyond immediate self-interest are required on the part of budding regional leaders – investors, academics, entrepreneurs or officials.

Thirdly, clusters do not arise in a vacuum. Silicon Valley's history predates its name and its industrial base reaches back at least as far as the founding of Hewlett-Packard in 1939. In addition to a century of scientific discovery, Cambridge had sustained a handful of innovative firms from the early twentieth century (Cambridge Scientific Instruments – founded by Charles Darwin's son, Horace; Pye Electronics; Marshalls).

Intel's first fabrication plant outside the US had been built in Jerusalem in the 1980s and by the end of that decade produced 75% of Intel's flagship 386 microprocessor. In 1971, Israeli engineer Dov Frohman invented the electrically programmable read only memory (EPROM), providing chip-based permanent memory able to retain a PC's core programming even when power is off. EPROM (which evolved into flash memory through the work of Xicor, founded by Raffi Klein, an Israeli) contributed 80% of Intel's profits during the 1970s, as it grew to become the world's leading semiconductor company. Before Yozma came Inbal, an earlier attempt at providing government support for venture capital; it was not successful but still afforded useful learning opportunities for policy makers.

All three clusters succeeded through an alignment of distinctive technical capabilities built up over many years meeting significant market opportunities, with the entrepreneurial competencies to exploit new openings. Long term thinking is essential – far longer than the tenure in office of most CEOs, university presidents or government ministers - as is the need for a sense of mission transcending immediate necessities.

While specific developments (Barclays Bank financing Hermann Hauser in the 1980s, or Arthur Rock relocating to California as a venture investor) may contain elements of happenstance, they are 'lucky' simply in the sense intended by Charles Pasteur: 'In the fields of observation, chance favours only the prepared mind.' In the Valley, the entrepreneurial ground was prepared long before the internet boom of the late 1990s, though the foundation of Stanford University as an institution dedicated to both research excellence *and* practicality, California's permissive labour laws (striking down restrictive covenants, permitting hiring and firing at will) and networking culture.

> Chance favours only the prepared mind.

In all three cases, sustainable momentum only became possible once risk funding – mainly angel and venture-sourced – developed to enable later generations of start-ups to scale. Internationalisation (whether exporting, sourcing talent or investment) was also key to scaling; Israel in particular baked a global perspective into its entrepreneurs from the outset, leveraging also its diaspora.

Momentum is only possible with sufficient risk funding.

As each cluster became more successful, a positive feedback loop involving 'recycling' experienced entrepreneurs was introduced. Previous experience deepened not just the abilities of the individuals but also increased the depth of local networks, credibility among customers and investors, and the ability to recruit new team members for subsequent ventures.

Previous successes embolden later generations to think ambitiously, moving their clusters beyond a 'cottage industry' phase of small start-ups to the stage where many of the disciplines and structures of established corporations became required, including formal planning. Compared with start-ups, scale-ups undertake less experimentation because they have established which products and business models work for them and what makes them profitable. Scale-ups will likely recruit more specialised employees, be better able to do so in an established cluster and develop a distinctive company culture.

All three clusters are notable for the fact that they comprise numerous scientific domains, from hardware to software to biotech or drug discovery. Skills learned by entrepreneurs in one field can often be ported to other sectors, and a broad base creates robustness, particularly in smoothing out economic cycles.

In each case the role of government was both essential and elusive. A well-known study by UK academic Prof Mariana Mazzucato (2013) demonstrated that all the twelve key technologies behind that ultimate of consumer device – the iPhone - championed by the icon of entrepreneurship, Steve Jobs – had been developed through the support of government funding (often US defence or small business research grants): microprocessors, solid-state drives, the Internet, cellular networks, and so forth.

Governments cannot create clusters from scratch but can significantly help (intelligent design of a new venture funding sector in Israel) or hinder (obsolete planning laws in Cambridge). Government is often most effective where it creates the right framework conditions (foresight programs to identify emerging long-term trends, early-stage innovation grants, taxation reform leading to a strong angel sector, employee share options) and enables the private sector to make informed investment decisions but does not take those decisions itself. Practitioners at the forefront of entrepreneurial endeavour have a greater chance of improving regulation and other framework conditions (national or local) if they make a point of regular, constructive dialogue with government.

