



Global Startup Ecosystem Report 2018

Succeeding in the New Era of Technology

crunchbase



TECH
CITY

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About Startup Genome



Startup Genome works to increase the success rate of startups and improve the performance of startup ecosystems globally. In a collaborative effort with hundreds of public and private organizations in more than 30 countries we built the world's largest primary research on startups, the Voice of the Entrepreneur, with +10,000 founders participating each year. This allowed us to develop rigorous models that are considered the new science of startup ecosystem assessment.

We advise leaders of innovation ministries, agencies, and organizations supporting startups, bringing data-driven insights, clarity, and focus to actions that produce more scaleups, job creation, and economic growth. With our partners Global Entrepreneurship Network and Tech Nation (formerly Tech City UK), and thanks to the generous support of the Kauffman Foundation, we deliver holistic, evidence-based strategy frameworks for startup ecosystems across all phases of development.

Reach out to us if you are seeking to boost job creation and economic growth in your region through startups.



About the Global Entrepreneurship Network



The Global Entrepreneurship Network (GEN) operates a platform of projects and programs in 170 countries aimed at making it easier for anyone, anywhere to start and scale a business. By fostering deeper cross border collaboration and initiatives between entrepreneurs, investors, researchers, policymakers and entrepreneurial support organizations, GEN work to fuel healthier start and scale ecosystems that create more jobs, educate individuals, accelerate innovation, and strengthen economic growth.

Our extensive footprint of national operations and global verticals in policy, research and programs ensures members have uncommon access to the most relevant knowledge, networks, communities and programs relative to size of economy, maturity of ecosystem, language, culture, geography and more. We help celebrate, understand, support, and connect entrepreneurs and those who champion them.

Stay up-to-date on news and updates via genglobal.org.



About Our Global Partners

crunchbase **Crunchbase:** Everyday investors, journalists, founders, and the global business community turn to Crunchbase for information on start-ups and the people behind them.



Tech Nation (formerly Tech City UK): Empowers ambitious tech entrepreneurs through growth programmes, digital entrepreneurship skills, a visa scheme for exceptional talent, and by championing the UK digital sector through data, stories and media campaigns.



Orb Intelligence: Database of firmographics that provides company information on 50 million companies worldwide and powerful data matching capabilities to marketing software vendors and B2B marketing agencies.



Dealroom: Helps corporations, investment firms, and governments to track innovative companies and identify strategic opportunities, through data-driven software.



Our Global Network



A Word from a Founder

The intense and exciting life of a startup with all its ups and downs, what a ride! This report cannot capture what it really feels like to be inside any of your startups, inside Startup Genome or my VR startup. What it can do is inform your decisions and priorities using the power of the only deep and global dataset built from the voice of thousands of founders with the support of more than 300 organizations supporting startups in almost 30 countries—thank you!

This year, we focus on a development in the Tech sector that is happening at an unprecedented pace and has deep implications for founders and our economies at large: convergence. It is the Third Wave. We are now producing true industry players, breaking away from the “Tech” label. Many of our companies would now be more accurately called by their industry focus, for instance as transportation (Uber) and hospitality (Airbnb) companies.

This report dives into leading startup ecosystem sub-sectors (or verticals) answering strategic questions for our global community of founders, talent, investors and supporters: which sub-sectors are growing the fastest, attracting investor attention, and creating bigger successes? Where should I be present to benefit from a

thriving cluster of startups, and from institutions and corporations that can provide IP, talent, customers, and channels?

We tackle the rise of Deep Tech, and along with it, of China. We are not only creating disruptive business models with software, we are increasingly creating tangible IP in AI, blockchain, robotics, and accelerating the creation of IP in other sectors, such as life sciences and even automotives.

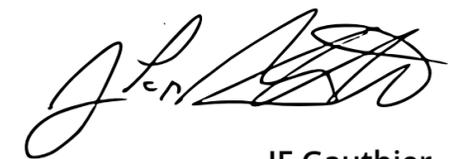
We pursue our world-leading research as to the genome of startup and ecosystem performance by quantifying on a global basis how important are Founder Mindset and Local Connectedness—for founders to develop quality relationships with each other, investors and experts. Startup founders who are personally more connected see their startups grow faster. Free-riding inside a connected community doesn't work. Not only that, we can now quantify an ecosystem's Local Connectedness and demonstrate that the ones that build a deep sense of community—for instance where founders help each other—perform better at producing scaleups.

Along with Global Connectedness and Global Market Reach, these constitute the new genome of scaleups and high-performance ecosystems. Funding and Talent are very important, but they are not enough.

Finally, we are helping startups by advising governments and other local leaders, focusing their policy and program action plans for greater impact, and providing a broad set of validated metrics to monitor progress. Along with Global Entrepreneurship Network

and Tech Nation (formerly Tech City UK), we have started delivering national innovation policy strategies and program action plans. And with the support of the Kauffman Foundation, we are clarifying how to take action at the earliest stages of an ecosystem. A laundry list or “just copy the old success story of [insert favorite example]” doesn't work. National context and lifecycle phase matters, and we are going further.

This is your report, the report of the global startup revolution. Let's raise our voices together and change the world. Let's build a shared engine of economic growth and job creation in every city in the world. And let's share the wealth we are creating—at an unprecedented rate—with our brothers and sisters and the next generation. This is important.



JF Gauthier

Founder and CEO of Startup Genome

Foreword

Connectedness matters for startup success and ecosystem performance. This has been empirically validated by Startup Genome at both the global and local levels, and connectedness is core to our mission at the Global Entrepreneurship Network (GEN), where we seek to build one global entrepreneurial ecosystem.

Ecosystem builders all over the world face political, economic, and social challenges in helping local startups succeed. We make their job easier in two ways. First, we help establish national GEN affiliates, which lead a wide variety of ecosystem stakeholders to ensure that entrepreneurs are served in the best way possible by a healthy ecosystem. While we operate in 170 countries, GEN has independent affiliates now in over 80 countries. Second, we help ecosystem builders connect to their peers across the world sharing knowledge and insights, and support for each other.

For all this to work, however, strong data and evidence are needed. GEN affiliates need to know what their ecosystem strengths and gaps are, and where they stand relative to ecosystems elsewhere. Ecosystem builders need information on the most effective actions

they can take—at the right time—to help startups. And startups need to be empowered with knowledge that will help them succeed.

This is why we are thrilled to once again partner with Startup Genome in releasing the Global Startup Ecosystem Report (GSER), which I view as the world's leading source of knowledge on ecosystem performance. The rigorous analysis produced by Startup Genome helps quantify and clarify the Success Factors behind ecosystem performance, and what actions can strengthen ecosystem vibrancy.

Based on the voices of over 10,000 founders across the world, the GSER assesses 43 ecosystems in 23 countries on a dozen Success Factors. This year's Report also provides, for the first time, advanced analysis of 15 startup sub-sectors in which technology-based startups are creating economic value. With this knowledge, we know much more today than we did yesterday about startup ecosystems.

Most encouragingly, the GSER's analysis of startup sub-sectors highlights the ability of any ecosystem, no matter its size or location, to concentrate resources on developing excellence in a focused area. Your ecosystem doesn't need to be Silicon Valley—you just need to focus on helping startups succeed in a few key areas.

Such work, however, is difficult. Building a broad-based economy powered by innovation requires dedicated investments and tough decisions by policymakers. Information and knowledge are critical

tools in that work. If your cities are not in this report, reach out to me at GEN if you want to see your ecosystem included in next year's assessment.

We are proud to count Startup Genome as a core member of the Global Entrepreneurship Research Network (GERN). Together with all our other leading research institutions, we are always at work finding new ways to gather data, new research questions to address, and how to best translate research into practice. We hope the leading researchers in your country are engaged.

There has never been a better time to start a startup, or a better time to join the global effort to build strong startup ecosystems. This can only be done if we are able to assess what a startup ecosystem requires at each point in its development, and focus resources on those policies and programs proven to accelerate growth and increase performance.



Jonathan Ortman
President
Global Entrepreneurship Network (GEN)

State of Startup Ecosystems

Entrepreneurial Revolutions of the Future and the New Era of Tech

The global startup revolution continues to grow. Global venture capital investments in startups hit a decade high in 2017, with over \$140 billion invested. Total value creation of the global startup economy from 2015 to 2017 reached \$2.3 trillion—a 25.6% increase from the 2014 to 2016 period.¹

Underneath this continued growth, fundamental shifts are occurring. The types of companies that fueled the first and second generation of global startup ecosystems—social media apps, digital media, and other pure internet companies—are declining.

While these companies have built the current infrastructure that the new generation of startups use—think Facebook and Google as a platform for global marketing, Wordpress for content publishing—startup formation in these sub-sectors is not growing as it used to, and in some cases, it is declining.

Top startup hubs like Silicon Valley, London, and New York continue to dominate top-level activity and maintain their status as the top performers for most sub-sectors. But we see strong up-and-coming ecosystems in specific sectors like Fintech, Cybersecurity, and Blockchain.

¹ Time frames covered are 2015 to first half of 2017, and 2014 to first half of 2016.

The shifts in the startup map, both geographic and economic, are signals that we are heading into a new era of tech.

New Era of Tech: Third Wave and Deep Tech

In this new era of tech, successful startups will do one of two things:

- 1 Tackle specific Third Wave verticals—think Uber for mobility or Airbnb for hospitality.
- 2 Rely on Deep Tech—build businesses through technological breakthroughs, e.g. distributed ledgers, AI, or Life Sciences.

We see this rise of Third Wave and Deep Tech clearly in the data for sub-sector growth. The fastest growing sub-sectors all fit these categories of Third Wave and Deep Tech, while declining sub-sectors are mostly associated with the first- and second-wave tech startups.

Third Wave of the Internet

The entrepreneurial revolutions of the recent past and present have been built almost entirely on the foundation of the internet and were driven by the information and communications technology sector. The value of these revolutions was overwhelmingly captured by Silicon Valley, the world's preeminent powerhouse for manufacturing the silicon-based microchips the internet itself relied on.

The entrepreneurial revolutions of the present and future are taking us much beyond just information technology and internet-focused businesses. While the prominent technology companies from the early 1990s to the 2000s have built businesses that live almost entirely on the web and mobile—with things like internet search, email, social media, and video—the prominent technologies of the future will live in the “real world.” They will transform not only what we do on the web, but also what we do outside of it, and sectors affected will include transportation, healthcare, heavy manufacturing, agriculture, and many more real-world industries. Entrepreneur and investor Steve Case calls this the Third Wave of the internet revolution. The first wave of this revolution was carried on by companies like Case's AOL, which helped build the foundation of the internet. The second wave was led by businesses like Google and Facebook who built social media, internet search, and email products for the web; while businesses like Snapchat created apps relying on smartphones. The Third Wave will bring these developments and learnings to the “real world” into specific industry verticals.

Top 4 Growing Sub-Sectors

- #1 Adv. Manufacturing & Robotics (189% 5-year increase in early stage funding deals)
- #2 Agtech & New Food (171% 5-year increase)
- #3 Blockchain (163% 5-year increase)
- #4 Artificial Intelligence, Big Data & Analytics (77.5% 5-year increase)

Top 3 Declining Sub-Sectors

- #1 Adtech (35% 5-year decline in early stage funding deals)
- #2 Gaming (27% 5-year decline in early stage funding deals)
- #3 Digital Media (27% 5-year decline in early stage funding deals)

These declining sub-sectors are primarily associated with first and second wave of the internet.

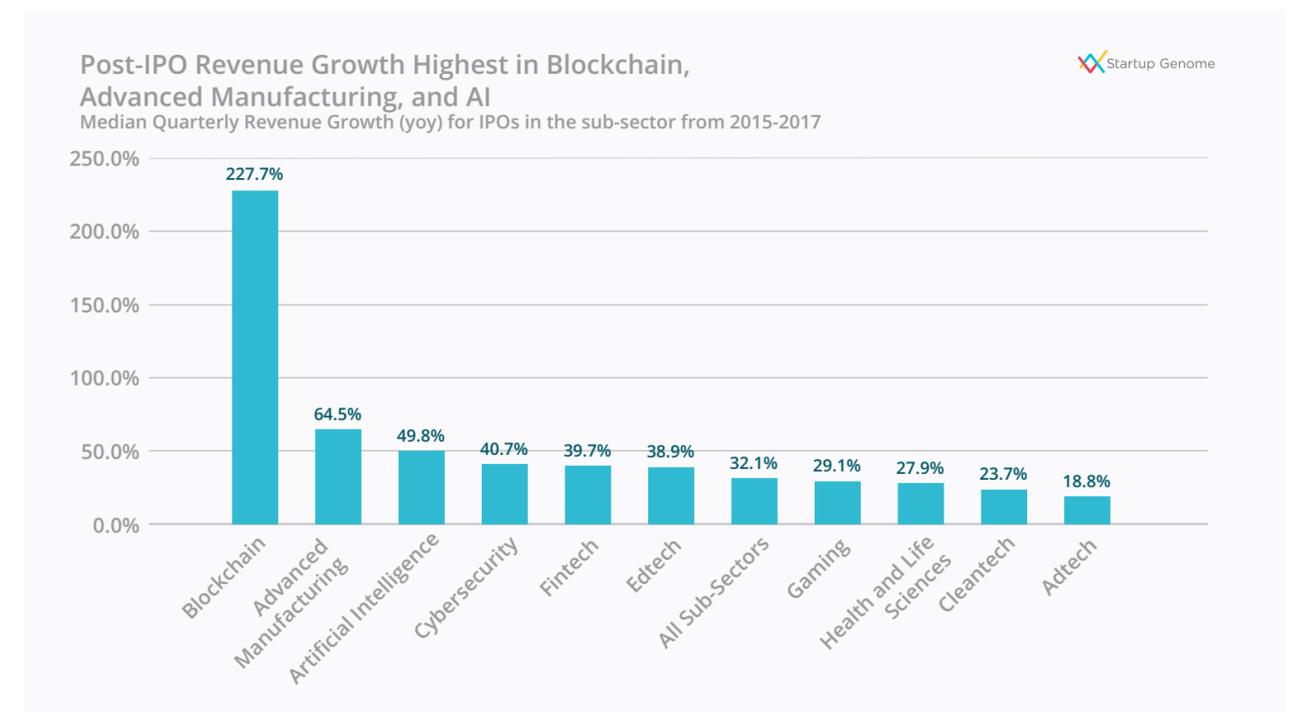
We see a similar story—though not exactly the same—in the performance of tech companies that went public from 2015 to 2017. Measured by revenue growth following their initial public offering (IPO), new era sub-sectors outperform more mature sub-sectors like Adtech. Agtech and New Food, not shown on this graph, had an even higher quarterly revenue growth, despite a smaller number of IPOs.²

² Startup Genome calculations. Data did not cover Digital Media IPOs.

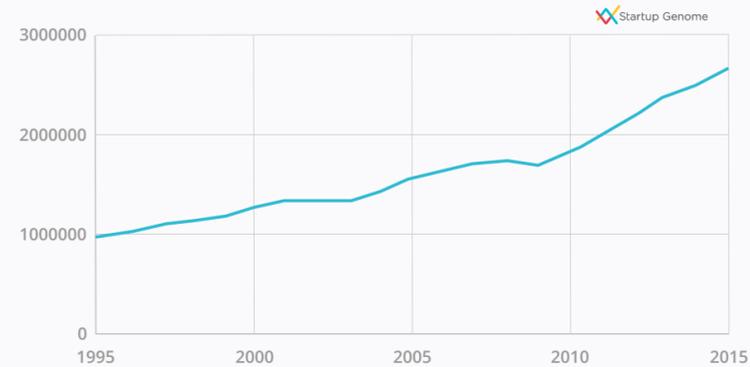
Top accelerators like Y Combinator also reflect this shift on some level: 18% of YC's most recent batch of companies are in Biotech and Health.³

The foundation for startups in this new era of tech comes in no small part due to global growth in research and development (R&D). Patent applications have grown by an astounding 174% in the past 20 years, with R&D spending as a share of the GDP growing by 13% in the same time period. On a similar upward trend, the number of R&D researchers per capita has grown 18% in the past 10 years.

³ Constine, Josh, et al. “Here Are 64 Startups That Launched Today at Y Combinator's W18 Demo Day 1.” TechCrunch, TechCrunch, 21 Mar. 2018, techcrunch.com/2018/03/19/here-are-64-startups-that-launched-today-at-y-combinators-w18-demo-day/.



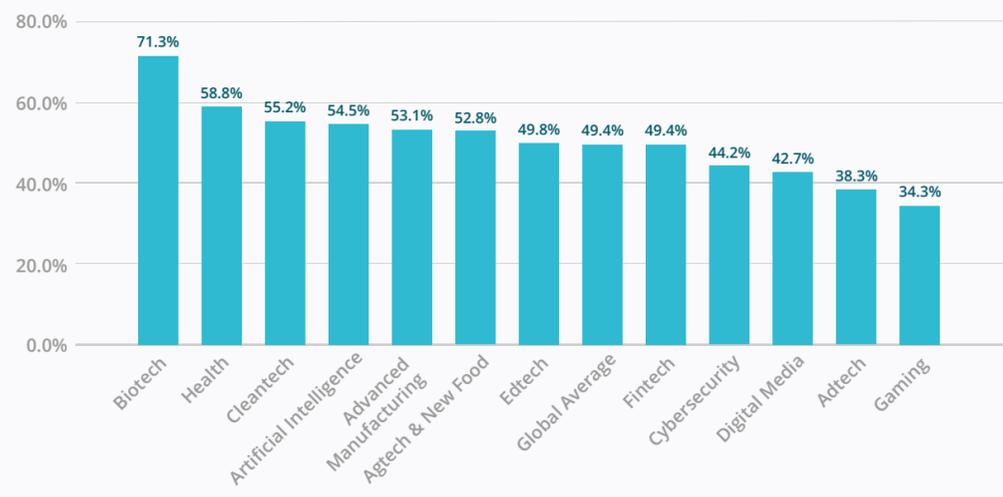
Patent applications globally have grown by 174% in the past 20 years
Growth deepens global knowledge fabric for tech startups. Global patent applications, 1995-2015



A New Type of Founder

The new era of tech opens up space for a new kind of founder. Experience and formal education are especially important for

Biotech, Health, Cleantech and AI are the Sub-Sectors with the most founders with graduate degrees
% of Founders with Graduate Degrees



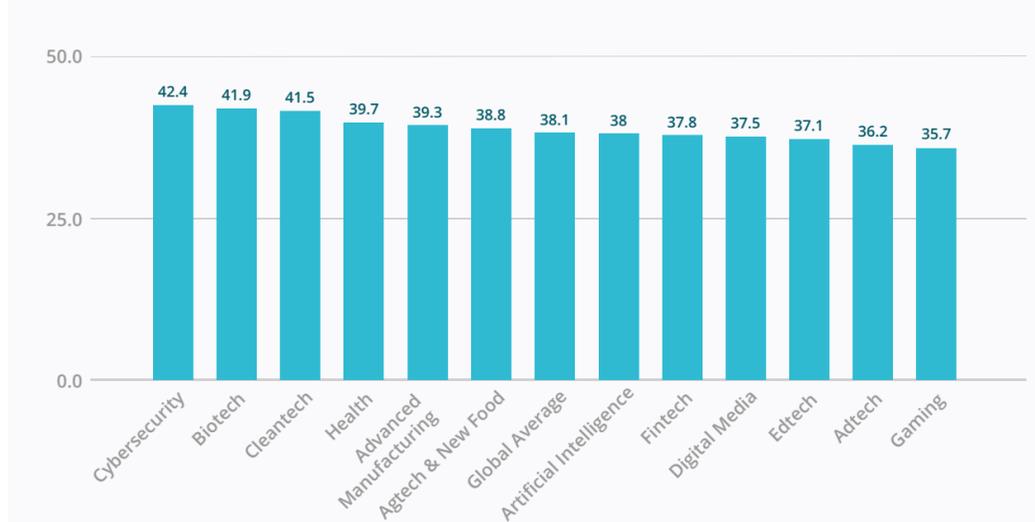
entrepreneurs in these vertical and deep tech startups. They are older and more likely to have advanced degrees. Their median age is 39, and 53% of them have graduate degrees. This compares to a median age of 36 and a 38% of graduate degrees for founders in Adtech, Gaming, and Digital Media.

New Hubs of Excellence

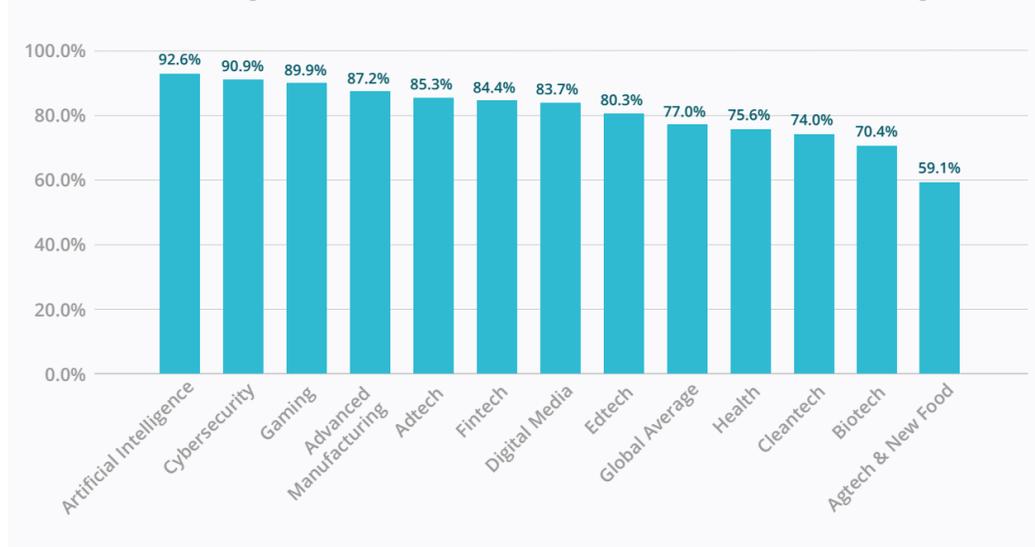
In this new era of tech, one strategy for smaller ecosystems to increase their footprint is to focus on specific sub-sectors in either verticals or deep tech areas where they have existing strengths. Only a few ecosystems can be the top-performer in the world across the board, but many smaller ecosystems have the potential to become a top cluster for specific sub-sectors. For example, Frankfurt, Germany is leveraging its economic strengths for this new era of tech, masterfully putting this strategy into action.