Challenges for Ecosystems

An important lesson from all three cases studies is what to avoid. Many clusters suffer to varying degrees from a 'techlash' (growing public animosity towards large Silicon Valley platform technology companies and their Chinese equivalents), to use the term first coined in 2018 by *The Economist*, and a realisation among policy makers that while concentrated tech sectors raise GDP they also increase inequality.

One recent study estimated that just 8% of the total workforce in Israel benefits directly from the high salaries available in tech sectors and that the 'tickle down' economic effect is limited because of the relatively small numbers of support staff also profiting. To give but one example comparing the impact of technology and 'legacy' sectors, Apple currently employs some 137,000 around the world; by contrast, in the 1950s, General Motors, based in Detroit, employed 400,000 in the US alone. At the same time, property prices in San Francisco, Tel Aviv or Cambridge became a political issue as younger or less sought-after groups in the labour market are crowded out.

Internationalisation has been key to the success of the tech clusters in these short case studies, including the ability to sell in foreign markets and attract investment. In a climate of increasing global tensions, both the availability of foreign capital and its desirability are called into question. For several years already, debate has bubbled in Israel over the long-term implications for high-value jobs when a fast-growth Israeli firm is absorbed into a global corporation.

International acquisitions have become increasingly contentious for strategic reasons. At the time of writing, Softbank – cash-strapped after the aborted stock-market flotation of WeWork – was reputed to be in discussions with Nvidia, the California-based chip manufacturer, for the sale of ARM, which it had bought in 2016 for $23.4bn. As Hermann Hauser, cofounder of ARM when it was spun-out from Acorn Computers in 1990, told the BBC, "It will become one of the Nvidia divisions, and all the decisions will be made in America, no longer in Cambridge." He added, ""It's not about the money, it's the industrial strategy statements that the government can make."

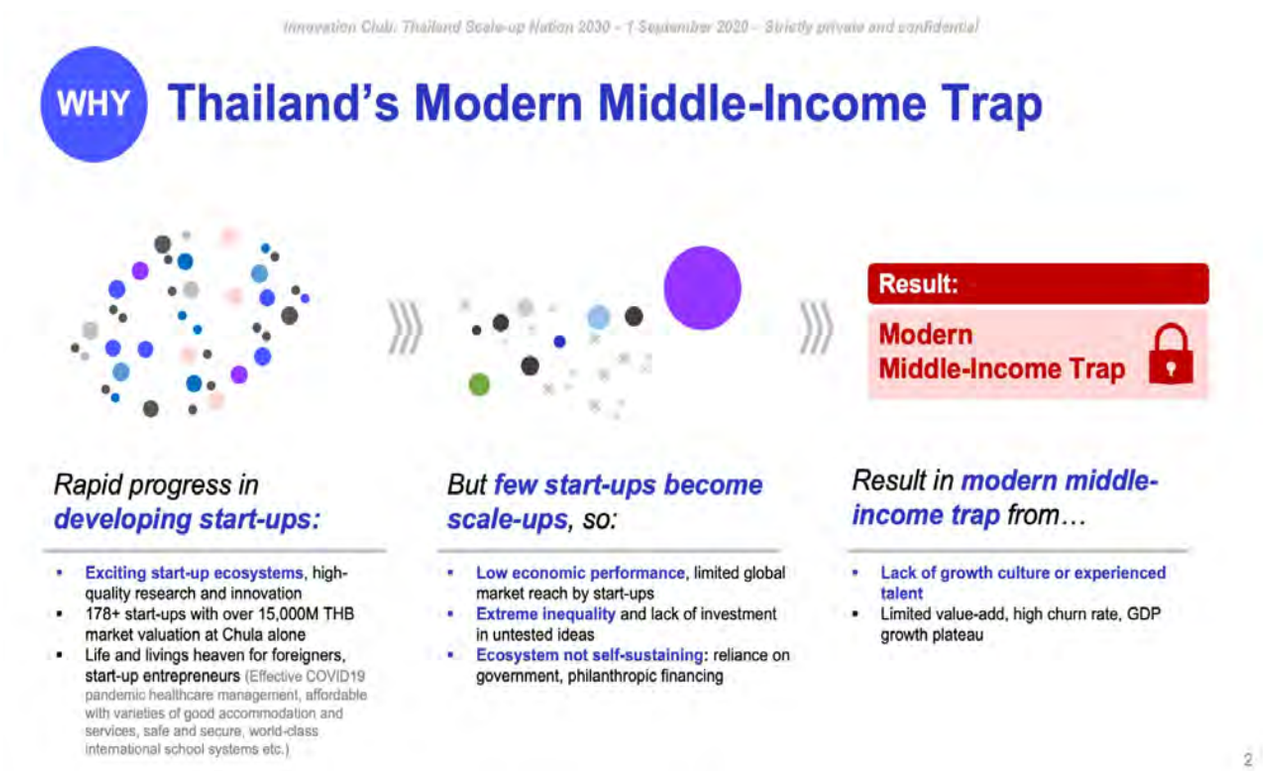
Another political risk hangs over many successful tech clusters. A major contributor to their success in recent decades has been the ability to attract skilled employees from other countries. Immigration to Israel from the former Soviet Union was an extreme, unrepeatable example, but in Silicon Valley a 2017 study found that 57% of STEM (science, technology, engineering and mathematics) workers were immigrants. Now the US government is restricting new work visas.

Perhaps, accelerated by the Covid pandemic and society's need to focus on *fundamental value* rather than speculative pricing, the days of 'unicorns' (private companies with price tags above $1bn) being the totem of successful clusters are coming to a close. As Martin Kenney of the University of California, Davis, and John Zysman of the University of California, Berkeley, put it in a 2018 briefing paper: "It may ultimately be the case that these Unicorns may turn out to be a very short-lived breed such as the Cheshire Cat - the fictional cat from Lewis Carroll's Alice in Wonderland that had a distinctive mischievous grin, but whose greatest distinguishing feature was that its body would disappear and all that would remain was the iconic grin."

Fundamental value, not unicorns.

A post-Covid world needs more from its innovators than an iconic grin.

SINGULARITY U THAILAND PARTNERS EVENT –
SUMMARY PRESENTATION



WHAT

The Innovation Club

A venue, a team, a mindset - delivering transformative change

Objectives: Scale-ups, Global mindset, Culture of collaborations and transformation

Steering group:
senior executives volunteering wisdom, resource

Annual convention
to address key policy/investment challenges

Working executive:
small full-time team of secondees to implement decisions

Innovation dashboard
for all stakeholders

Policy Proposal
for the Government to practice for benefit of the national economy

3

HOW

Strategic objective of the Innovation Club

"To enable **innovative start-ups** to **scale** and **go global**, transforming Thailand's **economy and society** through **sustainable growth**"

Definitions

- **Innovation:** "Practical implementation of new ideas"
- **Entrepreneurship:** "Growing the pie: creating significant value for customers, stakeholders"
- **Innovation & Entrepreneurship:** "Scalable, successful exploitation of new ideas"
- **Scalability:** "Adding revenues exponentially, but resources incrementally"
- **Sustainable:**
  (1) "Ecosystem: developing its own momentum through recycling resources (talent, funding, infrastructure)"
  (2) "Economy: thriving while limiting depletion of natural resources"
  (3) "Society: wide distribution of benefits from innovation and growth"

4

NEXT Collaboration is the key

Challenges for scale-up ecosystem **can be accomplished by the collaborations** among VC, Government, Entrepreneurs, and Universities to the Innovation Clubhouse
(Steering group, Annual Convention, Working Executive, Innovation Dashboard)

ABOUT THE AUTHORS

Associate Professor Dr. Natcha Thawesaengskulthai: Prof. Natcha is Vice President for Strategic planning, Innovation, and Global Engagement and Associate Professor at Industrial Engineering, Faculty of Engineering, Chulalongkorn University. She received her PhD in Manufacturing Engineering and Operations Management from the University of Nottingham, UK. She holds M.Sc. from Linköping Institute of Technology, Sweden and B.Eng (Hon) from Chulalongkorn University. She also a certified Thai Institute of Directors Association (IOD), Project Management Professional (PMP) and ISO9001 auditor. She is an Honorary Ambassador of the 9th/10th World Invention Creativity Olympics, Seoul Korea 2020 - 2021.