Frankfurt is the European Union's financial center with the European Central Bank headquarters and has over 70,000 people employed in financial services. In addition, the city is home to five Forbes 2000 companies in the financial industry, with a combined market cap of \$66.3 billion. Based on these assets, the ecosystem is focusing on building a Fintech cluster through targeted programs like an ac-

Cybersecurity, Biotech, and Cleantech have the oldest founders on average. Gaming and Adtech have the youngest Average Founder Age



AI, Cybersecurity, and Gaming are the Sub-Sectors with highest % of Founders with technical background in software % of Founder Teams with Technical Background



celerator, corporate involvement initiatives, and a coworking space.

The ecosystem's focus on Fintech is clear. Frankfurt has the highest concentration (tied with another ecosystem) of startups in a given sub-sector globally across the nearly 100 ecosystems we studied. In addition, more than 50% of local VC investment went into its Fintech startups between 2012 and 2017.

After only a few years of this strategy, results have been positive. The largest German Fintech exit of all time took place in Frankfurt: the foreign exchange trading company 360T was acquired for nearly \$800 million by Deutsche Börse, which runs the Frankfurt Stock Exchange.

Even though Frankfurt is the 40th largest ecosystem we cover, it ranks 21st in the world for early-stage funding per startup, and 7th globally in Sense of Community. In addition, Frankfurt founders are globally connected to top ecosystems, a metric that is highly-correlated to Global Market Reach and ecosystem performance. Frankfurt ranks in the top 5 globally for global connections happening locally; founders from top-performing ecosystems come to Frankfurt to network with its founders. This, in particular, seems to reflect the high concentration of finance expertise and Fintech startups there. The only other two small ecosystems with similar performance to Frankfurt in these indicators are Greater Helsinki and Lisbon—and both of them are home to major global tech events like Slush and Web Summit, respectively.

East vs. West: The Rise of China and Diminishing U.S. Dominance

A major way we see the map of entrepreneurship changing globally with new hubs of excellence is the increase of activity in Asia and the decline of U.S. preeminence. The United States and Silicon Valley are still the top value creators in the global startup ecosystem—but their dominance is not as sharp as it once was.

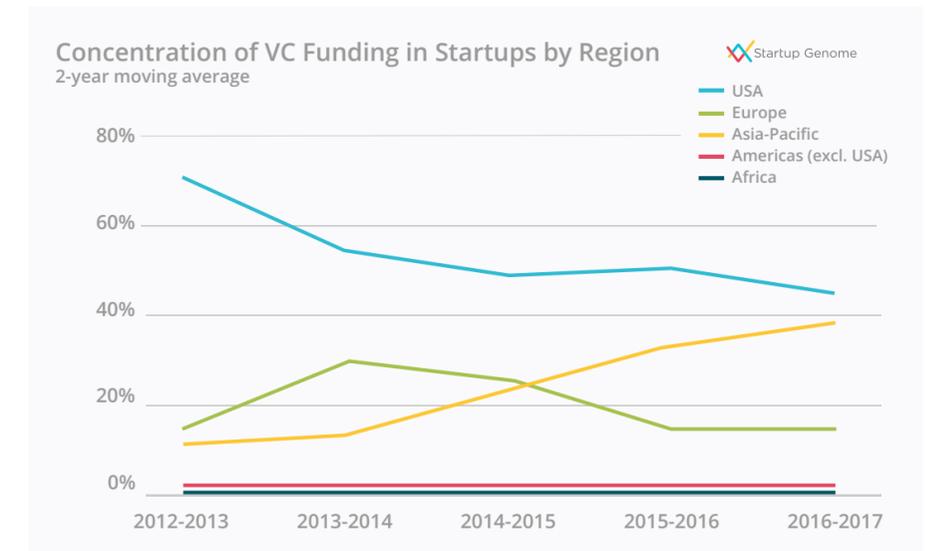
For the past six years, the share of funding going to Asia-Pacific countries grew, while the U.S. share declined. In 2017, VC funding for startups in the United States compared to the Asia-Pacific region were even, with each accounting for 42% of investment value. If we look at the combined years of 2016-2017, as we do in the following chart, the USA is still a bit ahead.

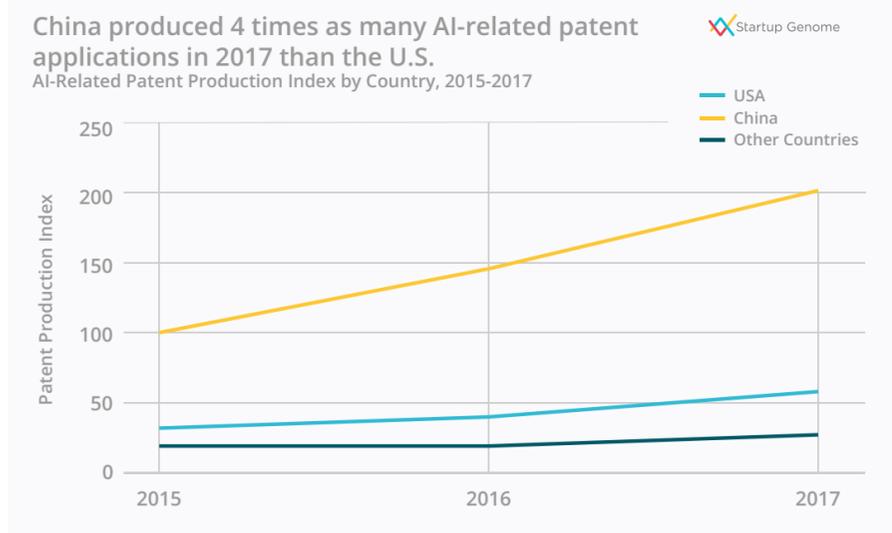
China is the primary growth driver in this shift. In 2014, only 13.9% of current unicorns were from China. In 2017 and 2018 so far, that number has grown to 35%—while for the United States it has decreased from 61.1% to 41.3%.

The United States still dominates in unicorn exits, partially because the unicorn phenomenon started and grew in the country earlier than elsewhere. When looking at total worldwide unicorn exits in 2016-2017, 65% are from the United States.

Of the 10 countries with the biggest growth in patent productions in the past 20 years, eight are in Asia. This massive increase in

knowledge production—of which patents are only one possible measure—is particularly apparent in two sub-sectors: AI and Blockchain.





While the United States has more startup activity in these two sub-sectors as measured by VC dollars, China has surpassed the United States in patent applications, with four times as many AI-related patents and three times as many Blockchain and Crypto-related patents as of 2017.

Top 4 Countries for AI-Related Patents in 2017

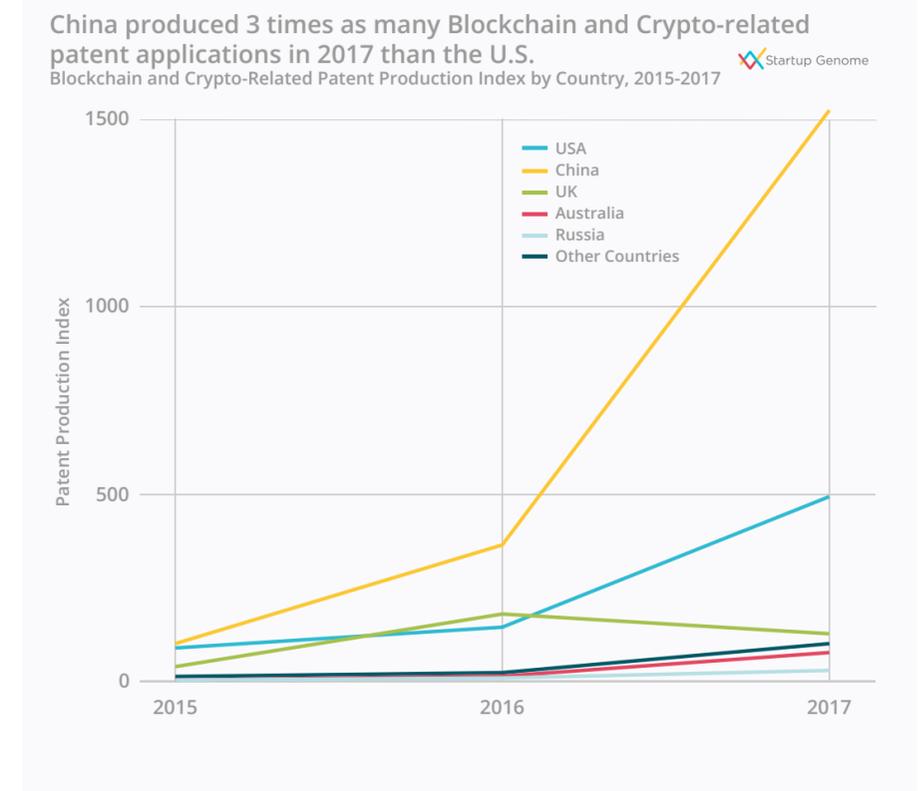
- 1 China
- 2 United States of America
- 3 UK
- 4 Australia

Building the entrepreneurship ecosystems of the future

The key takeaway from this new era of tech is that ecosystem builders need to not only look at tech as a whole, but pay attention to and invest in specific Startup Sub-Sectors. This is especially true for smaller ecosystems. It's impossible for an emerging ecosystem to be competitive across all tech sectors, but it is eminently feasible for a smaller ecosystem to become a hub of excellence for one or more Startup Sub-Sector. We turn our attention next to understanding these sub-sectors.

Top 5 Countries for Blockchain-Related Patents in 2017

- 1 China
- 2 United States of America
- 3 UK
- 4 Australia
- 5 Russia



The Growth and Decline of Startup Sub-Sectors

A Lifecycle Look at the Fastest and Slowest Growing Startup Sub-Sectors

Typical analysis of the economic future often talks about “technology” as though it was one giant sector. Yet, as software continues to eat the world, and deep technology affects a growing number of industries, treating the tech sector as monolithic becomes less meaningful. Instead, it is more useful to look at technology sub-sectors and how startup activity, investment, and growth differ across them.

These sub-sectors, just like products and startup ecosystems, evolve through lifecycles.

The first phase of the lifecycle is spurred by some sort of catalyst—a sub-sector emerges and begins to develop. The catalyst could be a new technological advance, or perhaps a regulatory change, or even a shift in resource costs. Artificial Intelligence, for example, has existed as a research field since at least the 1950s. But only in the last 10 years have increases in computing power and big data storage—combined with open access to machine learning tools—created a sizeable Startup Sub-Sector, creating the opportunity for small teams to apply machine learning algorithms to solve more and more problems, resulting in growing startup activity.

The second phase occurs when a new sub-sector coalesces as something distinct, and it grows. For instance, ten years ago, when people talked about technology use in education, they usually meant the presence of computers in classrooms. Today, Edtech refers to a huge set of startups and other organizations working to revolutionize education and quality using technology.

In the third phase of the lifecycle, a sub-sector matures: startup creation and early-stage funding slow down, while exits and Series B+ funding rounds continue to be strong.

Finally, the sub-sector enters the decline phase. Early-stage funding drops with exits eventually following suit.

Not every sub-sector is destined to decline, of course. A new technological development within the sub-sector may open a new era of growth, just like a new product feature may reinvigorate a fading product. But without new developments, the original upstarts become incumbents, and the disruptors eventually get disrupted.

Sub-Sector Definitions

Please see our Methodology section for a full list of our sub-sectors and their definitions. Note that sub-sectors are not mutually exclusive nor comprehensive — some startups are in sub-sectors we did not cover.

In addition, at least from patents, the data shows a clear tech convergence. Technology like AI are increasingly inter-related to other technology fields, and we would expect a similar convergence overtime for Startup Sub-Sectors.¹

For more detail, including in our machine learning classification of sub-sectors, please see our Methodology section. For more coverage on each sub-sector, please see their respective sections in the report.

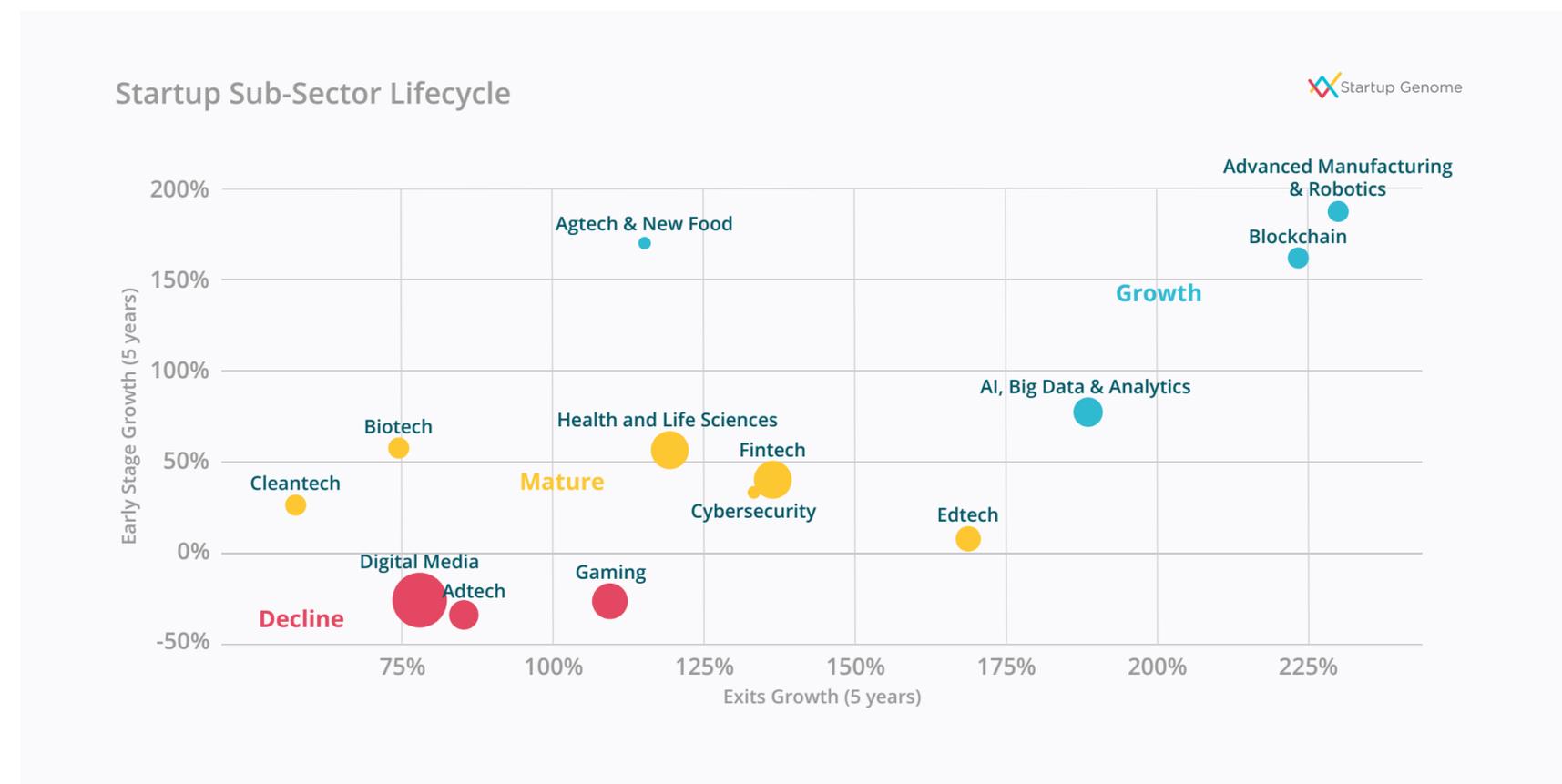
¹ "Patents and the Fourth Industrial Revolution. The inventions behind digital transformation," December 2017. European Patent Office.

For the first time, Startup Genome and the Global Entrepreneurship Network (GEN) are publishing the lifecycle of twelve key Startup Sub-Sectors based on data covering over 1 million companies, nearly 100 ecosystems, and 300 partners. This is the largest startup ecosystem study ever done. This data is further enriched with a global survey of over 10,000 startup founders and executives, interviews with more than 100 experts, and a machine learning algorithm to help classify startups, exits, and funding rounds into sub-sectors. As best we can tell, this is one of the first efforts to study these technology sub-sectors together and comprehensively

analyze startup activity and investments across them. For more details on analysis methods, please see the Methodology section.

This is our first ever methodology for measuring not just technology startup activity in general, but specific sub-sectors and industries, especially their past, present, and future. For the past, we study and measure legacy industries as one example—think traditional banks for Fintech or agricultural industry for Agtech. For the present, we look at current existing dynamics like market size, talent, and university research output. For the future, we measure sub-sector

attractiveness and growth. When looking at an ecosystem and identifying the industries where they have the most potential to build their new economy, we look for signs in the past and present that show both existing strengths and latent potential. These signals and metrics include data-driven startup output and investment numbers; the existence of strong legacy industries such as a traditional banking community; intellectual and research presence; as well as intangible aspects like perception of the ecosystem, culture, and human networks. Here is what we found:



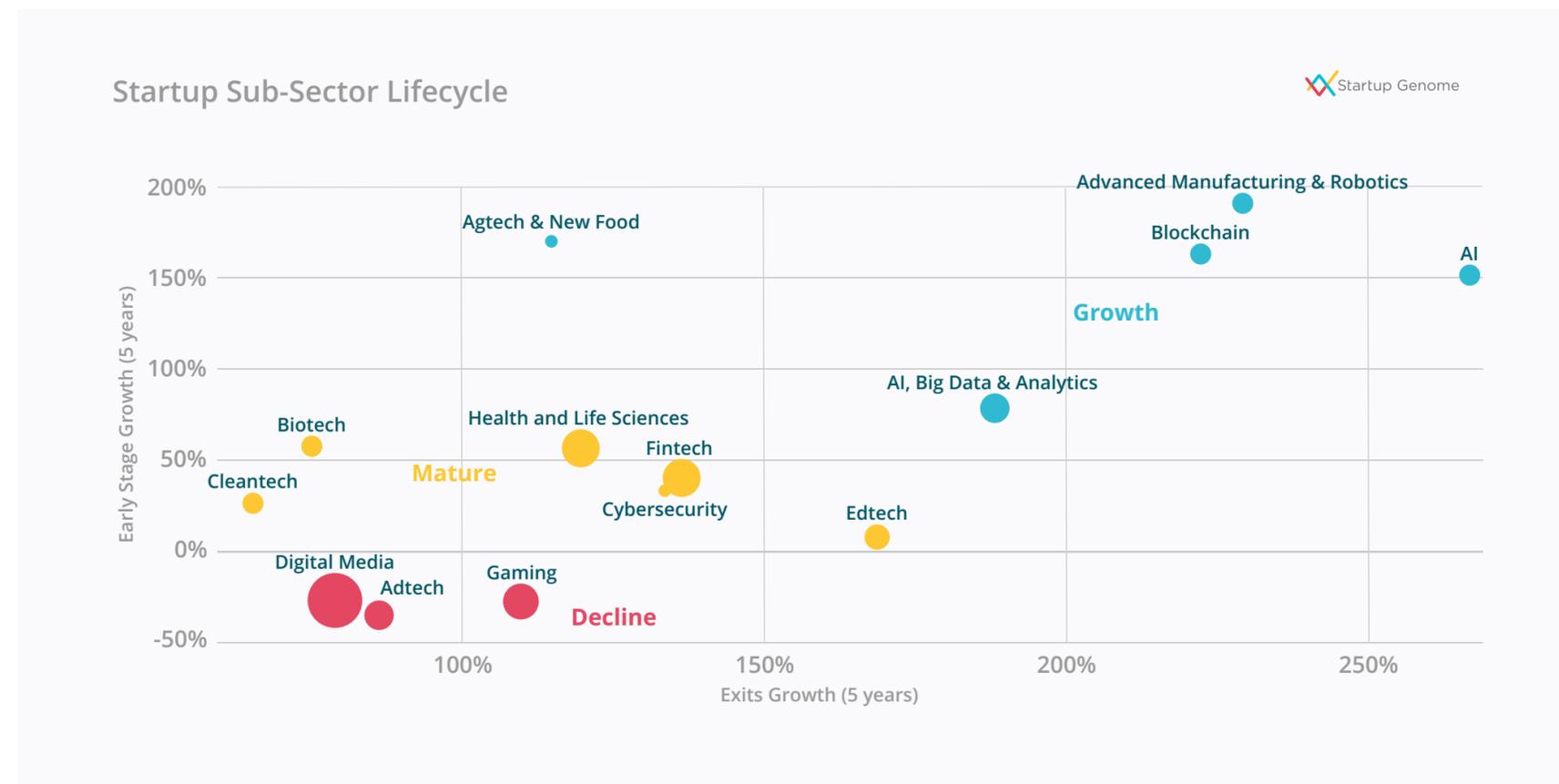
Growth Sub-Sectors

- Advanced Manufacturing & Robotics
- Agtech & New Food
- Blockchain
- Artificial Intelligence, Big Data & Analytics

These four sub-sectors are experiencing tremendous growth, but the nature of that growth differs. Advanced Manufacturing, Agtech, and Blockchain are still in the emerging phase of the lifecycle, and are growing from smaller bases in terms of the number of startups. These sub-sectors have between 0.6% to 1.5% of all global startups estimated from our data.