She leads the Chulalongkorn University Innovation Hub, Siam Innovation District and CU Enterprise, strategies to create an innovation and enterprise ecosystem that empowers talent and helps transform how Thais live, learn, and play. The hub nurtures talent through cultivating creative thinking and entrepreneurial skills for students, professors, and alumni. Impactful innovations to address global and local challenges are developed through promoting cross-disciplinary research collaboration among faculty and students, and supported by incubation and acceleration programs, including incubation space, seed fund, mentorship and network connections to early stage investors, and outreach program to generate awareness. In addition, Siam Innovation District is a sandbox for smart and intellectual community development where people are co-created and collaborate for the future of Thailand. At present, she spearheads the new School of Integrated Innovation, the interdisciplinary college of Arts and Science. This new model of higher education is to produce not only knowledge in a specific discipline, but also students who are capable of using technology, tackling new problem, initiating and innovating solution which impact change to the better world.

Chulalongkorn University Founded in March 1917, Chulalongkorn University is Thailand's first institution of higher learning. Chulalongkorn University is a comprehensive and research-intensive university. It is ranked as the best university in Thailand in many surveys, quality of students, quality of research, quality in particular subjects, university reputation, environmental management systems. CU is placed 1st in Thailand, Chulalongkorn University is one of the National Research Universities and supported by the Office of Nation Education Standards and Quality Assessment of Thailand. Moreover, CU is the only Thai university which is a member of Association of Pacific Rim Universities (APRU). Chulalongkorn University consists of 19 faculties, three colleges, one school and many institutes which function as teaching and research units. Chulalongkorn University receives the Prime Minister Award 2020: Innovation for Crisis combating COVID19 pandemics from National Innovation Agency (NIA).

Caroline Hyde, Head of International Relations and Outreach, Cambridge Enterprise: Caroline was previously CEO for Allia Future Business Centres Ltd where she established an initial innovation and incubation centre for social ventures and 'tech for good' companies and built out a network of four centres operating across Cambridge, London and Peterborough. Caroline has spent over 20 years working with entrepreneurship and innovation in and around Cambridge and is well networked in the Cambridge ecosystem. She brings this, as well as previous experience working in a research, development and commercialisation department of a UK University, to ensure that international partners benefit from the richest experience of engagement.

Cambridge Enterprise: Part of the University of Cambridge, Cambridge Enterprise supports academics, researchers, staff and students in achieving knowledge transfer and research impact by helping innovators, experts and entrepreneurs use commercial avenues to develop their ideas and expertise for the benefit of society, the economy, themselves and the University. The University of Cambridge has been involved in the commercialisation of research since 1970, with the establishment of the Wolfson Industrial Liaison Office. In 2001, WILO was renamed the Technology Transfer Office, which was a steppingstone to becoming a separate legal entity. This came in 2006 when Cambridge Enterprise Limited was incorporated as a wholly owned subsidiary of the University with responsibility for the commercialisation of its intellectual property (IP).

Cambridge Enterprise regards consultancy as a highly effective way that university knowledge can be transferred to society. Consultancy Services supports University staff and research groups who provide expert knowledge and advice to public and private sector organisations. Cambridge Enterprise also provides access to Angel finance and early stage venture capital through the Cambridge Enterprise Seed Funds and Venture Partners. The Seed Funds team offers business planning, mentoring, and other related services.

David Gill, CEO, St John's Innovation Centre: David previously ran the Innovation & Technology Unit at HSBC Bank in London (1997-2004). Educated at Cambridge, he was called to the Bar by the Middle Temple before working in corporate finance for US and UK banks. A Sloan Fellow at the Stanford Graduate School of Business in California (2004-05), he is an Academic Visitor at the Institute of Manufacturing (University of Cambridge Department of Engineering), and a non-executive director of ET Capital (venture capital), Syndicate Room (angel finance), Ask Inclusive Finance (inclusive SME lending), and the European Business Network (business incubation). In recent years, he has been involved in advisory and training projects for Poland, Libya, Kuwait and China.

His publications cover innovation ecosystems (USA, Israel, Germany, UK), entrepreneurial finance (Show Me the Money - 2nd edition 2015, also translated into simplified Chinese 2016; Consolidating the Gains: Government intervention in risk capital – 2015; Patient Capital: Where Are We Now? - 2019) and business incubation (Incubation for Growth – 2011; Startup Support Programmes: What's the Difference – 2015; Cambridge Incubator Space – 2017).