Artificial Intelligence, Big Data & Analytics, meanwhile, is also growing strongly, but the sub-sector is much bigger and closer to the Mature phase, with 5% of all global startups. Digging deeper into this sub-sector, it becomes apparent that AI companies are driving growth.

Sub-Sector	Early Stage Deals 5-Year Growth	Exits 5-Year Growth, Count	Share of Global Startups	Startup Formations Growth
Advanced Manufacturing & Robotics	189.4%	229.6%	1.3%	15.3%
Agtech & New Food	171.4%	114.3%	0.6%	14.3%
Blockchain	162.6%	222.9%	1.5%	17.9%
Artificial Intelligence, Big Data & Analytics	77.5%	188.3%	5.0%	12.9%



Mature Sub-Sectors

- Biotech
- Health and Life Sciences
- Fintech
- Cybersecurity
- Cleantech
- Edtech

Startup Sub-Sectors in the Mature phase are relatively large in size and some of the biggest value creators globally. Because global startup ecosystems are growing worldwide, Mature sub-sectors continue to experience growth. Some geographies (e.g., Edtech in Asia) and segments (e.g., crypto-related Fintech) within a sub-sector may be growing faster than the aggregate Mature sub-sector.

Sub-Sector	Early Stage Deals 5-Year Growth	Exits 5-Year Growth, Count	Share of Global Startups	Startup Formations Growth
Biotech	57.2%	75.0%	1.8%	-5.7%
Health and Life Sciences	56.2%	119.4%	6.8%	-0.3%
Fintech	38.9%	136.3%	7.1%	6.8%
Cybersecurity	35.4%	133.3%	0.7%	4.6%
Cleantech	25.4%	58.1%	2.1%	-9.7%
Edtech	7.9%	168.5%	2.8%	7.4%

Decline Sub-Sectors

- Adtech
- Gaming
- Digital Media

Startup Sub-Sectors in the Decline phase are those that are experiencing negative growth in Early Stage Funding deals, even though exits may still be increasing. In addition, because overall venture capital is growing globally and just hit a decade high of over \$140 billion worldwide, some of these sub-sectors may still have strong investments and exciting startups, despite the fact that they are underperforming compared to others.

Like Mature Sub-Sectors, Decline Sub-Sectors may be still be growing in certain parts of the world. For example, Asia has a lot of activity in Adtech despite the slowdown in much of Europe and North America. Of course, at any time new technologies can renew a sub-sector and take it to the Growth Phase again. For example, while activity for Adtech is declining, new channels like Virtual Reality and Augmented Reality can infuse new energy and growth. Similarly, specific segments of these sub-sectors may still be growing.

Sub-Sector	Early Stage Deals 5-Year Growth	Exits 5-Year Growth, Count	Share of Global Startups	Startup Formations Growth
Adtech	-34.6%	85.9%	3.3%	-6.9%
Gaming	-27.2%	109.3%	4.8%	-4.2%
Digital Media	-27.1%	78.7%	20.4%	-2.3%

Variable Definitions

Early Stage Deals 5-Year Growth, Count

- Count of all early stage funding deals, growth from 2012-2013 to 2016-2017

Exits 5-Year Growth

- Count of all exits, growth from 2012-2013 to 2016-2017

Share of Global Startups

- As of 2017-2018

Startup Formations Growth

- Annualized growth in startup formations from 2008-2016

Ecosystem Strategy and Science

Introduction to Ecosystem Strategy

New Science of Ecosystem Assessment

Founder Mindset

Local Connectedness

Female and Male Founders

Immigrant Founders

Introduction to Ecosystem Strategy

By JF Gauthier. *With our partners GEN and Tech Nation (formerly Tech City UK) we are advising national and local governments, combining science, policy and community building experience to achieve measurable impact.*

Effective ecosystem strategy requires a triple focus: according to Phase, Success Factor Gaps, and *relative* Sub-Sector Strengths

One of the major challenges for our friends leading innovation ministries and agencies has been the sheer magnitude of the task at hand. In most countries, startup ecosystems are not producing enough jobs and economic growth despite years of efforts by corporations, institutions, and the creative class.

There's so much to do. Where to start? As Michael Porter said, the essence of strategy is "more about what you're not going to do" than what you're going to do.

A new model has been lacking. There has been some success, but they are so different that they do not offer a direction. And they happened at the city level, in already modern economies, with the rest of their country falling behind anyway. Most also happened early in the advent of the startup revolution.

Now cities and nations compete for global resources and markets—not only mega-corporations.

This lack of a clear model—compounded by a lack of comparable local and global data on startup ecosystems—has led policy and strategy consultants to recommend a long list of policies and programs, pointing to where each has been successful. The Yozma program in Israel has been copied, but has never been as successful as it was in the 1990s when it had no competition.

This has left the job squarely on the shoulders of innovation ministries and agencies to sort through what is worth doing, prioritize, and define the best possible strategy.

Porter's industry cluster framework, so successful to guide national strategy with regards to traditional sectors, has been bogged down by the fundamentally different shape of startup ecosystems. Traditional industry clusters were constructed of tangible IP, human and financial capital, and billion-dollar assets accumulated by large corporations over decades. The government could focus on providing the right support and incentives to a handful of the leading industry participants—well-known and stable—and produce results.

On the other hand, Startup ecosystems are loosely shaped by young talent in communities producing disruptive business models coded in a technology available to all with or without a degree: software. New leaders emerge every few years, with old leaders becoming less relevant quickly (Novel, Netscape, Yahoo...).

Not surprisingly the existing economic data and formulas, industry theories, and strategies were no longer producing the expected results.

Startup Genome has now developed:

- a primary research process to capture and codify the missing data on early-stage startups on a local and global basis
- a scientific method to
 - quantify and describe the startup Ecosystem Lifecycle, its drivers and triggers
 - measure an ecosystem size and maturity along the lifecycle
 - precisely quantify Success Factors gaps
- lenses to position the relative strengths of an economy and its emerging sub-sectors against global competition

These frameworks provides clarity at several levels—as to the maturity, gaps and strengths of an ecosystem—and result in a focused strategy. Focus is needed at several levels to produce greater impact with your limited budget. Less is More.

Last year we brought focus to ecosystem strategy by clearly identifying the specific objectives to target at each phase of the Lifecycle, plus further prioritization based on the relative importance of each Success Factor gap—or Do the Right Thing at the Right Time.

The work performed to produce this report—which captures a fraction of the global knowledge we captured and analyzed about each startup sub-sector—lays the foundation of frameworks and global data needed to properly guide strategic focus at the sub-sector (or vertical) level.

An ecosystem should focus on a startup sub-sector most closely related to its strongest traditional strengths relative to global competition. These constitute the core competencies of a startup ecosystem: the business cluster of related traditional industries, research centers and institutions of higher educations, intellectual property, and successful corporations produced by that innovative sub-sector.

We look forward to putting this to work for your country or city.

The New Science of Ecosystem Assessment

Ever wonder how Stockholm, a relatively small startup ecosystem, can produce scaleup firms at such a high rate? And why Chicago, an ecosystem three times bigger, does not produce more of them?

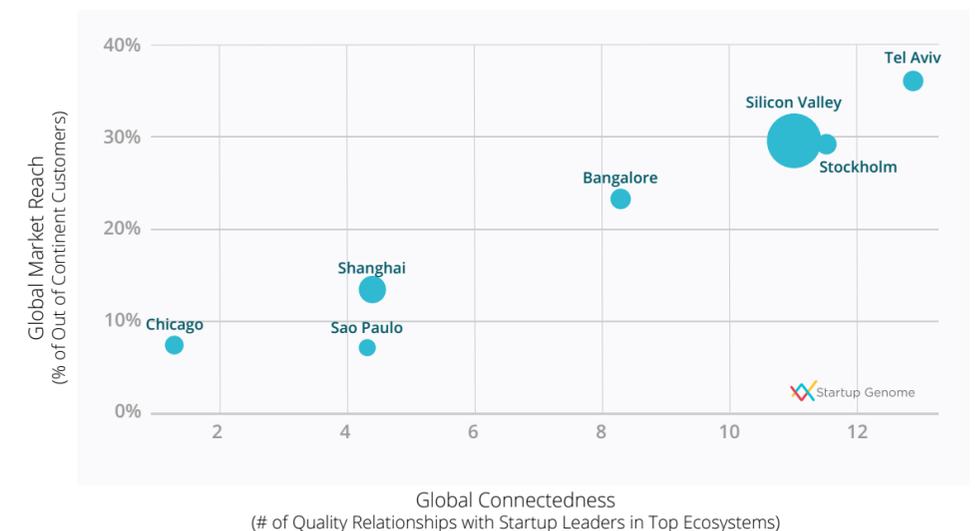
A key reason is that despite its size, Stockholm's startup founders are very well connected to those in the world's top 7 ecosystems (see Figure). This Global Connectedness keeps them at the leading edge of global knowledge about innovation and business models. This translates into an ability to engage with global customers from their earliest stages, which in turn translates into greater scaleup success.

Many think U.S. startups have an advantage due to their large local markets. Yet this confers little advantage unless "going global" is in the startup ecosystem's DNA. Unlike other U.S. ecosystems that do lead global markets, Chicago's founders are not globally connected outside the United States, and thus their global potential directly suffers.

Digging deeper, we see that Stockholm's startups are much more likely to develop products with global customers in mind than

Chicago startups. This must be the focus from Day 1: ambition and a later focus of the customer acquisition team on global customers cannot close the initial gap.

Global Connectedness injects the global knowledge crucial to the creation of globally-leading startups, which is a key ingredient of Global Market Reach. As prior Startup Genome research established, startups that focus on and penetrate global markets from their earliest stage are able to grow revenues twice as fast (see



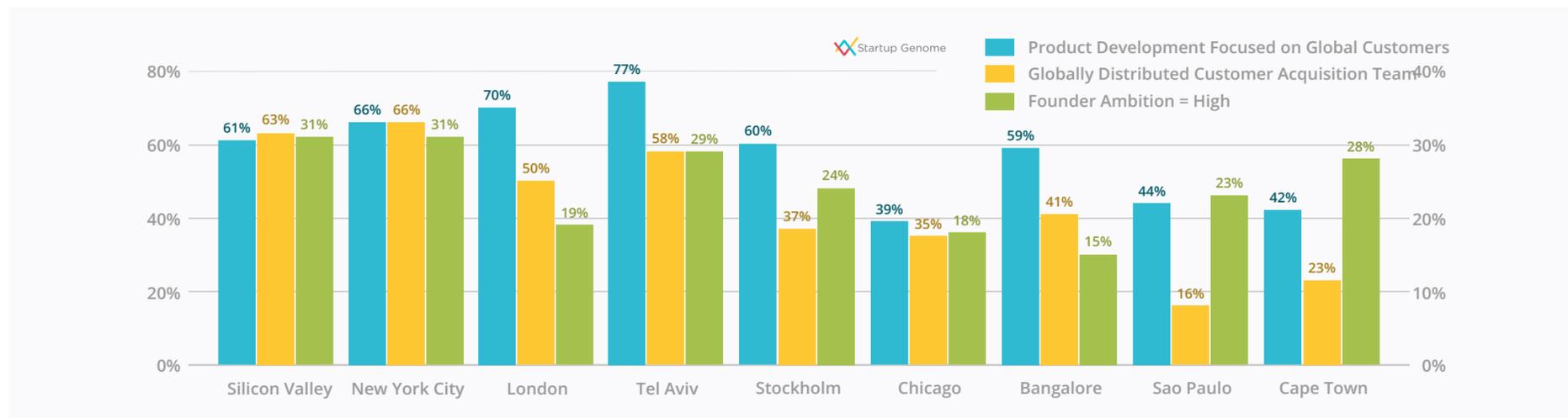


Figure later in this article). At the ecosystem level, if several of those scaleups reach or exit at a billion-dollar valuation, they Trigger Global Resource Attraction to an ecosystem, fueling its accelerated growth and more Global Connectedness. This is the virtuous cycle of the most successful startup ecosystems.

This kind of insight is not apparent from casual observation. Identification and analysis required the development of a new science of startup ecosystems. Over several years of working closely with startups and ecosystem leaders across the world, Startup Genome developed a powerful assessment model and scientific approach to perform this type of analysis. Startup Genome itself is built upon the serial entrepreneurship experience of several members of our team in different continents, plus several years of startup performance benchmarking at Startup Compass.

Imagine trying to manage national monetary and fiscal policy without hundreds of validated measures and indicators at your fin-

gertips. For many years, this was the situation faced by innovation policy leaders when trying to understand and take action to grow their startup ecosystem. All they had was imprecise (and terribly slow) government data, or they were lectured by academics on the secrets of Silicon Valley.

But, startup ecosystem research is not about the secrets of Silicon Valley. Practical research on startup ecosystems must rigorously study many large and small ecosystems, map their Lifecycle, figure out the right data and and Success Factors, and produce actionable insights. This type of research is in short supply—yet startup founders, ecosystem builders, and policymakers all over the world are in dire need of it.

Seven years ago, the Startup Genome Project was formed with the intent to crack the code of innovation that leads to higher rates of startup success and ecosystem performance. Today we are nearing the point of mapping the DNA of startup ecosystems

using primary data from tens of thousands founders across the world, secondary data on half a million startups, and deep insights into the determinants of performance. We are now able to advise innovation policy leaders laboring to accelerate economic growth through entrepreneurship with:

- a rich dataset on their local startups with 100+ validated metrics;
- benchmarks to measure themselves against dozens of other startup ecosystems;
- identified and prioritized gaps;
- and proven policies to address those gaps.

Up to now, only our Members had access to our methodology, complete research results, and actionable insights. The Global Startup Ecosystem Report for which most people know us includes only about one-quarter of the performance-validated metrics we've developed. In a few months, for the first time, we will publish the full breadth of our science as way to expand the knowledge network of those who work to guide policy and boost economic growth by fostering vibrant startup ecosystems. Here, we offer a summary of our ecosystem assessment science.

Key Elements of Startup Genome Approach

To be scientific, the methodology of ecosystem assessment must be predictive, not merely descriptive. We have developed a mathematical model that can objectively prove, based on quantified knowledge, that a variable has a positive or negative impact on

the performance of a startup or its ecosystem—or that it doesn't, in which case we go back to the drawing board and invest more time to better understand and codify.

Accordingly, our approach is based on 10 key elements:

- 1 **Direct experience of startups and ecosystems:** our team brings the experience of serial entrepreneurship across multiple countries and continents, angel investing, startup community building, and corporate innovation management.
- 2 **Ecosystem Definition** — a region with a shared set of characteristics and pool of resources, generally located within a 60 mile (100 km) radius around a center point, with a few exceptions. Toronto and the Waterloo region, for example, are two distinct regions roughly 60 miles apart. However, the data-driven assessment of both of them resulted in almost identical results, demonstrating that they were in fact one and the same ecosystem. Also important, if a startup moves prior to an exit we identify the startup's original ecosystem to properly measure its ability to produce startup success.
- 3 **Measuring pre-seed startups and their original location**—startups are dependent on their ecosystem's Success Factors and resources only at the early stage. In every ecosystem, most startups are pre-seed or bootstrapped, yet no one has data on them. Funding databases cannot capture relevant data on pre-seed startups, so they tell a misleading story.
- 4 **Large datasets**—with the absence of rich data on early-stage startups being the largest challenge, we invested seven years into building the largest global dataset on such startups.

- 5 **Partnerships**—achieving such a large research requires the support of the global community. We depend on the collaboration of more than 300 partners, more than 40 governments and innovation agencies, more than 50,000 startup founders, and several global partners like Global Entrepreneurship Network, Tech Nation (formerly Tech City UK), Crunchbase, and Orb Intelligence.
- 6 **Quantifying experience, not opinions**—with our survey instrument, for instance, we ask, "How many days did it take to get a visa?" We don't ask, "How difficult is it to get a visa?"
- 7 **Performance validation**—all our variables are derived from practical experience and the research literature. We then put each one to the test of both our startup and ecosystem performance models. If it doesn't clearly impact performance metrics, we discard it—over the years we discarded more than a hundred metrics that failed our performance tests.
- 8 **Consistent data collection**—we measure ecosystems around the world at the same time of the year over several years to remove seasonality and cyclical effects.
- 9 **Studying many ecosystems at different stages and benchmarks**—a wide range of ecosystems is required to understand how factors change across time and contexts, and build a sound mathematical model. Also, one performance datapoint is not worth anything without something to compare it to. The experience building a dynamic SaaS startup performance benchmarking application at Startup Compass came handy.
- 10 **Mathematical model**—we combined all this data with deep data science skills to build a complex mathematical model that captures the impact (outcomes) of input variables (Success Factors) against a performance model.

Intellectual Foundation

Here, we review some of the important concepts that inform and define our approach.

Our science is rooted in Michael Porter's work on industry clusters. The "geographic concentration of interconnected businesses, suppliers, and associated institutions"¹ in a particular sector or industry increases the a) average productivity of each entity, b) innovation and c) creation of new businesses.

While this is a good foundation, it is important to mention that this concept was largely based on the examination of traditional industries. Porter's insights shaped multiple generations of economic development practice and continue to do so today. But we tested these dimensions to account for the new reality of innovation-based, and especially Tech/ICT ecosystems.

Key Dimensions of Industry Clusters and Startup Ecosystems

- 1 **Size.** Michael Porter asserted that the larger the size of an industry cluster, the higher the productivity of its participants; the higher the level of innovation; and the higher the rate of new business entry. We found that in fact the average productivity does not consistently increase with size, but the production of scaleups does.

¹ Porter, M.E. (1990). *The Competitive Advantage of Nations*. New York: The Free Press.

Together with the Kauffman Foundation, we are developing a methodology to precisely assess small ecosystems. This is a critically important initiative for many cities.

2 **Local Connectedness.** Michael Porter wrote that the degree of interconnectivity is the second key dimension of industry clusters because “economic activities are embedded in social activities; that ‘social glue binds clusters together.’” Many growth economists over the past 30 years have looked at the phenomenon of “increasing returns,” finding that knowledge networks play a key role in promoting growth. Our research has furthered this work explored these networks and quantified their dimensions. Our Local Connectedness factor captures the extent to which a startup community is tightly-knit (a factor that facilitates the flow of knowledge) or not. Please see the accompanying article for our detailed findings.

3 **Global Connectedness.** This is our original contribution to the concept of industry cluster: a third and very important dimension of innovation-based startup ecosystems. Think of it as the global fabric of knowledge, ideas, people and organizations, weaved primarily by quality founder-to-founder relationships across countries. As illustrated with Stockholm and Chicago, a higher level of Global Connectedness helps startups integrate into this global fabric, raising their level of performance. We developed a new way to measure this because the existing methods were inadequate. Knowledge about new innovations or the complexities of disruptive business models are spread by word of mouth between people with quality relationships, not by light LinkedIn connections.

4 **Scaleup Production.** Because among startups “the top-performing 10% provide roughly 80% of gross revenue and job

creation”², scaleup production becomes the main goal of startup ecosystems. It directly ties in to the third dimension we just proposed: startups evolving in ecosystem connected to the global fabric of knowledge have a higher capacity to develop globally-leading business models. In turn, if

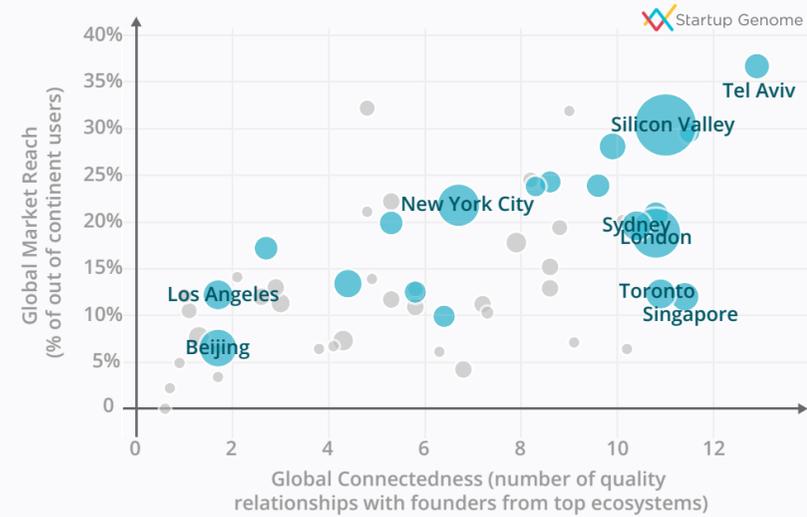
2 Stanford Graduate School of Business (2015). George Foster: Are Startups Really Job Engines? Retrieved Apr. 9, 2015 from <http://www.gsb.stanford.edu/insights/george-foster-are-startups-really-job-engines>

they focus on global customers from the earliest stage and achieve Global Market Reach, they seize leadership and see their revenue grow twice as fast as others. These are scaleups in the making. The charts below show how closely Global Connectedness and Global Market Reach are related, and to the right, how startups who achieve Global Market Reach during their early stages see their revenue grow twice as fast.

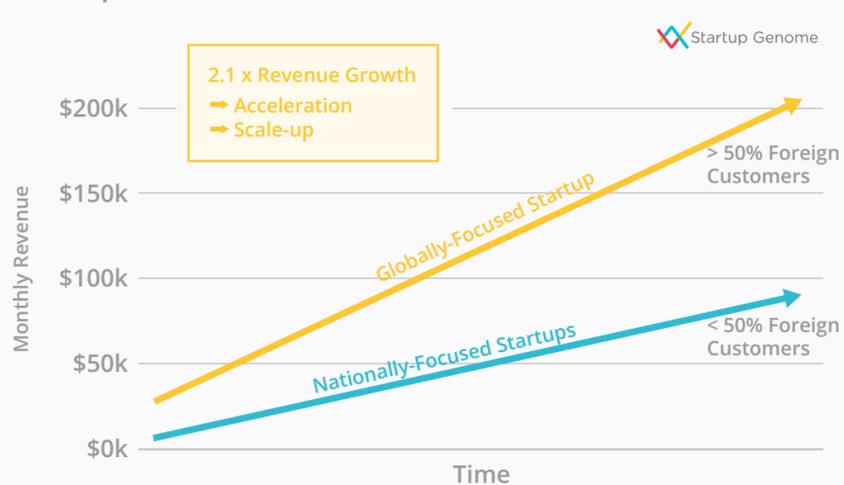


Entrepreneur Connections and Global Market Reach

Bubble size indicates the percentage of Inbound Entrepreneur Connections.



Startup Revenue Growth vs. Global Market Reach



Startup Ecosystem Lifecycle Model

Please refer to our article on the Ecosystem Lifecycle Model in the 2017 Global Startup Ecosystem for a full exploration.¹

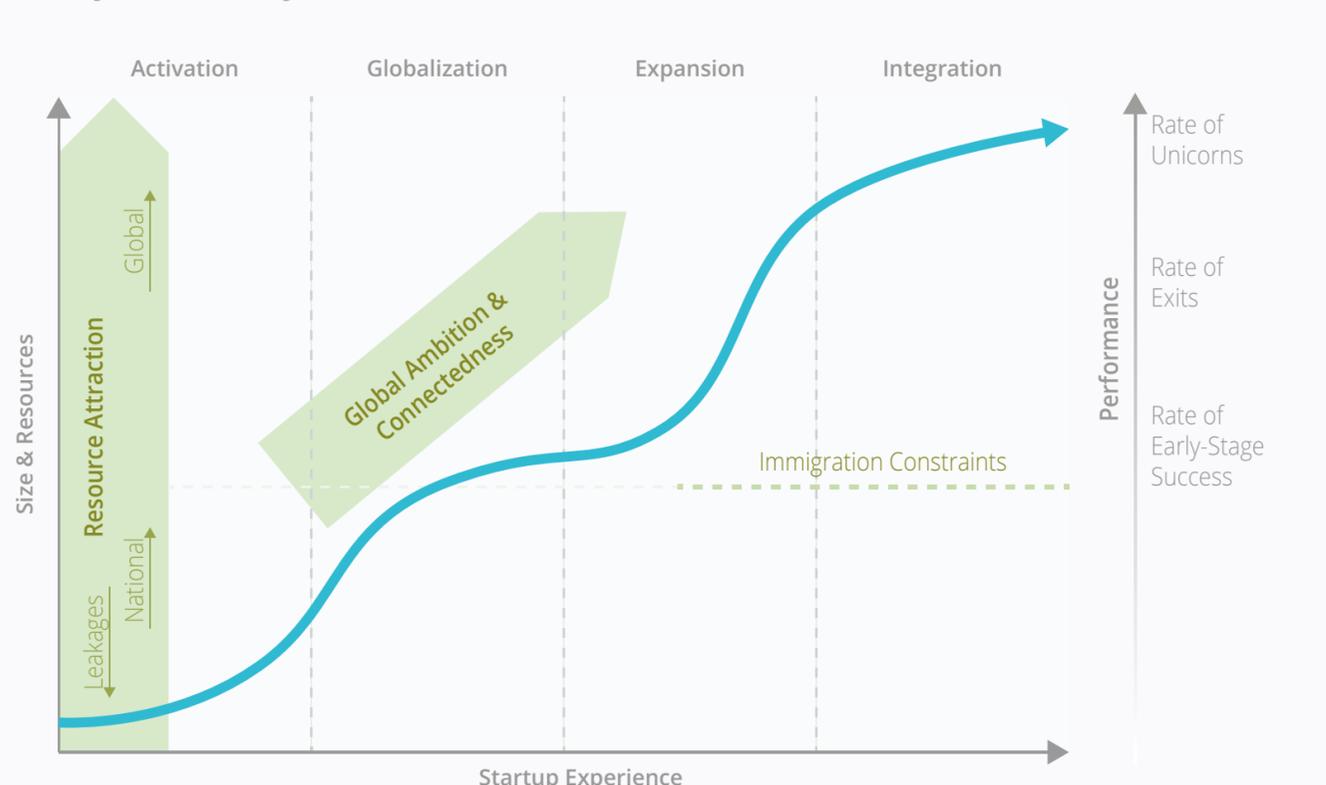
Startup ecosystems evolve through different phases. Each phase has different features, resource characteristics, and needs. We de-

¹ "Measuring an Ecosystem's Lifecycle," in Startup Genome, Global Startup Ecosystem Report 2017, at <http://www.startupgenome.com/report2017/>.

veloped our Ecosystem Lifecycle Model, as seen below, based on experience and several years of data-driven analysis. It describes how startup ecosystems evolve and explains what we see unfolding in those cities.

The Ecosystem Lifecycle Model fills two gaps in research and practice. It addresses the observation by Brown and Mason that most models of startup ecosystems were, until now, "lacking a time dimension... the temporally and unfolding and evolutionary nature of [ecosystems]."² Second, and more importantly, the Lifecycle Model provides guidance to decision makers and actors in startup ecosystems, helping them prioritize and focus their activities.

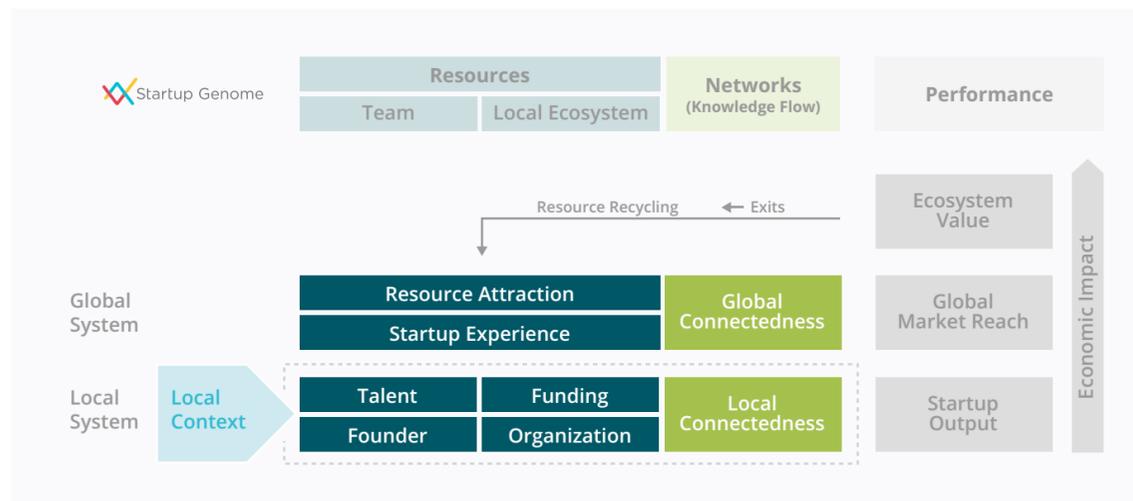
Ecosystem Lifecycle Model



Success Factor Model

Startup ecosystems are complex systems. The Ecosystem Lifecycle Model describes the flow, and the Success Factor Model breaks down the different parts, each of which functions at different levels across the Lifecycle. Therefore,

² Colin Mason and Ross Brown, "Entrepreneurial Ecosystems and Growth Oriented Entrepreneurship," Paper prepared for OECD LEED Programme, January 2014, at <http://www.oecd.org/cfe/leed/entrepreneurial-ecosystems.pdf>.



The Success Factor Model captures broad inputs (including resources, knowledge, attitudes, people, and organizations), as well as the quality and cost of those resources. It measures what supports the performance of local startups. It also uses deep analytics to measure serial entrepreneurship experience and explain ecosystem performance. The next diagram shows how well the Startup Genome Success Factor Model explains ecosystem performance.

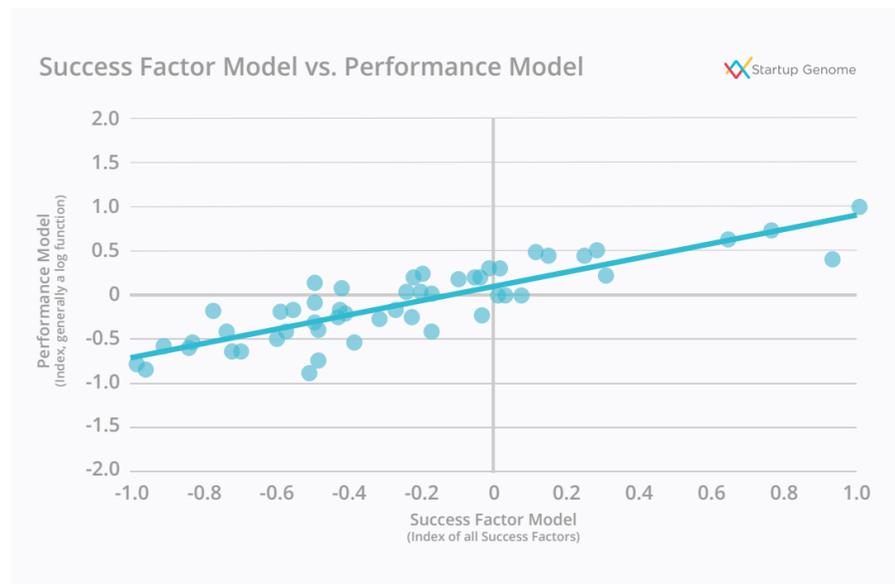
Local System. The Local System is the sole focus of ecosystems at the Early Activation phase. The Success Factor Model is an entrepreneur-centric model, with co-founders, the team organizations, investors, and capital all forming the local community. The quality of the community is measured by its Startup Experience and its Local Connectedness, while its performance is mainly captured by its Startup Output and Output Growth Index.

The Local System also includes the Local Context, as the startup community is influenced by the local and national communities where they exist and their diversified economies. The Local Context captures the collection of cultural issues, English proficiency, coding proficiency, infrastructure, size of the local and national economy, and the general laws and regulations and how all these factors influence the startup ecosystem.

Because our primary research focuses on the startup community, we measure their issues through secondary research and use more than one source wherever possible. The most difficult to codify are

cultural issues such as entrepreneurial spirit and fear of failure. There is a great need for improved measurements of these aspects. Please contact us if you have a method that can be scaled globally.

Global System. In the Late Activation phase, the Global System slowly becomes the focus. In order to thrive at this point and beyond, the ecosystem community needs to increasingly “belong” to the global startup community, as expressed by its Global Connectedness. As described earlier, this allows the community to tap into the global fabric of knowledge to better develop globally-leading business models, achieve Global Market Reach, and accelerate into exits. Exits help recycle resources into the ecosystem, furthering its growth. Several large exits combined may indirectly Trigger a sharp acceleration of ecosystem growth by provoking a rapid increase in net Resource Attraction. In the Activation phase, Resource Attraction is usually negative for an ecosystem, with more startups leaving than arriving. With more Triggers and ecosystem growth, Resource Attraction and Startup Experience (see below) become actionable factors for leaders.



the Lifecycle becomes a lens through which to look at the Success Factor gaps (and strengths) in order to understand the importance of each. Benchmarks provide a second lens through which the relative importance of a gap can be understood.

Performance Model

- Scaleups, Unicorns, Exits**—lagging indicators. Production of these is undeniably the ultimate and most important goal of a startup ecosystem, given their disproportionate economic impact. Annually in the United States, 50% of gross job creation is accounted for by only 15% of firms, most of which are young startups.³ Among early-stage startups, only 10% of

³ Ryan Decker, John Haltiwanger, Ron Jarmin, and Javier Miranda, “The Role of Entrepreneurship in US Job Creation and Economic Dynamism,” *Journal of Economic Perspectives* (Summer 2014).

them generate 80% of their job creation.⁴ Data on scaleups and exits, however, show to what degree an ecosystem was able to support startups created 5 to 10 years earlier.

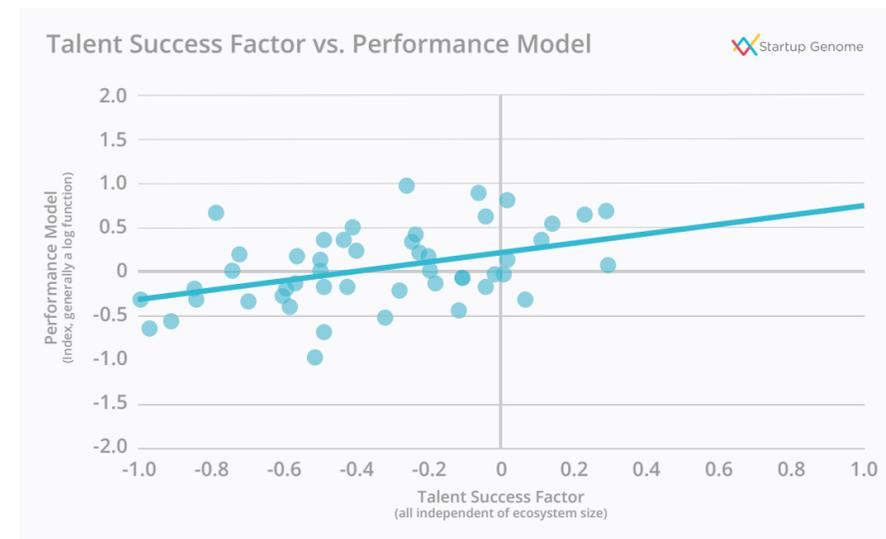
- 2 **Startup Valuation**—current indicator. New valuations of startups, which are tied to funding rounds, occur regularly and in higher numbers than the lagging indicators above, providing better and faster feedback on the quality and improvement of a startup ecosystem.
- 3 **Ecosystem Value**—mixed (current and lagging) indicator. The sum of Startup Valuation and Exit Value, this is a key measure of ecosystem size and performance.
- 4 **Startup Output**—leading indicator. For many years, we asked local experts to provide an estimate of the number of startups in their cities, but to no avail. We ended up with wide estimate ranges unlinked to any statistical methodology. Yet it became imperative to measure the number of startups per ecosystem in a rigorous and standardized manner, and we think we have made a major breakthrough here. By processing multiple lists of startups from local and global organizations (including ours) amounting to half a million unique domains, working with Orb Intelligence’s powerful technology, and processing results through a multiple systems estimation, we achieved estimates with +/- 7% accuracy. The rigor has been enhanced by performing these estimates for the same ecosystems over time.
- 5 **Growth Indexes**—leading indicators. The growth momentum of each ecosystem varies, but it is not easy to compare them and account for different local perspectives. To manage

⁴ Antonio Davila, George Foster, Xiaobin He, and Carlos Shimizu, “The Rise and Fall of Startups: Creation and Destruction of Revenue and Jobs by Young Companies,” Australian Journal of Management, February 2015.

this, we compute an Exit Growth Index, Output Growth Index, and Funding Growth Index.

Success Factors

- A **Founder.** This Success Factor—which we started defining in 2011 and recently returned to complete its DNA—looks at issues intrinsic to the founding team and that are under their control. These are internal Success Factors rather than ecosystem Success Factors, which are external. Sub-factors include:
 - a **Mindset and Ambition:** a set of metrics based on cognitive science research, as well as separate measures of ambition and motivation.
 - b **DNA:** demographics, economic and educational data, and influencing factors on the choice to become an entrepreneur.



- c **Startup Strategy:** the company’s go-to-market strategy, the markets it is targeting, the international experience of its leader, and the global deployment of the team.
- d **Know-How:** knowledge of the Customer Development and Lean Startup methodologies and other knowledge keys to early-stage success.

- B **Talent.** This is one of the most difficult Success Factors to quantify, in part because talent must be defined differently from conventional wisdom when talking about early-stage startups. While sheer engineering quality matters, the best local engineers are mostly out of reach for early-stage startups and therefore what most matters to early-stage startups is engineers with prior experience in a startup, and secondarily, scaleup experience along with attraction of foreign engineers.

As the following chart shows, the Talent Success Factor closely correlates with our Ecosystem Performance Model (correlation of 54%). It also correlates with Startup Output, but not quite as much, because an ecosystem’s scaleup experience is not relative to its number of startups but the number of its exits. The chart also shows that raw coding talent is quite geographically spread out, unlike Startup Experience which concentrates through the ecosystem lifecycle and Resource Attraction.

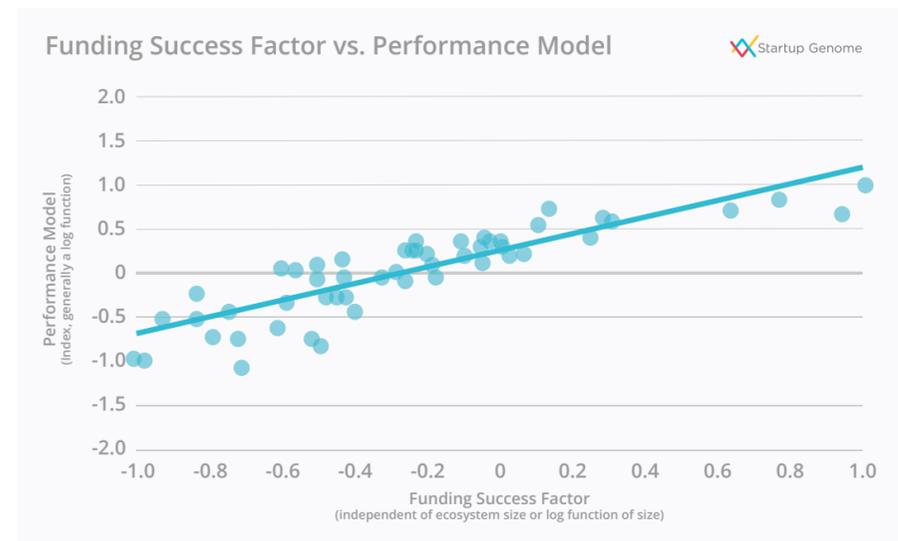
Talent Sub-factors are:

- a **Access:** we aim to capture the ability of early-stage startups to hire and attract engineers and growth employees,

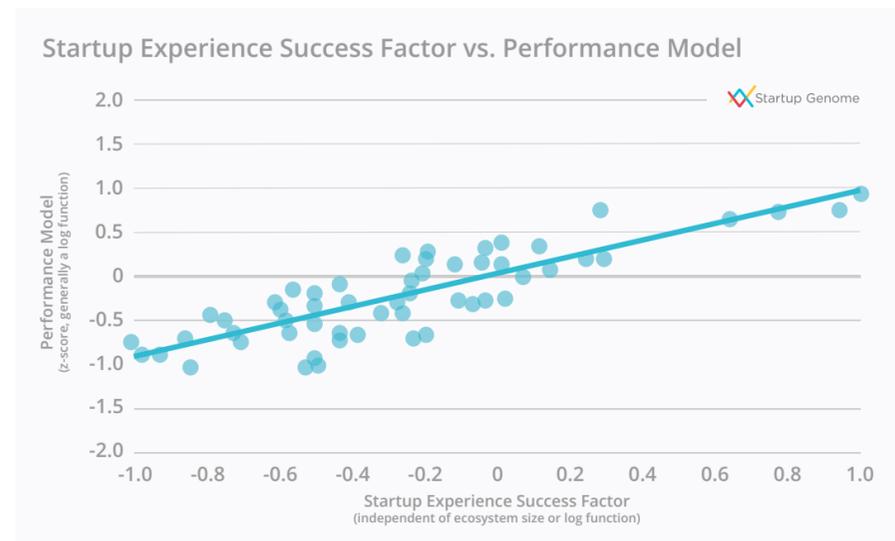
particularly those with prior startup experience, recognizing that access varies substantially by ecosystem stage and the quality of local educational institutions. More metric validation is required here.

- b Quality: we currently measure this by a mix of raw talent and scaleup experience in the community.
- c Cost: requisite compensation for hiring software engineers.

C Funding. Data on funding is widely available and is therefore overused in trying to explain startup and ecosystem performance. As a result, it becomes the main culprit in the conclusions of much research. Yet funding is only part of a complex system of resources across the lifecycle. Funding data is also misused—we have come to realize that much of the “current” funding data is later changed because it can take 6 to 12 months for funding rounds to enter the relevant datasets.



- a Early-Stage Funding Per Startup. Together with Startup Output, this is the first test of a potential gap. We combine global databases with local data, applying a set of correction mechanisms to account for missing rounds and differential coverage. We then break down any funding gap into four actionable issues:
 - i Proportion of startups obtaining seed funding, which varies widely and is a key challenge for Activation phase ecosystems.
 - ii Attrition rate from seed to Series A, frequently a gap issue.
 - iii Median seed amounts—because investors believe that a minimum funding level is needed for a startup to succeed, but that too much money can lead to harmful premature scaling, comparative interpretation of these results needs to account for differences, including in salary costs.



iv Median Series A amounts—our experience shows that these are more likely to be an issue because the purpose of this round is to fund growth.