St John's Innovation Centre (SJIC) was established by St John's College, Cambridge, in 1987 as the pioneering undertaking on St John's Innovation Park, which now hosts a number of other buildings occupied by knowledge companies and professional services firms. The site (owned by St John's College, Cambridge, since 1534) offers a campus setting close to the city centre. SJIC provides a supportive environment for its clients, with access to shared facilities and services that they could not afford individually, enabling tenants to concentrate on business development. A particular focus in on investment readiness and access to finance. Tenants are not required to have any connection with the University of Cambridge, though in practice a high proportion of resident entrepreneurs are Cambridge graduates, often at PhD level. Many take up residence when their business is about a year old at the start of their scale-up phase and stay in the Centre for three to four years, during which time numbers of employees per firm may grow from under five to over 20.

FURTHER READING

David B Audretsch, *Determinants of High-Growth Entrepreneurship: Report prepared for the OECD/DBA International Workshop on "High-growth firms: local policies and local determinants".* Copenhagen. 2012.

Albert Bravo-Biosca and Stian Westlake, *The Vital 6%: How high-growth innovative businesses generate prosperity and jobs.* London. NESTA. 2009.

William J Baumol, *The Free-Market Innovation Machine: analyzing the growth miracle of capitalism.* Princeton, NJ, Princeton University Press. 2002.

Steve Blank and Bob Dorf, *The Startup Owner' Manual: The Step-by-Step Guide for Building a Great Company.* Hoboken, New Jersey. John Wiley & sons, Inc. 2012.

Lord (Alec) Broers, *The Triumph of Technology.* Cambridge. Cambridge University Press. 2005.

Ross Brown and Colin Mason, *Looking inside the spiky bits: a critical review and conceptualisation of entrepreneurial ecosystems.* Small Buss Econ (2017) 49: 11-30.

Jirawan Chaipongpati and Natcha Thawesaengskulthai, *A Critical Review of University Innovation Frameworks. Paper presented at ISPIM Connects Bangkok – Partnering for an Innovative Community.* Bangkok. 1-4 March 2020.

Michael Cohen, *The Strategic Value of a University's Hyper-Local Innovation Ecosystem. Technology Transfer Tactics,* December 2012: 188.

Michael Cohen, *Strategies for Developing University Innovation Ecosystems. Les Nouvelles - The Journal of the Licensing Executive Society,* September 2016: 184-190.

Paul Collier and John Kay, *Greed is Dead: Politics After Individualism.* London. Allen Lane. 2020.

David Connell, *'Secrets' of the world's largest seed capital fund: How the United States Government uses its SBIR programme and procurement budgets to support small technology firms.* Centre for Business Research, University of Cambridge Centre for Business Research. 2006.

Cornell University, *INSEAD, and WIPO, The Global Innovation Index 2020: Who Will Finance Innovation?* Ithaca, Fontainebleau, and Geneva. WIPO.

Nicola Dee, David Gill, Caren Weinberg, and Stewart McTavish, *Startup Support Programmes: What's The Difference?* London. Nesta. 2015.

Brad Feld, *Startup Communities: Building An Entrepreneurial Ecosystem in Your City.* Hoboken, NJ, John Wiley & Sons. 2012.

Richard Florida, *The Rise of the Creative Class and How It's Transforming Work, Leisure, Community and Everyday Life.* New York. Basic Books. 2002

Richard Florida, *The World is Spiky – Globalization has changed the economic world but hasn't levelled it.* The Atlantic Monthly. October 2005.

David Gill, Tim Minshall, Martin Rigby, and Robert Campbell, *Funding Technology: Israel and the Virtues of Necessity.* London. Wardour Communications. 2002.

C. Stewart Gillmor, *Fred Terman at Stanford: Building a Discipline, a University, and Silicon Valley.* Stanford, California. Stanford University Press. 2004.

Global Entrepreneurship Monitor, *2019/2020 Global Report.* London. Global Entrepreneurship Research Association. 2020.

Ruth Graham, *Creating University-based entrepreneurial ecosystems: evidence from emerging world leaders.* Cambridge, M.A. MIT Skoltech Initiative. 2014.

Victor Hwang and Greg Horowitt, *The Rainforest: the Secret to Building the Next Silicon Valley.* Los Altos Hills, CA, Regenwald. 2012.

Daniel Isenberg, *How to Start an Entrepreneurial Revolution.* Boston, MA. Harvard Business Review. June 2010.