- b **Early-Stage Capital Invested**—a measure of overall funding and, as a leading indicator, its growth.
- c **Experienced VC Firms**—their number and proportion provides an indicator of quality.

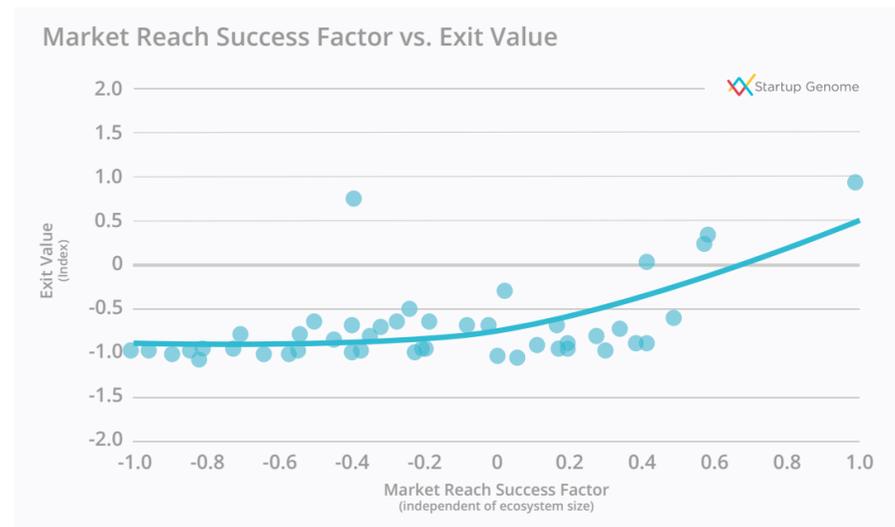
As the following chart demonstrates, the Funding Success Factor very closely correlates with our Ecosystem Performance Model (correlation of 87%).

D Startup Experience. Measuring the diversity and complexity of experience in a community is difficult. We have developed a set of metrics that capture experience and are validated against ecosystem performance. These include:

- a Giving equity to advisors and employees, which is linked with success.
- b Scaling experience through exits.
- c Experience with growth in a fast-growing startup or unicorn

Along with Funding, Startup Experience has the highest correlation with the Ecosystem Performance Model (correlation of 85%). The fact that those variables are very much independent from the Ecosystem Performance Model variables makes this correlation quite striking. We developed a solid Startup Experience model and solidified the Factor’s position in the Lifecycle Model as the X axis, with ecosystem Size & Resources a function of Startup Experience.

E Global Connectedness. Defined earlier in this article along with a chart showing its close relationship with Global Market Reach below.



F Local Connectedness. Our new Local Connectedness Success Factor is defined earlier in this article and is the object of its own article later in this report. It has a correlation of 46% with the Ecosystem Performance Model. It includes the sub-factors:

- a Sense of Community: how founders and investors help each other.
- b Local Relationships: the number of quality relationships between founder and other founders, investors, and experts.
- c Collisions: participation of founders in community activities and events.

d Density: the prevalence of co-working spaces and how many startups use them, the physical proximity of startups to each other, and how far founders live from where they work.

G Global Market Reach. As explained above, we measure 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. In most Canadian ecosystems, for example, startups report a high percentage of foreign customers. But, when North America is removed, the Global Market Reach of Canadian startups falls sharply. Most of them are selling into the United States, but not elsewhere.

As explained earlier, Global Connectedness leads to Global Market Reach and the production of scaleups. The Global Market Reach Success Factor is therefore closely related to the Ecosystem Performance sub-factor Exit Value, as the chart below demonstrates. The exponential relationship between the two factors is very noticeable.

H Organizations. Measurement of the quantity and quality of organizations, programs, events, and other activities is being conducted with support from the Kauffman Foundation. The result will be a prioritized list of programs and characteristics that have the most impact on increasing of the number of startups, activating investors, and building a highly-connected local community.

I Economic Impact. Equipped with seven years worth of performance data on startups plus the data of our partner Orb

Intelligence, we are currently developing this new factor to support governments in particular.

Each of these seemingly independent success factors correlate highly with the performance model and with each other. This is a complex system where parts reinforce each other as size drives resources, resources drive other resources and performance, which in turn drives more activation of local resources and attraction of external resources, leading to yet higher performance in a cycle of success. This further validates our Lifecycle Model, showing that many resources improve together while only a few factors really changed over the lifecycle.

Sub-Sector Strength Assessment

To maximize the impact of limited budgets, policymakers and ecosystem builders must focus on the key objectives of their Lifecycle Phase (taking the right actions at the right time), and prioritize their ecosystem's deepest gaps. Additionally, they must identify the one, two, or three sub-sectors where their ecosystem have a real chance to become a world-leading ecosystem, ie what we consider the competitive advantage of a startup ecosystem. In this year's Global Startup Ecosystem Report, we examine the Third Wave and develop the foundation of data-driven assessment to support our Member Ecosystems with focused sub-sector strategies. This analysis links to strategy and policy actions for our Members. Please see the accompany article looking at global trends in sub-sectors and our Member profiles showing their relative positions by sub-sector.

Policy

Our Ecosystem Lifecycle and Success Factor models link directly to our policy framework, which is a data-driven engine for policymaking. Composed of 17 policy levers with dozens of specific policies, and supported by partnerships with Tech Nation (formerly Tech City UK) and GEN, the next step is collecting data on innovation and entrepreneurship policy worldwide. Our goal, together with our Members, is to determine the impact and effectiveness of different policies. The policy levers include:

- A Population-wide policies such as those aimed at creating an entrepreneurial culture, lifting English proficiency, or technical skills (such as coding) proficiency.
- B Enabling laws that directly target the startup ecosystem such as tax treatment of share options and business creation procedures.
- C Indirect laws and policies that affect the startup ecosystem in sometimes obscure ways.

The framework will be the object of a future article, with results published in next year's report.

Founder Mindset

By Dane Stangler and JF Gauthier (Startup Genome), Michelle Duval (Fingerprint for Success), Patrick Merlevede (JobEQ)

Building a startup is hard. That is, by now, an obvious observation. But, when assessing startup ecosystems and looking at which Success Factors help startups (or don't), it's worth reiterating. Startups are a rollercoaster unlike almost anything else in economic life. That up-and-down ride will, at times, demand unbelievable mental fortitude, and at others require a Zen master-like detachment. Certain behaviors, attitudes, and preferences will be more helpful than others to founders' work of creating something from nothing.

To analyze these essential mental attributes, Startup Genome and Fingerprint for Success asked founders around the world questions pertaining to their Founder Mindset.¹ **We discovered three main things:**

- 1 Serial entrepreneurs have a strong Founder Mindset;
- 2 Repeated accelerator participation doesn't foster Mindset; and,
- 3 The Mindset attributes associated with Startup Success and Scaleup Success are correlated with ambition, funding outcomes, and, in some cases, revenues.

We found limited demographic differences.

"The good news is you can change your Mindset. Major events shape you—like going through the cycles of a startup!—and so can coaching. I'm a geek, originally too high on Depth to be a good founder and CEO, who developed soft skills by watching others, slowly developed Breadth through experience, and later became high on Initiation—at work. At home I'm different. So we adapt, and coaching can help us proactively and deliberately invest time and efforts to change, rather than learn the hard way."

JF Gauthier

Serial Founder

What Mindset Is and Is Not

Mindset is not about an "entrepreneurial personality" that would seem to disqualify some people from entrepreneurship. Our philosophy is that it's possible for anyone to be a founder. Analyzing Founder Mindset is not meant to presuppose which people might

not succeed; it's about showing people what attitudes, behaviors, and skills help founders to succeed. The five factors analyzed here are only a handful of many more factors involved and studied in Mindset research. Based on cognitive science research and tested with thousands of founders across the world over 20 years, the

Insights for Startup Founders

- Know yourself. The Delphian Oracle spoke the truth for entrepreneurs: know (and be honest about) your preferences, attitudes, and inclinations.
- Seek co-founders who complement. If you can accurately judge your own preferences, look for the opposite in co-founders—to a degree. Many startups fail because of team dysfunction and there are other behaviors and attitudes (not studied here) that correspond to healthy team dynamics.
- Aim high and think big. Founders who target large, global markets and who score in our Startup Success range tend to be big-picture thinkers who don't get lost in the details.
- Evolve with your startup. Too much focus on Structure at early stages may limit flexibility and strategic thinking—but more Structure at later stages will help you grow.
- Find a good coach. Mindset is not fixed: it can be changed like any behavior or attitude and a coach can help you evolve with your startup's needs.

Insights for Ecosystem Builders

- Help founders grow; don't try to change them. Support programs should seek to offer founders in your community a variety of ways to explore and develop their own preferences and attitudes.
- Pitch a big tent. Programs and activities should not presume that to be successful, all founders must share the same set of behaviors. Each individual will differ in their Mindset, but those differences won't necessarily correspond to your prior assumptions.
- Take a hard look at programs such as accelerators and incubators. What do they purport to offer founders and how do they actually perform in terms of helping founders experience and learn different Mindset orientations?

Mindset metrics measured by Fingerprint for Success capture what people prefer to focus on and pay attention to, what brings them enjoyment at work, and how they filter reality. A particular "score" on one of the Mindset variables does not determine ability; they capture what either gives or drains energy from people. The analysis here looks at the following Mindset dimensions:

- **Initiation**—this indicates a proclivity and energy level to start new things, to turn ideas into action. Research has found a high score on Initiation is positively correlated with startup venture success (see below).
- **Reflection + Patience**—a high score on this variable indicates someone who pauses and waits before taking action.
- **Breadth**—a preference for abstraction, general overviews, and "big picture" thinking. Research finds a high score on Breadth to be positively correlated with startup success.
- **Depth**—indicates a preference for details, specification, and concrete thinking. A high score on Depth is found to be positively correlated with startup venture failure.
- **Structure**—preference for planning and organizing before starting on a task. Research finds a high score here to be correlated with startup venture failure, although it is also positively significant for later-stage "business builders" (see below).

For our analysis, the following definitions were used for success at different stages:

- Early-stage ventures: success defined as an exit within five years of starting for between \$6 million and \$1.2 billion. We refer to this as Startup Success.
- Business builders: success defined as scaling a venture profitably over a 10 to 15 year period.² We refer to this as Scaleup Success.

² Definitions of success and the performance zones come from Fingerprint for Success. Startup Genome is conducting further research this year on what it means to be a "scaleup" firm.

Scores and results were separated along three “attitudinal performance zones”:

- **Green Zone** = success range. Founders here tend to have Mindset attitudes that are correlated with Startup Success and Scaleup Success.
- **Orange Zone** = slightly higher (or lower) than the success range;
- **Red Zone** = far outside the success range, much higher (or lower).

These benchmarks are based on in-depth research, and are representative of the Mindset attitudes of entrepreneurs that have achieved Startup Success and Scaleup Success.

Based on thousands of survey responses, we analyzed where founders fall in terms of the performance zones and how individual variable scores in each category (e.g., Initiation) correlate with Startup Success and Scaleup Success. We also cross-analyzed these scores with our results on other founder and company attributes, including funding stages, ambition, and demographics.

How Founders Compare to Mindset Benchmarks for Startup and Scaleup Success

The following table displays the distribution of founders in our global survey sample across the three zones or benchmarks on overall Mindset.

Share of Founders Globally By Mindset Zone	Startup Success	Scaleup Success
Green	24%	38%
Orange	4%	6%
Red	72%	56%

Only one-quarter of founders in our sample align with the overall Mindset benchmark for Startup Success. Nearly four in 10 founders align with the overall Mindset benchmark for Scaleup Success. These results do not mean that three-quarters of founders globally will fail, or that half of them will fail to scale their company successfully. But, given the high failure rate for startups globally, this distribution means that there are considerable learning and coaching opportunities. Some founders will fall into the Green Zone for two of the five Mindset variables here, but still be in the Red Zone overall (see tables below).

Across ecosystems, this distribution varies: in some ecosystems, the share of founders falling into the Green Zone for overall Mindset is greater than the global share. In others, a relatively low percentage of founders are in the Green Zone. On overall Mindset, only seven

of our 43 ecosystems rank in the top tier of Green Zone founders for both Startup Success and Scaleup Success (see Table).

Ecosystems in Top Tiers for Founders in Green Zone on Both Startup and Scaleup Success

Ecosystem	% in Green Zone for Startup Success	% in Green Zone for Scaleup Success
Phoenix	31%	52%
New Zealand	29%	48%
Singapore	32%	47%
Frankfurt	32%	46%
London	27%	46%
Jerusalem	27%	47%
Ottawa	29%	43%

Note: In our analysis, South Africa had the highest share in the world of founders in the Green Zone for Scaleup Success Mindset, but one of the lowest shares for Startup Success. Because the overall correlation across ecosystems between these two Mindset benchmarks is so strong, and because our sample size in South Africa is comparatively low, more research is needed on South African founders—and we believe such research will turn up some interesting findings!

Most founders in our global sample do score highly on some of the individual Mindset attitudes correlated with Startup Success. Nearly two-thirds, for example, are aligned with the Green Zone for Initiation. It is important to note that the Green Zone for each variable does not always correspond to a “high” score. The Green Zone of Depth, for example, indicates that 51% of founders in our sample have a low preference for focusing on details—a preference that is negatively correlated with startup failure.

Percentage of Founders in Global Survey Aligned with Startup Success, per Attitude

	Initiation	Reflection + Patience	Breadth	Depth	Structure
Green Zone	60%	54%	60%	51%	34%
Orange Zone	24%	19%	0%	22%	14%
Red Zone	16%	26%	40%	27%	53%

Interestingly, a slight majority fall into the Red Zone for Structure—this means that most founders in our survey sample have a high preference for Structure, which is negatively correlated with Startup Success.

When we look at individual variables for Scaleup Success, we find a higher share of founders in the Green Zone across each variable.

Percentage of Founders in Global Survey Aligned with Scaleup Success, per Attitude

	Initiation	Reflection + Patience	Breadth	Depth	Structure
Green Zone	74%	62%	60%	62%	46%
Orange Zone	10%	8%	19%	11%	29%
Red Zone	16%	30%	22%	27%	25%

Founder Mindset, Startup Performance, and the Importance of Co-Founders

We found a positive relationship between the overall Mindset of B2B founders and the revenue of their companies. Founders in the Green and Orange Zones for Startup Success enjoy higher revenues at their companies than those in the Red Zone. Our findings on another dimension of performance—employment growth—were not as robust. There is only a weak relationship between Founder Mindset and startup employment growth.

This reflects the structure of our research and the importance of founding teams. Our survey results reflect the responses of only one founder at each startup, but most of the startups in our sample have multiple co-founders. It’s possible—even quite likely—that a strong relationship exists between Mindset and startup performance when multiple founders are present. **Prior Startup Genome research has found that the optimal founding team size is three.** We attribute this to the fact that co-founders complement each other in the strengths and gaps they bring to a startup, and this enhances overall startup performance.

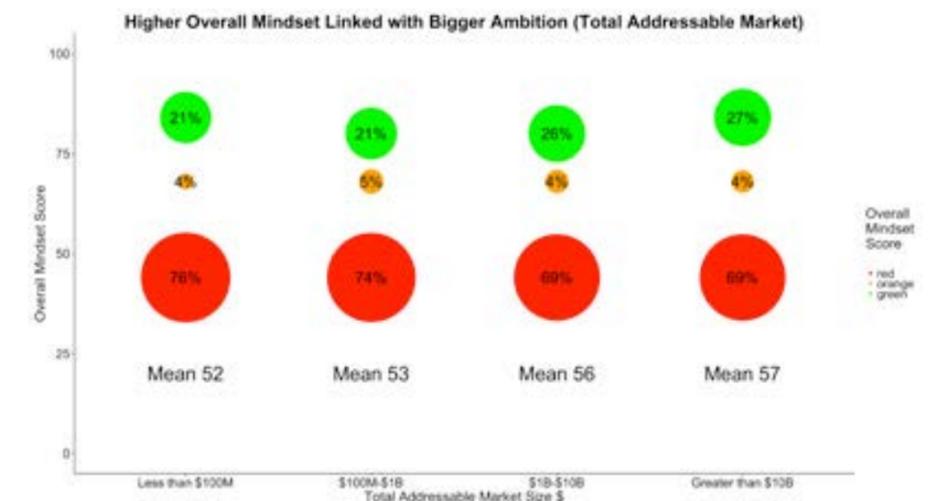
How Do Ambition and Mindset Interact?

Initial Ambition directly influences the profitability of new companies. Business owners seeking a stable income and lifestyle will make different choices about business model, funding, and organizational structure than a startup founder who is developing a brand-new product for large global markets. To gauge ambition,

founders were asked about the total addressable market (TAM) they’re aiming for, as well as whether they are working on a “local version of an established product” or developing a “new, first-of-its-kind globally” product or service. We find some fairly clear relationships between overall Mindset and these individual variables.

Founders targeting smaller markets have lower overall Mindset results for Startup Success, while founders with larger markets in their sights have a higher likelihood of being in the range for Startup Success. Those targeting smaller markets score lower on Breadth and have a higher focus on details. Correspondingly, founders focused on larger markets have a smaller Depth orientation.

We find similar relationships when looking at the type of product or service founders say they are developing. Founders working on a local version of an established product or service have lower overall

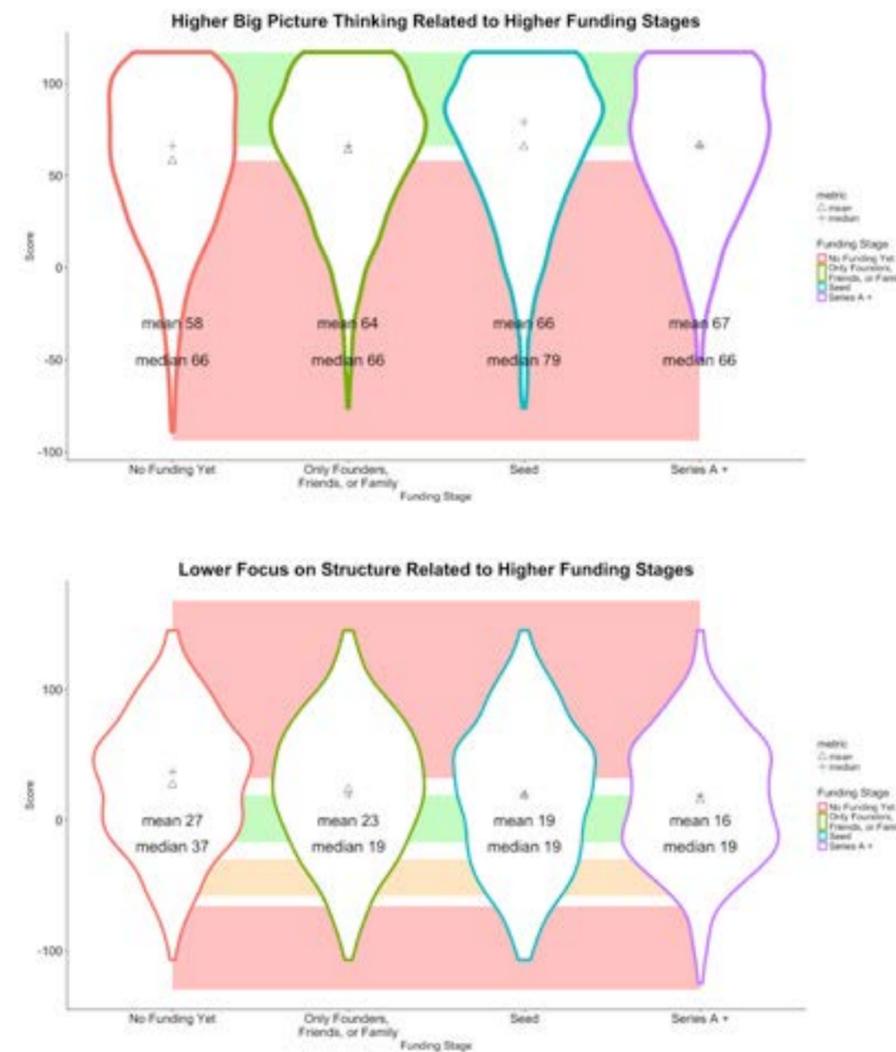


Mindset results (outside the Startup Success range) than founders developing unique products or services for global markets. The globally-ambitious founders have stronger orientations toward big-picture thinking and a lower focus on details (Breadth and Depth, respectively). Founders focused on local versions of existing products or services, by contrast, are in the Red Zone for Breadth and the Orange Zone for Depth. Lower ambitions appear to be correlated with a greater focus on details rather than generalities.

A straightforward interpretation of these results is that founders with particular Mindset characteristics incline one way or the other in their market ambitions and strategies. It's also possible that ambition itself influences firm strategy and shape founders' attitudes. If, for example, a startup seeks to develop a new product or service for large, global markets from the beginning, this could force a broader orientation among founders (Breadth), which is associated with Startup Success.

Raising Money: Initiating, Thinking Big, and Lacking Structure

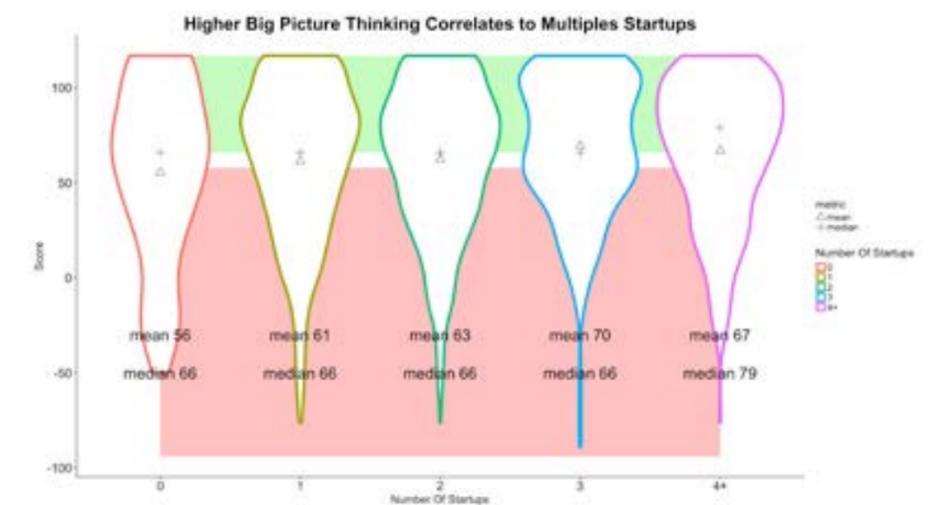
We discovered that founders who have raised seed stage funding are solidly in the range of Startup Success, with 13% higher Breadth scores than founders who have not yet raised money. All founders with early-stage funding (from friends, seed, and Series A+) score in the Green Zone for Initiation and Structure—recall that a low orientation toward Structure (planning and organizing) is positively correlated with Startup Success. The lowest results for Structure, in fact, are found among founders at the seed stage and beyond.



Mindset could determine whether or not a startup receives funding. Founders who bootstrapped or have not received funding carry a much lower preference for Initiation than those with funding. Meanwhile, among founders with funding, the highest scores for Initiation are among founders at the Series B stage. It clearly takes a certain orientation to initiate the fundraising process, and those

who haven't taken the first step (low on Initiation) are those who have not raised outside money. (Bootstrapping, though, may have other virtues for startups.) It's also possible that outside equity investors identify and screen for those Mindset variables that we have looked at here, although this would not necessarily apply to the "friends" funding source.

Causation may also run the other way: raising money—and bringing in outside investors as advisors and board members in the case of equity funding—could force an evolution of founders' attitudes. Founders learn over time, and what they learn shapes their Mindset going forward. Serial entrepreneurs, for example, have a strong inclination to start things (Initiation), focus on the big picture (Breadth), and are found to have a lower orientation toward Depth and a lower proclivity for Reflection + Patience. Overall, our analysis shows that the more companies one starts, the stronger In addition to direct experience, founders may also learn to develop stronger



Mindset characteristics through participation in accelerator programs. While the results on accelerator participation and overall Mindset score were mixed and inconclusive, we did find interesting differences with regard to individual variables. Founders who have gone through zero or only one accelerator program have a higher focus on Initiation than those who have done two or more accelerator programs. Those who have been through three or more accelerators have a much higher orientation toward Structure, placing them in the Red Zone for Startup Success. The latter finding seems intuitive: founders who go through at least three accelerator programs seem to be seeking some sort of structure or guidance. Structure, however, is negatively correlated with Startup Success: comfort with ambiguity, not an orientation toward, planning, is an early-stage asset.

If serial entrepreneurs score in the Green Zone on Mindset variables related to Startup Success, it's possible that this is a result of founder learning over time. We can't know that for sure without following individual founders over time, which is beyond the scope of this analysis. Yet we do see that more frequent accelerator participation is not correlated with Green Zone results for Startup Success. This tells us that either founders are not learning through these experiences or accelerators are not facilitating evolution in Mindset.

But founders who go through one accelerator program do have a strong Initiation orientation—as do founders who did not go through an accelerator. This points to a selection effect: founders who have Mindset characteristics correlated with Startup Success choose not to do an accelerator or they only do one. What we don't know is what differences might exist among various types of

accelerator programs, but it does appear that some accelerators are adding no value when it comes to Mindset orientation for Startup Success.

How Does Mindset Differ Across Demographic Groups?

One of the dangers in researching Mindset characteristics among entrepreneurs is that results could be co-opted or distorted by those looking to “prove” that certain groups are more or less suited to succeed with startups. We find little support for any such propositions. We find no significant Mindset differences among founders of different ages or between immigrant and non-immigrant founders.

Male and female founders do differ on some of the individual Mindset variables, but perhaps not in the expected ways. **Female founders in our sample have a higher orientation than men toward big-picture thinking (Breadth) and are solidly in the Green Zone for both Startup Success and Scaleup Success on this variable.** By contrast, male founders have a lower orientation toward Structure, which lands them in the Green Zone for Startup Success, while female founders (who tend to favor Structure) are in the Red Zone. For later-stage businesses, however, female founders land in the Green Zone for Structure—and while a higher focus on Structure is detrimental to Startup Success, it is a strength for Scaleup Success. If founders can adapt and adjust as their companies mature and grow—in this case, moving toward a greater preference for Structure—they will be better positioned for success.

Local Connectedness

How Connected Should Your Ecosystem Be—and How Connected Should You be to Your Ecosystem?

Startup founders always have more to accomplish than they have time for and local support networks, which are intended to be helpful, can present a bewildering array of options. Should you attend that evening networking event? Should you try to meet as many local ecosystem stakeholders as you can? Apply for the latest pitch competition? Take that early-morning coffee request? Our latest research on Local Connectedness has determined the answer to these and other questions:

Yes. But not all forms of networking are created equal.

Last year in the 2017 Global Startup Ecosystem Report, we unveiled our research on Global Connectedness which showed that when founders in a startup ecosystem have meaningful relationships with their peers elsewhere (especially in the world's top ecosystems), it is associated with greater levels of Global Market Reach, startup growth, and overall ecosystem performance.¹

Now, we find that **Local Connectedness—especially relationships with other founders—is strongly associated with higher startup performance.** Just as importantly, not being locally connected is strongly associated with lower startup performance.

¹ "The Need for Global Connectedness," in Startup Genome, Global Startup Ecosystem Report 2017, at <http://www.startupgenome.com/report2017/>.

"Of my five startups, one was a miserable failure. A Digital Health startup founded with another successful founder (\$100M exit and more) and money from Sequoia. One year into it someone at a conference told me "you're the third generation of startups doing this business model and they all failed...". We were in a Globally- and Locally-Connected ecosystem (Silicon Valley) but we were B2B enterprise software experts, not personally connected in the B2C Health space. One year later we were, just in time to access all kinds of valuable knowledge...and run out of money! "

JF Gauthier

Serial Founder

Beyond relationship-building, a healthy Sense of Community fostered by founders helping each other is highly correlated with overall ecosystem performance.

What Does Local Connectedness Mean?

Prior research, the lessons of common experience, and the practice of economic development have led to two presumptions about Local Connectedness: (1) being connected to local networks is important for entrepreneurs; (2) physical proximity strengthens those local networks. Mostly, analysis and practice have assumed

Insights for Startup Founders

- Invest time and efforts in developing your network and nurturing many relationships, very early in your startup.
- Help out other founders. Brad Feld is right—giving before you get is good for the ecosystem.
- There's no free-riding: you don't get the benefits of a connected ecosystem if you're not connected yourself.
- Relationships with other founders matter the most.
- Build relationships with investors and experts, too.
- All these relationships function as conduits for knowledge transfer, source of introduction to investors, partners, customers and future employees, and much more.
- Building relationships takes valuable time away from working on your startup, but it pays off. And the cost of not doing it is higher.

reducing distance between people will lead to more connections and more success.

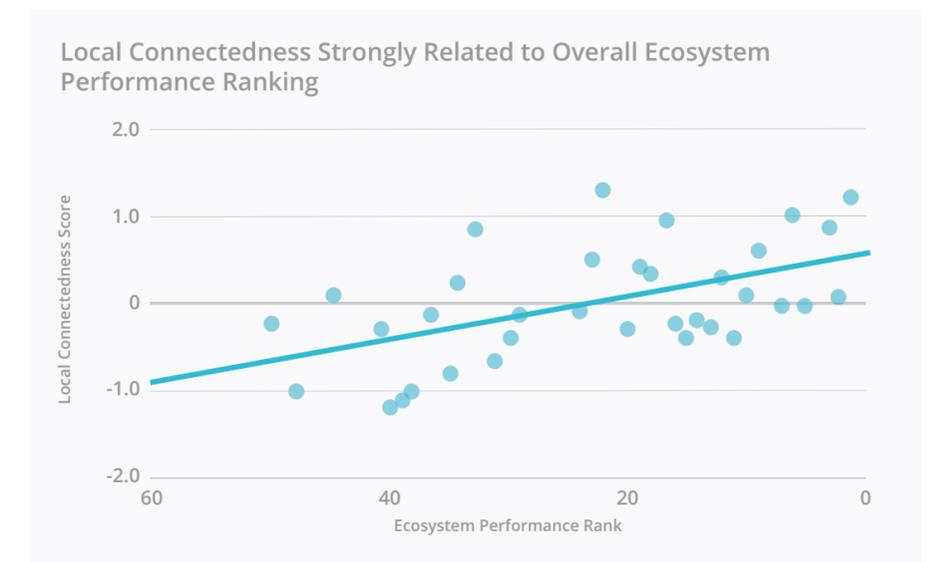
We find that Local Connectedness reveals a lot about startup success and ecosystem vibrancy, but it does not confirm all of these prior assumptions.

In our analysis, the new Success Factor of Local Connectedness is comprised of four sub-factors:

- **Sense of Community**—“people helping people.” We asked startup founders and executives about the ease of seeking and receiving help and introductions from other founders and investors.
- **Local Relationships**—how many local founders, investors, and experts do startup founders and executives have a relationship with? (Investors here does not include investors in their own startup.)
- **Collisions**—to determine whether the vogue concept of Collisions (serendipitously running into others from the startup community) matters, we asked startup founders and executives about their engagement with others in the community and their attendance at events.
- **Density**—this sub-factor captures how closely startups work with other startups, either in the same office or in a coworking space, and how close founders and executives live to their office location.

What we found is that while there seems to be a chain of causation among these elements, they do not all matter equally for startup success or overall ecosystem performance. Density—with lots of startups working (and sometimes living) near each other—helps create Collisions. Those Collisions, in turn, help develop Local Relationships and a Sense of Community; the Collisions sub-factor is highly correlated with these. On its own, however, the Collisions sub-factor has low correlation with ecosystem size, and only a slight correlation with ecosystem rank. **It's not the fact of event participation and community engagement that helps an ecosystem: it's the relationships that Collisions help create.**

Overall, Local Connectedness correlates strongly with overall ecosystem rank, which reflects our multivariate analysis across nearly one hundred metrics (although the Local Connectedness sub-factors have not yet been included in the ranking analysis).



It Takes a Village to Raise a Startup

Using these Local Connectedness sub-factors, we classify founders as being high, medium, or low connected in their ecosystems. We find large differences in startup performance across these categories. **Highly-connected founders, in particular, enjoy a higher rate of success in their startups.** While we cannot say definitively that high Local Connectedness of founders causes better startup performance, our robust findings here are certainly suggestive.

We looked at two measures of startup performance: employment and sales. For overall Local Connectedness, low-connected startups have, on average, lower employment than startups that are better connected. Surprisingly, the high-connected startups are often younger companies: they are building local relationships early on and growing faster in size.

Less-Connected Startups Have Lower Employment and Slower Employment Growth

Connectedness	Low Local Connectedness	Medium Local Connectedness	High Local Connectedness
Share of Startups with >25 FTEs	9.3%	12.2%	12.3%

Which dimension of overall Local Connectedness is most associated with startup performance? A higher number of Local Relationships—with other founders, investors, and experts—is correlated with higher sales, as shown in the table. Founders in the “high”

connected category outperform the medium- and low-connected in sales, and the high- and medium-connected founders come from slightly younger startups.

Less-Connected Startups Have Lower Revenues and Slower Revenue Growth

Quarterly Sales and Share of Startups	Low LC Relationships	Medium LC Relationships	High LC Relationships
\$0.5M-\$1M	8.3%	10.0%	11.2%
>\$1M	4.1%	6.8%	7.4%

These results don't necessarily mean that being well-connected locally causes startup growth. Another consideration may be that founders who are not plugged into local networks (and thus fall into our low-connection category) might be focusing on Global Connectedness because of the type of their company. Or, perhaps these founders are spending their time building their company rather than networking.²

But what is most striking about our analysis is the consistency of the positive relationship between a high-level of connection and startup performance.³ **Clearly, there can be no free-riding by the unconnected: almost without exception, the lowest-connected founders are behind in terms of company performance.**

² Yasuyuki Motoyama and Jared Konczal, “Energizing an Ecosystem: Brewing 1 Million Cups,” Kauffman Foundation, March 2013, at <https://www.kauffman.org/what-we-do/research/a-research-compendium-entrepreneurship-ecosystems/energizing-an-ecosystem-brewing-1-million-cups>.

³ Also worth noting is that high- and medium-connected founders had a higher response rate to the confidential sales survey question than low-connected founders.

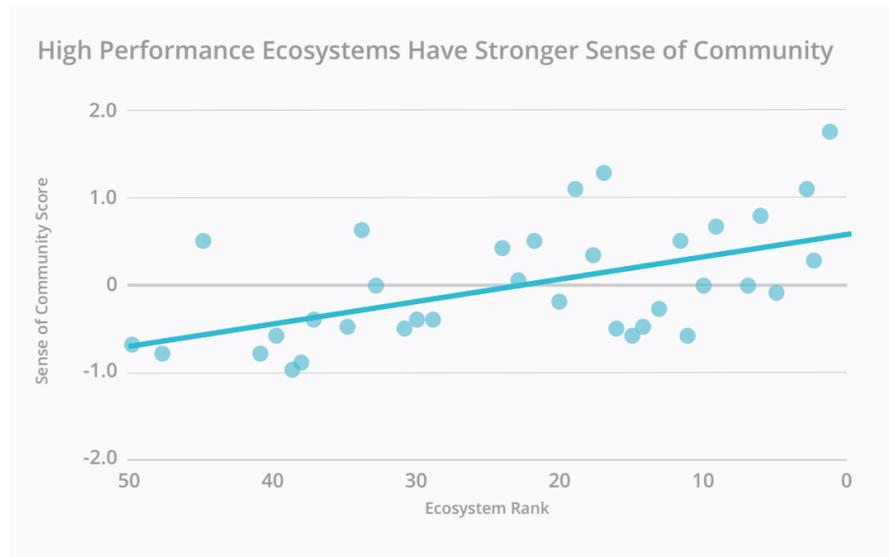
Insights for Ecosystem Builders

- Work inclusively, connect everyone, including experts and investors. Local Connectedness acts as a multiplier, increasing access to local resources, knowledge, and global connections.
- Invest explicitly in building a strong Sense of Community. When founders help each other and receive help from investors and experts on an informal basis, overall ecosystem performance is enhanced.
- Physical proximity is less important than quality relationships that lead to exchanges of assistance and knowledge transfer. While events and activities can help generate those relationships in the first place, coworking spaces and co-located offices do not automatically build Sense of Community or Local Relationships.
- Fill relationship gaps: female founders overall have a higher level of relationships with peers than men, but are less-connected to investors.

Does Local Connectedness Boost Ecosystem Performance?

In our analysis of Local Connectedness and startup performance, we did not find any significant relationship with Sense of Community. But, Sense of Community does correlate highly with indicators of overall ecosystem performance such as Startup Output, exits,

startup valuations, exits, unicorns, and ecosystem value. A higher level of Local Relationships is also positively correlated with ecosystem performance.



This correlation is driven mostly by the individual metric of Founder Help—defined as founders helping founders, providing advice, introductions, or perhaps just a sympathetic ear. When founders help other founders, overall ecosystem performance is stronger. At the ecosystem level, then, we find empirical support for Brad Feld’s “give before you get” proposition.

But there is a difference between relationships and help. A strong Sense of Community emerges from Local Relationships, and is based on the quality, not necessarily the quantity, of those relationships. Founders’ interaction with investors is different, however.

The individual metric of Investor Relationships is strongly correlated with ecosystem performance, but the metric of Investor Help is not. Relationships with investors are conduits for the transfer of knowledge, experience, and tacit know-how, and these, rather than direct help from investors, appear to be a key resource for founders.

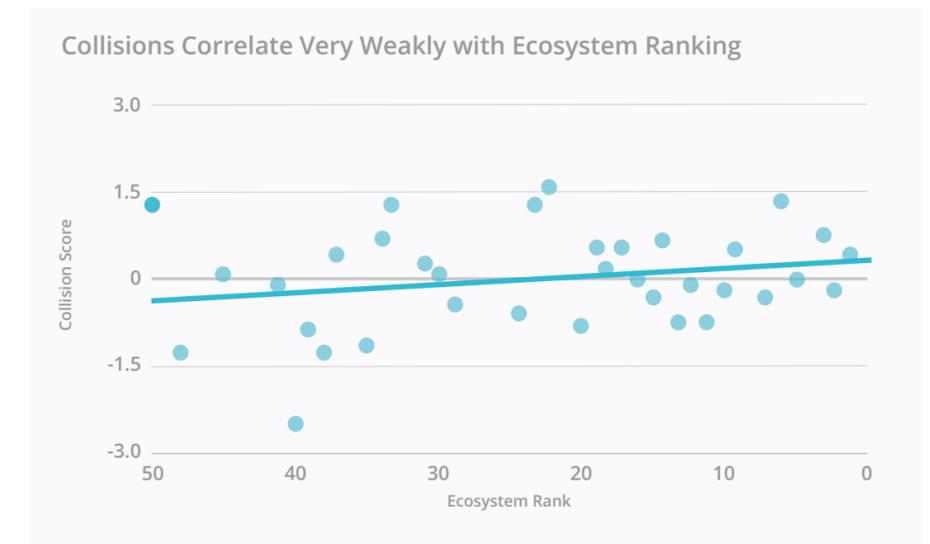
The connections between Sense of Community and Local Relationships and overall Local Connectedness are not always straightforward, and they vary by ecosystem. Greater Helsinki and Jerusalem, for example, are both small, strong startup ecosystems, with similar levels of Sense of Community in our analysis. The Greater Helsinki region, however—at number one in our analysis—has a much higher level of Local Relationships (among founders, investors, and experts) than Jerusalem.

Top 10 Ecosystems for Local Connectedness

- Greater Helsinki
- Silicon Valley
- Tel Aviv
- Sydney
- London
- Houston
- Los Angeles
- Atlanta
- Amsterdam
- Singapore

The (Overrated?) Role of Physical Proximity

We also looked at Density—a term that captures whether startups in a given ecosystem work in a coworking space or an office with other startups, and how far founders live from their office. Initial analysis failed to find any significant relationships or correlations between the Density sub-factor and our measures of startup success and ecosystem performance. Density metrics correlated fairly well with the Collisions metrics (not surprisingly), but that was it. Because of this, we removed Density from the overall Local Connectedness Success Factor. Even Collisions, however, does not correlate well with ecosystem performance.



What this tells us is that relationships and the assistance that is shared between founders is a greater factor driving startup success and ecosystem performance than mere physical proximity.

Sense of Community and Local Relationships are what ecosystem leaders should care most about, rather than trying to cram everyone into a single physical space. No matter how many startups work next to or near each other, if they don't help each other or even really know each other, their companies (and the ecosystem) will suffer. Accelerators, by contrast, do appear to facilitate relationships and exchanges of assistance; founders who went through an accelerator are better-connected than those that didn't.

This is precisely why our new research this year in the United States, supported by the Kauffman Foundation, is so important. Through this joint work, we will be digging to the quality and quantity of events and activities (Collisions), and determining what leads to relationships and a sense of community.

Female and Male Founders

In our latest survey results, we looked at how female and male founders might differ and where they are similar across several different startup variables. Based on our analysis, we find that **women are more likely to say they want to “change the world” with their startups, while men are more likely to say their main mission is to “build high-quality products.”** We also find that **in their local ecosystems, women tend to build more relationships with other founders, but are not as well-connected to investors as their male counterparts.** Additionally, our research shows differences in how female and male founders initially finance their startups.

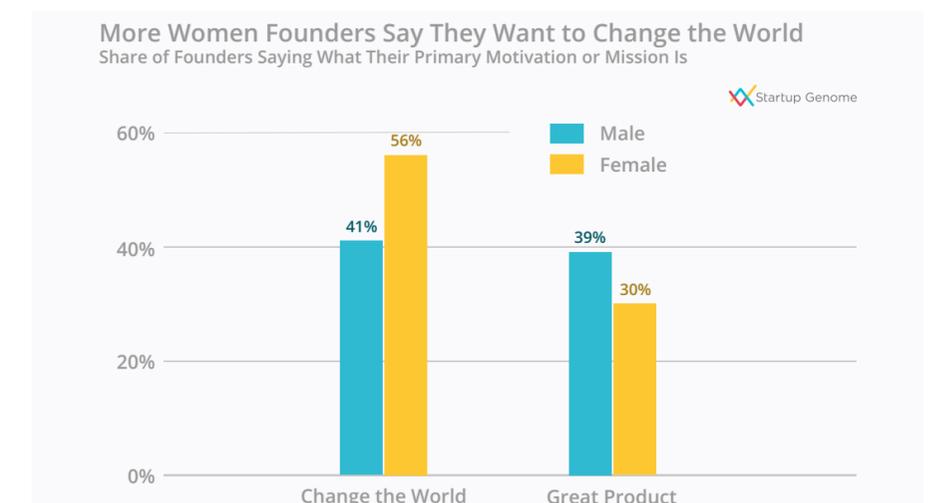
These are among the findings from our analysis of female and male founders, which brings new insight and clarity, while also leaving some unanswered questions. We will further explore these questions in a forthcoming, in-depth article. Here, we highlight some of our findings about gender and startups.