Daniel Isenberg and Vincent Onyemah, *Fostering Scaleup Ecosystems for Regional Economic Growth.* Innovations: Technology, Governance, Globalization, volume 11, number 1-2. Cambridge, MA. MIT Press. 2016.

Jane Jacobs, *The Death and Life of Great American Cities.* New York. Random House. 1961.

Jane Jacobs, *The economy of the cities.* New York. Random House. 1969.

Avi Jorisch, *Thou Shalt Innovate.* Jerusalem. Gefen Publishing. 2018.

Martin Kenney and John Zysman, *Unicorns, Cheshire Cats, and the New Dilemmas of Entrepreneurial Finance?* Berkeley, CA. Berkeley Roundtable on the International Economy, Working Paper 2018-1.

Kate Kirk and Charles Cotton, *The Cambridge Phenomenon: 50 Years of Innovation and Enterprise*. London. Third Millennium. 2012.

Kate Kirk and Charles Cotton, *The Cambridge Phenomenon: Global Impact*. London. Third Millennium. 2016.

Rob Koepp, *Clusters of Creativity – Enduring Lessons on Innovation and Entrepreneurship from Silicon Valley and Europe's Silicon Fen*. Chichester, John Wiley & Sons. 2002.

Alexandre Lazarow, *Out-Innovate: How Global Entrepreneurs from Delhi to Detroit Are Rewriting the Rules of Silicon Valley*. Boston, MA, Harvard Business Review Press. 2020.

Josh Lerner, *Boulevard of Broken Dreams: How Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do About It*. Princeton, NJ, Princeton University Press. 2009.

Chadaphon Loprakhon, *The Implementation of Pracharath Policies into Action: A Case Study of Pracharath Rak Samakkee Chachoengsao (Social Enterprise) Co., Ltd. The Journal of Law*, Public Administration and Social Science. School of Law Chiang Rai Rajabhat University, 4(2), 161-183. 2020. Retrieved from: https://so06.tci-thaijo.org/index.php/lawcrru/article/view/239886

Alfred Marshall, Principles of economics. London. Macmillan. 1890.

Nobuaki Matsunaga (ed.), *Innovation in Developing Countries: Lessons from Vietnam and Laos*. Singapore, Singer Nature. 2019.

Margaret Pugh O'Mara, *Cities of Knowledge: Cold War Science and the Search for the Next Silicon Valley*. Princeton, NJ, Princeton University Press. 2005.

Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs Private Sector Myths*. London. Anthem Press. 2013.

Jerry Z. Muller, *The Tyranny of Metrics – How Our Obsession with Quantifying Human Performance Threatens our Schools, Medical Care*, Business, and Government. Princeton, NJ, Princeton University Press. 2018.

Natcha Thawesaengskulthai, Assessment of Entrepreneurship of Higher Education Institutions in Thailand. National Science Technology and Innovation Policy Office. 2018.

Natcha Thawesaengskulthai, Entrepreneurial Universities Development. Office of National Higher Education Science Research and Innovation Policy Council. 2020.

Michael Porter, *Clusters and the New Economics of Competition, Harvard Business Review*, 1998, 76(6), 77-90

David Rosenberg, *Israel's Technology Economy: Origins and Impact*. Cham, Switzerland, Palgrave Macmillan. 2018.

Lord (David) Sainsbury, *Windows of Opportunity: How Nations Create Wealth*. London. Profile Books. 2020.

AnnaLee Saxenian, Regional Advantage: *Culture and Competition in Silicon Valley and Route 128*. Cambridge, Massachusetts. Harvard University Press. 1994.

Dan Senor and Saul Singer, *Start-up Nation: the Story of Israel's Economic Miracle*. New York. Twelve. 2011.

James Silver, *Upscale: what it takes to scale a startup, by the people who've done it*. London, NBN International. 2018.

Ben Spigel and Richard Harrison, "Towards a process theory of entrepreneurial ecosystems", *Strategic Entrepreneurship Journal,* vol. 12, no. 1, pp. 151–168. https://doi.org/10.1002/sej.1268. 2018.

Erik Stam, Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. European Planning Studies 23(9): 1759-1769. 2015.

Howard Stevenson, *"A Perspective on Entrepreneurship."* Harvard Business School Working Paper #9-384-131. 1983.

Startup Genome, *Global Startup Ecosystem Report*. San Francisco. Global Entrepreneurship Network. 2020