Founder Motivation. In our global survey, founders were asked about their motivations for starting their companies, as well as their market ambitions.

In terms of motivation driving a startup, female founders appear to be much more mission-driven than men. For example, **over**

half of women founders (56%) say they’re trying to “change the world” through their startups, compared to only 41% of male founders. On the other hand, a larger share of men (39%) say their motivation is to create a “great product,” compared with 30% of women. A higher share of women also say they focus on “niche” products, while more men say they focus on making “better” products.

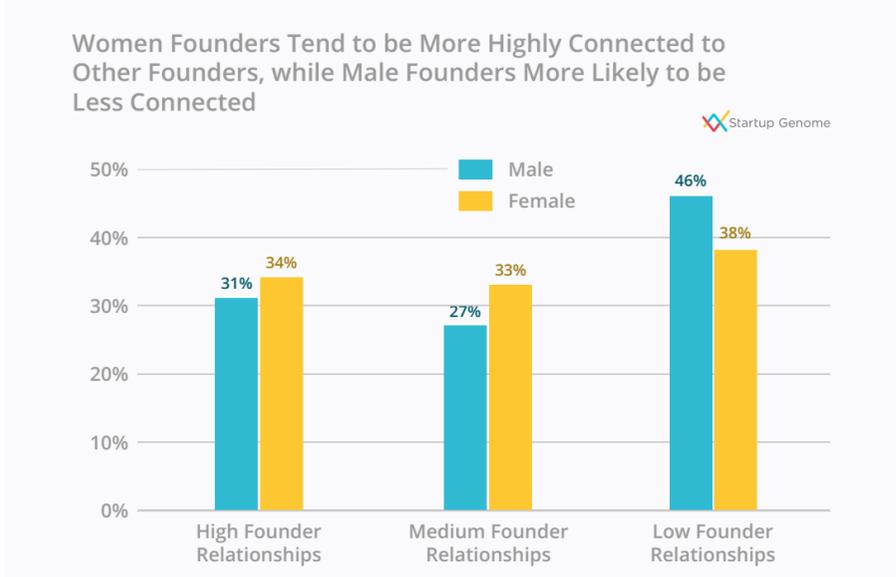
Women and men do not differ in the size of the Total Addressable Market (TAM) that they are addressing with their startups, and both female and male founders say they are working on new products for global markets.



Local Connectedness. Women and men tend to interact with their local ecosystems in different ways: slightly higher shares of female founders are well-connected locally with other founders (High and Medium Founder Relationships), while men are much more likely to be in least connected group of founders.

Our measure of Local Connectedness captures the number of founder relationships that individuals cultivate in their local ecosystem. **Women founders are less likely to be in the Low connection category**—this is meaningful because connectedness is correlated with performance. Those with higher levels of connectedness tend to have better outcomes in terms of revenue and employment growth. (Please see the article on Local Connectedness for further insight.)

When it comes to relationships with investors, however, we find the reverse. While men are slightly better connected to investors,



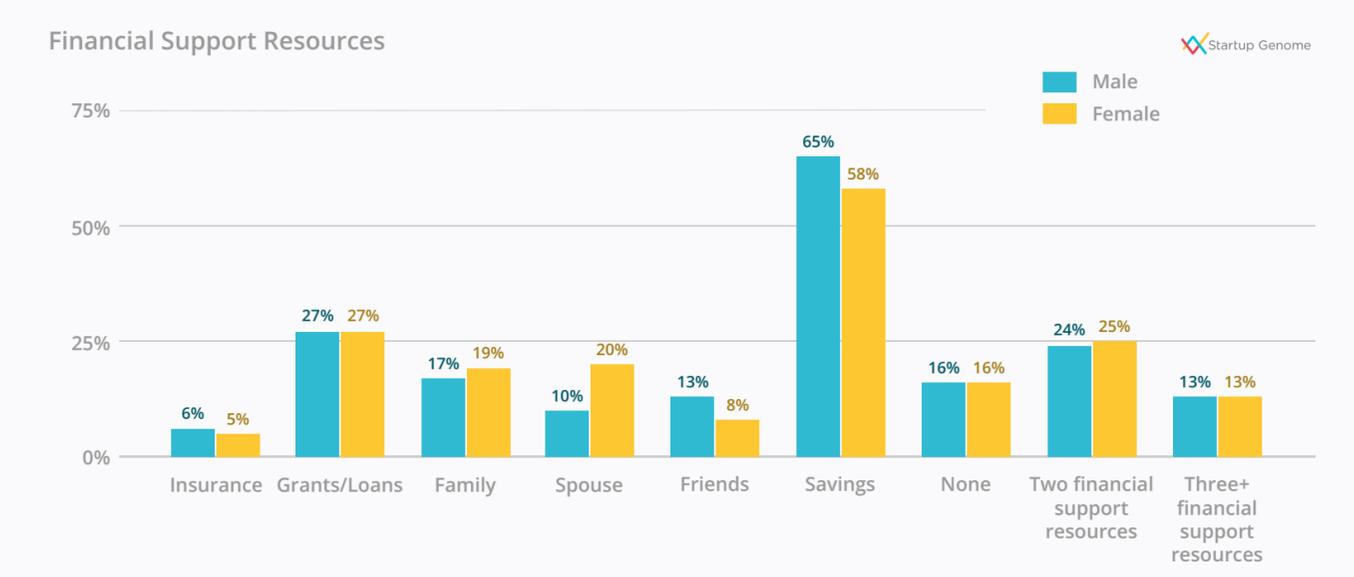
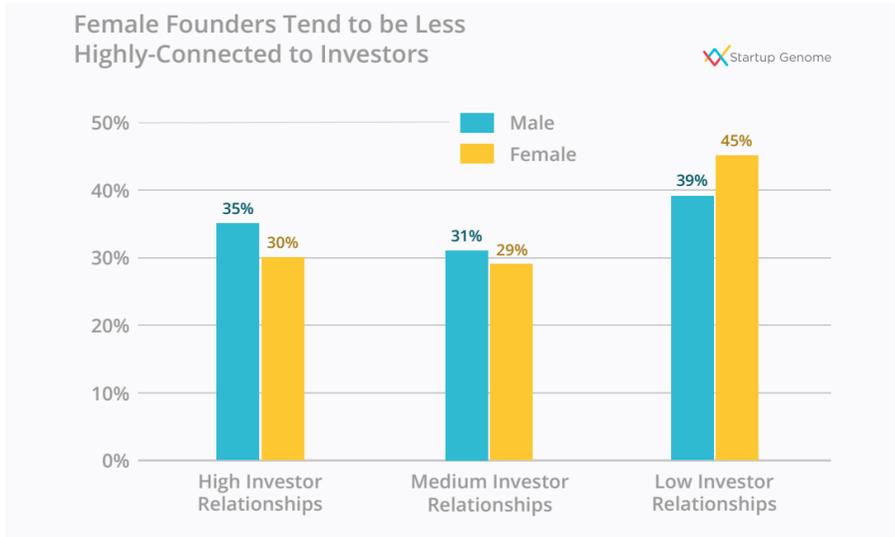
women are much more likely to be in the the low-connection category for investor relationships. (This refers to investors who are not currently invested in a founder’s company.)

This finding might shed light on the persistent equity financing differences found between women and men founders—women appear connected to fewer investors. Further research could look at why this is the case and what programs and policies could address this gap.

Support Network. We find further evidence for financing challenges facing women in our results about founders’ financial situations. A key determinant for potential entrepreneurs, both men and women, is often a spouse’s employment status—if a spouse has steady income (and, in the United States, health insurance), that can free someone to pursue a startup. Interestingly, women founders are about twice as likely as men to indicate that they could count on financial support from their spouse. This may reflect historical earnings differences between men and women. It also may influence funding structure, i.e. men are more likely to expect financial support from friends, rather than spousal support (see chart) . This indicates a potential financial constraint for female founders.

The gap between women and men on spousal support differs only

slightly between the United States and Europe, although a higher share of American female founders said they could expect their spouse to support them financially (charts not shown).



Immigrant Founders

Immigrant entrepreneurs make important contributions to local and national economies. Research consistently finds that immigrants have a higher entrepreneurial propensity than non-immigrants. In the United States, for example, they are twice as likely to start a business and disproportionately start technology companies.¹ In this article, we compare immigrant and non-immigrant founders on a handful of our metrics, as well as differences between founders who immigrated as adults and those who immigrated as children.² In a forthcoming article, we will look at immigrant founders more closely. Here, we highlight a handful of our findings related to immigration.

- 1 Immigrants are also over-represented in the ranks of entrepreneurs in other countries, and this higher propensity is variously attributed to differences in knowledge, education, risk tolerance, and networks. Peter Vandor and Nikolaus Franke, "Why Are Immigrants More Entrepreneurial?" Harvard Business Review, October 27, 2016, at <https://hbr.org/2016/10/why-are-immigrants-more-entrepreneurial>; Kauffman Foundation, "Kauffman Compilation: Research on Immigration and Entrepreneurship," October 2016, at <https://www.kauffman.org/what-we-do/resources/kauffman-Compilation-research-on-immigration-and-entrepreneurship>.
- 2 Except where indicated, the "immigrant" classification here includes those who migrated as children and those who migrated as adults. We do highlight where these two groups differ in some cases.

Insights for Ecosystem Builders and Policymakers

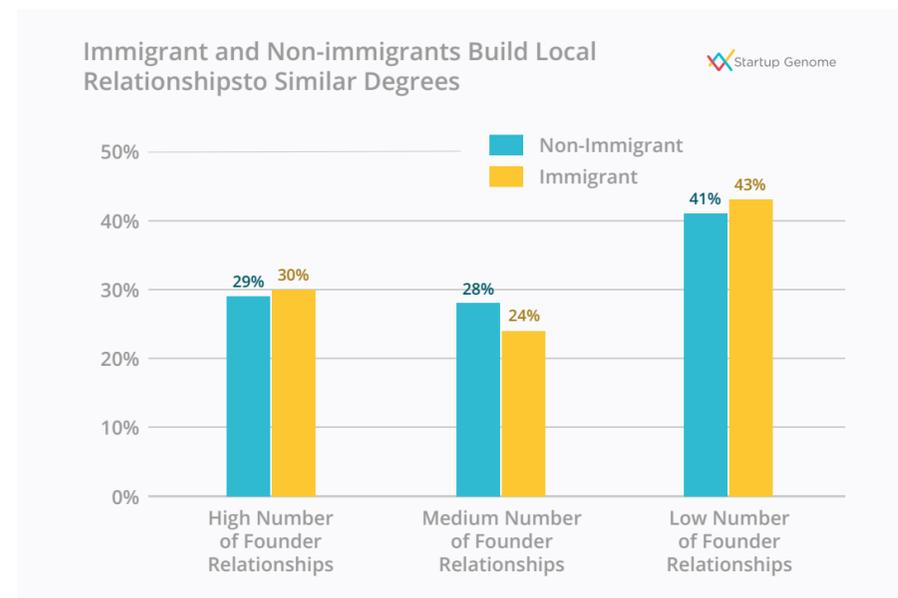
- Connect immigrants to local startup networks, especially local investors and experts.
- Ensure that immigrant and non-immigrant founders connect to each other.
- Design broad and diverse immigration policy. Founders who immigrate as children connect well with local networks as they start new companies. Those who immigrate as adults make immediate economic contributions through their startups.
- Let foreign students stay. Many countries host large populations of foreign students at their universities, but in many places they are not welcome to stay. Foreign students often become founders who build strong, helpful local networks.

Where Do Immigrants and Non-Immigrants Differ in Local Relationships?

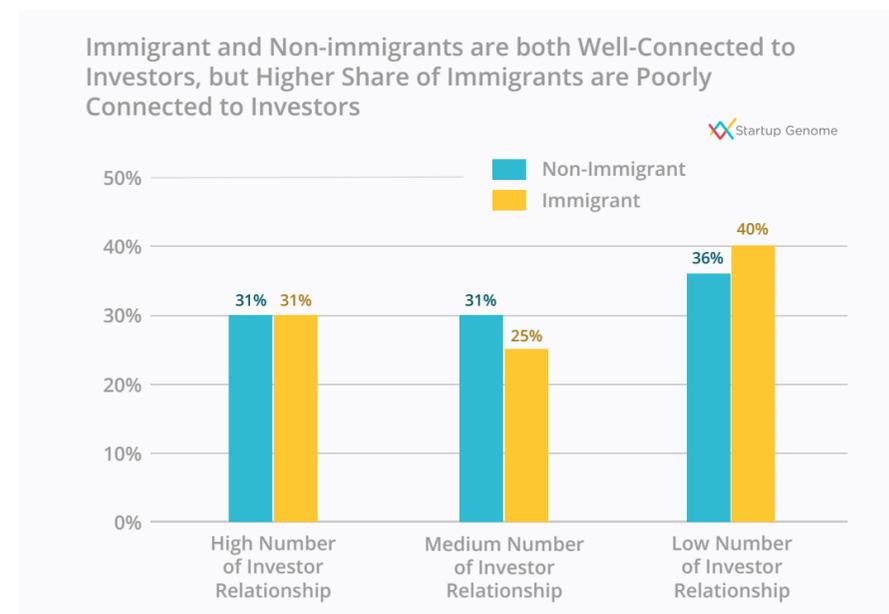
All startup founders build relationships at the local level with other founders, investors, and experts (which includes mentors, coaches, and university faculty). We categorize relationship connections as high, medium, or low.

Immigrant and non-immigrant founders build a similarly high level of relationships with other founders in their local ecosystems, and similar shares fall into the least-connected category. (See Figure.) Both groups are thus equally likely to be well- or low-connected to founders.

Relationship building is enhanced through participation in local activities such as hackathons, networking events, and accelerators;



immigrants and non-immigrants participate in these to an equal degree (chart not shown). This helps explain their similar levels of local relationships with other founders.

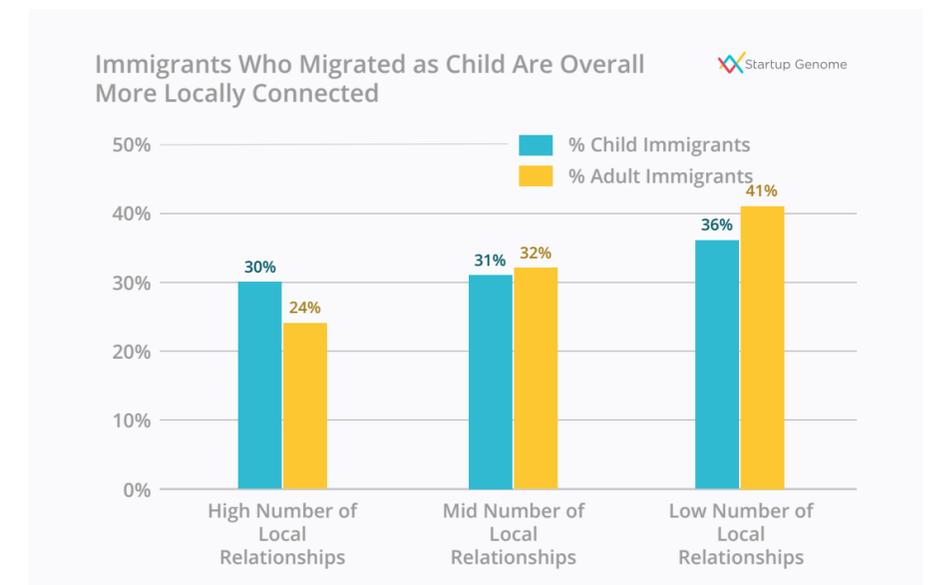
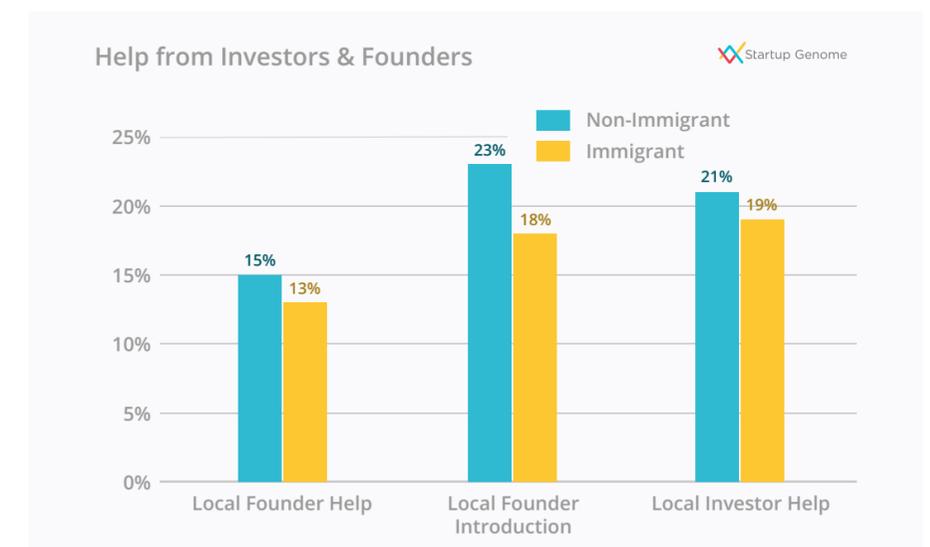


Immigrant and non-immigrant founders are equally likely to be highly connected to local investors, but a higher share of immigrants fall into the least-connected category (See Figure.)

This indicates a potential connection gap in which more immigrant founders do not have access to local investors. There is also a larger difference in local relationships with experts: immigrants are overall less well-connected and more likely to be not connected to local experts (chart not shown).

In addition to capturing local relationships, we also asked founders about the help they receive from founders and investors in their local ecosystem. Despite having the same level of Local Relation-

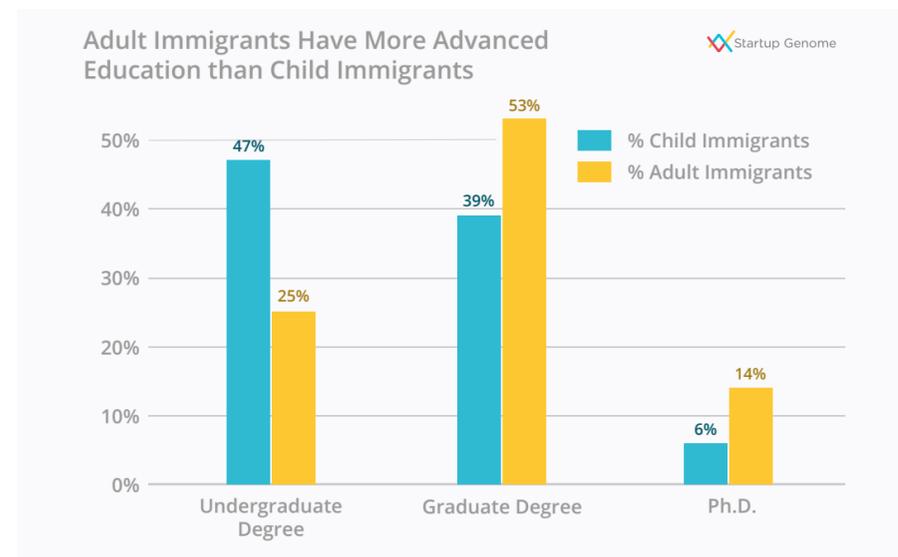
ships with other founders as non-immigrants, **immigrants receive less help locally from founders and investors than non-immigrants.** Among immigrants, those who migrated as adults receive



more help on average than those who migrated as children—and a larger proportion of adult immigrants get significantly more help. This advantage exists despite the fact that child immigrants are more locally connected than adult immigrants overall. (See Figures.)

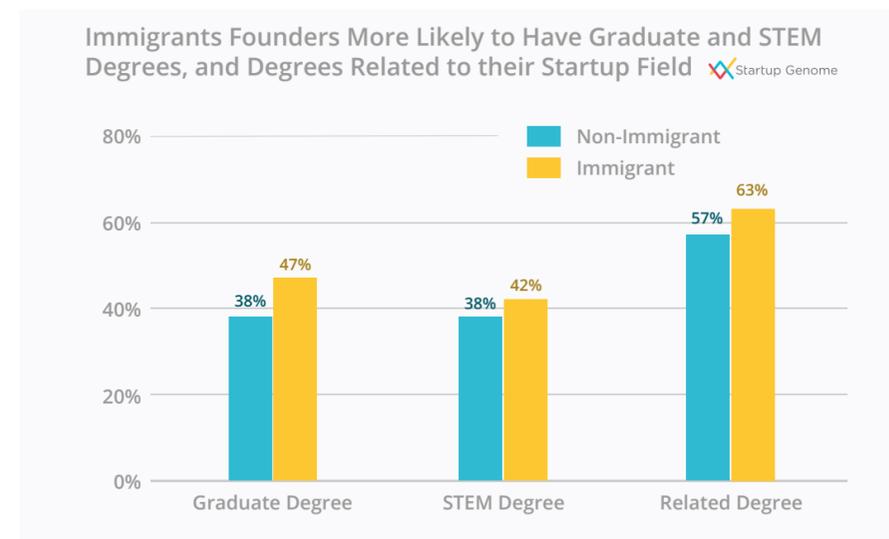
Growing up in a particular place allows more time to develop local networks, hence the higher level of Local Relationships exhibited by those who immigrated as children. Adult immigrants, however, appear to build very close-knit networks. This indicates to us that adult immigrants build stronger relationships with other immigrant founders, which may be due to shared education and work experiences. **Strong bonds develop among these adult immigrants, making it more likely that they provide help to other immigrant founders..**

Immigrant founders who migrated as adults are more likely to have graduate degrees and PhDs than child immigrants.



(See Figure.) **Adult immigrants also tend to have degrees in a field related to their startup's sector.**

Overall, in fact, more immigrant founders have graduate degrees than non-immigrants, as well as more STEM (science, technology, math, and engineering) degrees. Immigrant founders are also more likely to have degree related to the field of their startup.



Based on these findings, we postulate that many immigrants move, as adults, to other countries for advanced degrees. When they are allowed to stay after university, they go on to build startups in fields related to their degree. Through university and work experience, they build tight networks with other immigrants, resulting in a high level of help offered to fellow founders.

Immigrant founders are hugely important to startup ecosystems. They start a disproportionate share of tech companies, and also bring connections to their home countries, which could enhance

Where Immigrant and Non-Immigrant Founders Do Not Differ

We did find a considerable degree of similarity across immigrant and non-immigrant founders.

- They both pursue similar value propositions, developing new global products, niche products, or local products in more or less equal proportion.
- They share the same motivations: both immigrants and non-immigrants want to change the world or build great products to the same degree. We found no difference in the total addressable market that immigrants and non-immigrants are targeting.
- Immigrant and non-immigrant founders do not differ in terms of prior work experience, in having entrepreneurs among their close circles of family and friends, or in which technology sub-sectors they start companies in.

Global Connectedness. Public policy should be designed to welcome immigrants—both children and adults—and make it easy for them to build and join startups. In particular, in countries and regions with high foreign student populations, new mechanisms should be created to connect them with the startup ecosystem and allow them to stay.

Startup Sub-Sectors

Artificial Intelligence

Blockchain

Advanced Manufacturing & Robotics

Agtech

Fintech

Health and Life Sciences

Cybersecurity

Cleantech

Edtech

Gaming

Adtech

Consumer Electronics

Why Sub-Sectors?

About this Research

The entrepreneurial revolutions of the recent past and present were built almost entirely on the foundation of the internet, as part of the ICT sector. The value of these revolutions were overwhelmingly captured by the world's tech powerhouse: Silicon Valley.

The entrepreneurial revolutions of the future will take us much beyond just ICT-related and internet-focused businesses. While the prominent technology companies from the early 90s to the 2000s have built businesses that live almost entirely on the web and mobile—think internet search, email, social media, and video—the prominent technologies of the future will live in the “real world.” They will transform not only what we do on the web, but also what we do outside of it. Every sector is affected, including agriculture, transportation, healthcare and heavy manufacturing.

Entrepreneur and investor Steve Case calls this the Third Wave of the internet revolution. The first wave was carried on by companies like AOL who helped build the foundation of the internet. The second wave was led by businesses like Google and Facebook who built social media, internet search, and email products for the web, while businesses like Snapchat created apps relying on internet-connected smartphones. The Third Wave will bring these technological developments and learnings to the “real world”.

This presents a distinct opportunity for every region on the globe to build a new economy on their strong foundations of today. Regions known for their manufacturing capabilities may want to invest strongly in industrial robotics. Financial services hubs stand a good chance to do well in Fintech.

On this report, we present Startup Genome's first ever methodology for measuring not just technology startup activity in general, but specific sub-sectors and industries—with a look at their past, present, and future. For the past, we study and measure legacy industries as one example. For the present, we look at current dynamics like market size, talent, and university research output. For the future, we measure sub-sector attractiveness or growth potential.

When looking at an ecosystem and identifying the industries where they have the most potential to build their new economy, we look for signs in the past and present that show both existing strengths and latent potential. This research provides guidance to startup founders, ecosystem builders and policy leaders alike, in order for each of them to seize their personal opportunity of the Third Wave .



Sub-Sector Overview

Artificial Intelligence

Co-Author

Bjoern Lasse Herrmann

VP Collective Intelligence at Sage

463%

Growth in total VC funding in startups in the sub-sector from 2012 to 2017.

War for talent

Figures from McKinsey report that global demand for data scientists will exceed supply by over 50% in 2018. Chinese companies are on hiring sprees, with salaries for senior machine learning researchers topping \$500,000. The war for talent is one of the defining features of this sub-sector for the next 5 years.

\$15.7 trillion

Global GDP could be up to 14% larger in 2030 as a result of AI— the equivalent of an additional \$15.7 trillion.

In early 2018, Google CEO Sundar Pichai claimed that artificial intelligence (AI) will be more transformative to humanity than electricity.

Elon Musk, meanwhile, is concerned that AI represents humanity's biggest existential threat, posing "vastly more risk" than a nuclear North Korea. Mark Zuckerberg is optimistic, expecting that AI will improve quality of life—e.g., preventing car accidents—and enhance human productivity.

The true impact of AI will likely be somewhere in between: neither an unalloyed good nor a wholly bad development. One thing, however, is certain: AI has opened up an entirely new landscape for startups.

AI is the sub-sector with the highest growth in number startups created, growing at 24.8% year-over-year since 2008, as our data shows. The broader AI, Big Data & Analytics sub-sector is growing at a rate of 12.9% in the same period. Recent PwC research shows that global GDP could be up to 14% larger in 2030 as a result of AI— the equivalent of an additional \$15.7 trillion, making it the biggest commercial opportunity in today's economy. The greatest gains from AI are likely to be in China (which will enjoy a boost of up to 26% larger GDP in 2030) and North America (potential 14% boost).

Major opportunities also exist in the adjacent markets of Big Data and Analytics. Market intelligence firm IDC estimates that spending on Big Data and Analytics will grow from \$130.1 billion in 2016 to more than \$203 billion in 2020. The AI race even has a geopolitical dimension, with countries seeing it as a key area of economic opportunity and national security. The Chinese government, for example, declared that the country should be a global AI leader by 2030.

In this section we focus on AI, as well as Big Data & Analytics. While these are obviously different sub-sectors they have close relationships. Big data has allowed for scale in AI, and analytics has been one of the first major AI users.

What is Artificial Intelligence, Big Data & Analytics?

As a startup sub-sector, AI, Big Data & Analytics is an area of technology devoted to extracting meaning from large sets of raw data, often including machine intelligence. While AI, Big Data, and Analytics are distinct type of technologies, they are adjacent. They depend on a similar set of elements to thrive in the type of talent, knowledge, and local strengths that drives these sub-sectors.

Artificial Intelligence

Startup Output

Global Share of Startups
5.0% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
12.9% Global Startup Growth: 4.5%

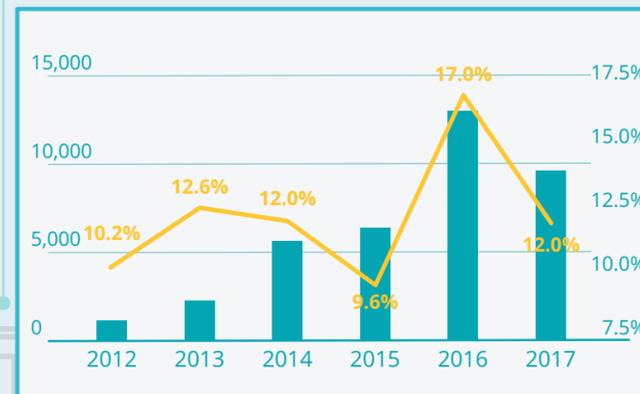
Funding

Total Funding Value Growth (2012 - 2017)
463% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$500 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$5 million Global Median: \$4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

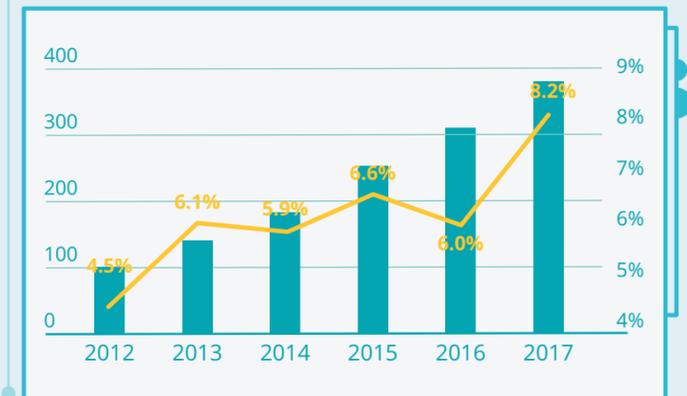


Exits

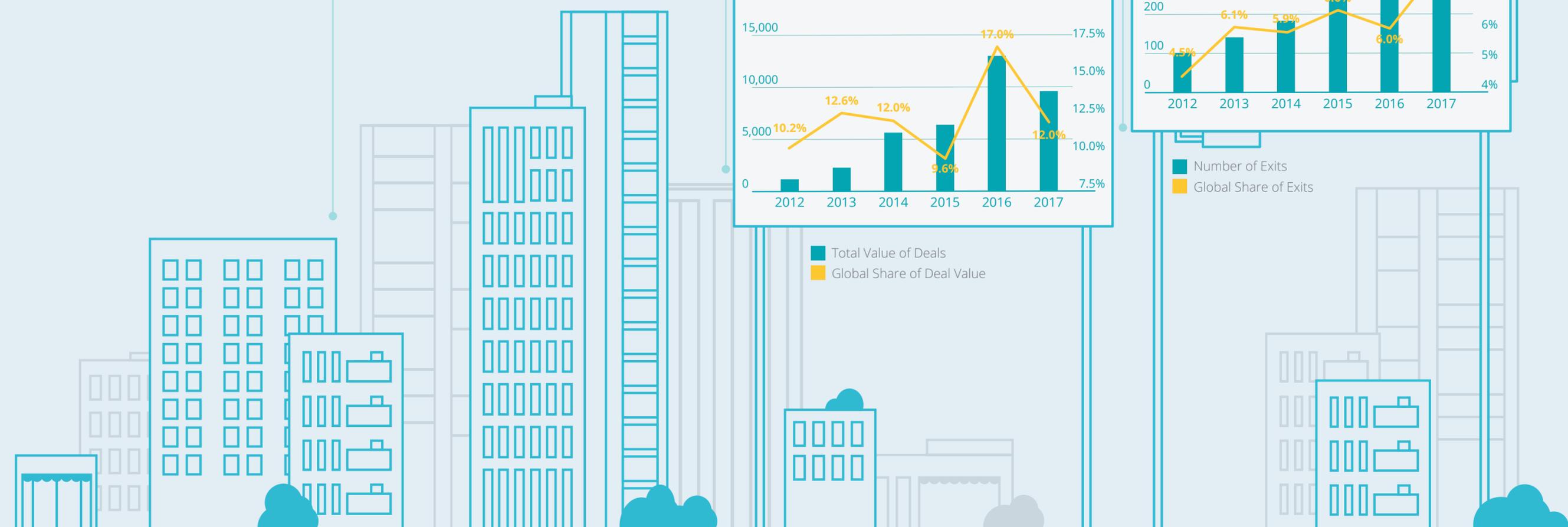
Exit Value Growth (2012 - 2017)
393% Global Average: 126%

Median Exit Value (2012 - 2017)
\$38 million Global Median: \$30 million

Number of Exits and Global Share of Exits



■ Number of Exits
 ■ Global Share of Exits



Key Drivers and Trends

Machine intelligence and big data stack widely accessible to startups. A lot of the fixed cost of developing underlying machine learning technologies has been paid by existing institutions—government, universities, engineering communities, and large tech companies. The marginal costs of deploying these technologies have dropped, and that is a boon for startups. Even relatively small teams can deploy machine intelligence algorithms quickly and cheaply.

Now, with open source tools for AI and big data like TensorFlow, scikit-learn, and Hadoop freely available, even the fixed cost of doing machine intelligence operations and managing large amounts of data has dropped dramatically. Cloud services for low prices from players like Google Cloud and Amazon Web Services also play a role in this. It is now easier than ever before for a startup to get up and running with AI technology.

Artificial Intelligence, Big Data & Analytics Example **Snowflake**

Snowflake, the upstart taking on big tech on cloud services, is a great example of a company growing by offering a complement of AI: cloud data warehousing. In a recent development the company started offering pay-per-second services, lowering the minimum cost a customer needs to incur to use them. The company's model is gaining traction, and they raised a \$263 million round at a unicorn valuation in January 2018.

Impact in all startup sub-sectors and traditional industries. Few technologies in growth phase today have more potential to impact the broader economy than AI. From a corporate demand side, 70% of enterprises expect to implement some AI technology in 2018, up from 40% in 2016.¹ Gartner predicts that by 2020, AI will be a top five investment priority for more than 30 percent of CIOs.²

In addition to the evident impacts AI and machine intelligence are having in analytics, it clearly has tremendous potential to influence every sector from healthcare to manufacturing to energy. We see this through the activity of legacy companies in the space. John Deere, the agricultural equipment behemoth, acquired robotics startup Blue River Technology for \$305 million in Sep 2017.³ In April 2017, France-based Thales (aerospace and defense) acquired startup Guavus to aid processing and predictive analysis of big

Artificial Intelligence, Big Data & Analytics Example

Uptake (Chicago, Illinois, United States)

Uptake is an industrial analytics platform helping traditional industries like agriculture, construction, and mining leverage their data through AI and analytics. The company raised \$117 million in November 2017 for a \$2.3 billion valuation, and is a great example of how startups are leveraging their local traditional industrial clusters to build tech ecosystems.

1 Forrester Research, "Predictions 2018: The Honeymoon For AI Is Over" (2018)

2 <https://www.gartner.com/newsroom/id/3763265>

3 <https://www.cnbc.com/2017/09/06/deere-is-acquiring-blue-river-technology-for-305-million.html>

data.⁴ In Feb 2017, US auto giant Ford acquired an AI startup called Argo AI for \$1 billion to help market fully self-driving cars by 2021.⁵ General Motors purchased Cruise Automation for \$1 billion, and Aptiv—the UK automotive company—bought nuTonomy. More recently, in the financial industry, S&P Global bought analytics company Kensho for \$550 million.

The Three Elements of AI

According to Jim Adler, Managing Director at Toyota AI Ventures, there are three key elements of AI technology.

1 Perception

Using sensors, cameras and connected devices to collect data and interpret it in ways we never could before

2 Prediction

Wrangling and analysing data to figure out the most likely outcomes to happen in the future

3 Planning

Leveraging data and predictions to decide on the next course of action.

So far, AI is very good at the first two pretty much by itself, whereas the third still heavily relies on human input.

Startups looking to shape legacy industries should think of where they fit in this framework to add the most value—and where their ecosystem has local strengths to build upon.

⁴ <https://www.thalesgroup.com/en/worldwide/group/press-release/thales-acquires-guavus-one-pioneers-real-time-big-data-analytics>

⁵ <https://www.recode.net/2017/2/10/14576730/ford-investment-uber-google-self-driving-cars-argo-ai>

AI will reshape the global workforce, and Industrial Revolution comparisons are not comforting. It is clear that AI is already dramatically changing the workforce. Though there is some discussion on whether the effects will be net positive or negative, the short-term outlook looks painful.

The argument that AI will destroy millions of jobs—with nearly 50% of jobs in the U.S. at high-risk of being automated in the next two decades, according to Carl Frey and Michael Osborne from Oxford University—goes something like this: machines will get increasingly good at doing things human currently do. From self-driving trucks to smart accounting software, and no-cashier stores like Amazon Go to robo investment advisors, computers are doing work we thought had to be done by humans. While the transition takes time, and some jobs are more susceptible to automation than others,

Above the API and Below the API jobs

Some observers talk about jobs “above the API” and “below the API.” Below the API jobs are the ones where the machine tells a human what to do—for example, the Uber app telling a human driver to go from point A to point B, or 99designs telling designers what project they should do. Above the API are jobs that tell machines what to do or work directly with them.

From this perspective, below the API jobs are expected to either disappear with better AI and tech (e.g., self-driving cars) or be reduced to low pay “production line” type work; while above the API jobs can hold autonomy, space for human creativity, and good pay. Importantly, the “API line” keeps moving up, as AI becomes more capable of doing tasks it previously was unable to.

eventually machines will also be good at even building other machines, and humans will be out of work. The cost of paying a human will not justify hiring them.

The opposite side of the argument says humans will always excel at being human, something machines can never replicate, and AI will augment human productivity without ever fully replacing us. A prime example on this side of the argument points to the fact that automated teller machines (ATM) actually increased the number of bank teller jobs, as documented by economist James Bessen. Because ATMs made bank branches cheaper to operate, banks opened more locations with more jobs, and bank tellers actually switched focus to things machines couldn’t do like human relationship management.

Yet, saying that the AI Revolution will be fine for humanity because we came out stronger after the Industrial Revolution is not exactly comforting, as Tyler Cowen highlights. The Industrial Revolution was terrible for most people for a long time, with real wages for workers actually falling from 1770 to 1810. Physical stature even shrank. In addition, it’s clear that the people whose jobs are being destroyed do not necessarily have the skills to take the new jobs created.

The incumbent wall. Major tech companies—for example Microsoft, Google, Amazon, Baidu, and Alibaba—are all investing heavily in AI, creating in effect an incumbent wall that can make it increasingly hard for startups to compete against. Amazon effectively re-designed a lot of its businesses around artificial intelligence, creating what Wired labels an AI Flywheel—connecting learnings

from voice-activated software, buyer behavior, and its massive cloud business—and has built an AI-as-a-service offering on top of it. Baidu and Google spent between \$20 billion to \$30 billion on AI in 2016, with 90% of this spend on R&D and deployment, and 10% on AI acquisitions. Google's team has also published nearly 1,000 research publications on Machine Intelligence. Apple has made AI a clear priority in its acquisition strategy. Since acquiring Siri in 2010, the company has made several other speech acquisitions in recent years, including Vocal IQ and Novauris Technologies.

Thus the incumbents confronting startups. Competing specifically in AI and big data-focused products like AWS, Google's BigQuery, and Microsoft's Azure ML is incredibly tough because of the economies of scale those businesses have and the tremendous knowledge and teams behind their offerings.

Conversely, these companies have gone on acquisition sprees, and can be key targets for startup exits.

War for talent. Figures from McKinsey report that global demand for data scientists will exceed supply by over 50% in 2018. Chinese companies are on hiring sprees, with salaries for senior machine learning researchers topping \$500,000. And while open machine learning libraries like TensorFlow by Google have been a boon for startups that can use them, they also mean that big tech has a clear advantage in the talent pipeline, by being able to track top contributors and scoop them. This makes the war for talent fierce, especially for cash-strapped startups.

“The American and Chinese big players are clearly pushing for AI dominance. But startups’ agility and smart motivations can still spot new niches, and lead to significant advancements in the space. For example in the online eCommerce space, a good portion of the transactions are driven by the small and mid-size players, customers that are too small for the big players to pursue. This still leaves a lot of data (the AI currency) on the table for startups to build and grow on.”

Aidin Tavakkol

CEO and Founder of LimeSpot (Berkeley, California, United States)

Artificial Intelligence Ecosystems to watch

The map shows the most important global artificial intelligence ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on artificial intelligence. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Understand and leverage the economics of machine intelligence. As Prof. Ajay Agrawal highlights at a HBR article, the best way of thinking of how AI may affect industries and jobs is through an “input and complement” lens. Most tech revolutions are associated with the cost of an input dropping dramatically, sometimes by one or more orders of magnitude. When the internet came about, the cost of search and communication plummeted, and that 1) increased our demand for search and communication (the input), 2) increased the value of complements to that input (e.g., long-distance retail), 3) and decreased dramatically the value of substitutes of that input (e.g., traditional mail for letters).

Think about the coming of the digital camera, for example: the value of complements to photography went up (e.g., photo sharing tools, like social media), while the value of substitutes collapsed (like chemistry-based film). The best way to think about how startup ecosystems may take advantage of the AI revolution is to think about what complements to AI a region has to offer (e.g., legacy manufacturing industries that can provide a wealth of data), and be wary of the impacts of AI on the substitutes your ecosystem may be heavy on.

Invest public funds in training and attracting talent. AI is the quintessential deep technology. It requires heavy research investments and a highly educated workforce.

As Startup Genome data shows, AI founders and teams are among the most educated. Nearly 63% of them have a graduate degree—the third highest such number for sub-sectors, behind only Life Sciences and Cybersecurity. And, 93 percent of AI founding teams

are technical, the highest technical team composition across all sub-sectors. These numbers are a bit lower for the combined AI, Big Data, & Analytics sub-sector. Training highly technical talent through supporting university programs and attracting talent from outside through facilitating connections to local players and lowering barriers to immigration should be a top priority for ecosystems who want to win in the AI race.

Ecosystem leaders need to focus on vertical strengths and identify anchor hubs. The biggest growth potential for emerging ecosystems will be in legacy industries that have yet to see widespread AI use: for example agriculture, manufacturing, and healthcare. The explosive growth in AI, Big Data & Analytics investments in the past years competing in the “horizontal” (across all industry categories) make it incredibly hard for smaller ecosystems to compete across all categories.

Emerging AI ecosystems should focus on their specific industry vertical strengths. If data is the new oil, then strong legacy industries (like automotive in Detroit) and potential anchor hubs (like major corporates, or universities like Carnegie Mellon in Pittsburgh) are the most promising wells.

Opening data from these verticals and potential anchors (including government) to startups (e.g., through open data competitions), and connecting strong local industries to the entrepreneurial ecosystem (e.g., through reverse pitches) should be a focus for ecosystems who want to leverage their existing industries for AI. An industry pivot based on past strengths is possible—Toyota started as a maker of weaving looms, Nokia as a wood pulp mill.



Sub-Sector Overview

Blockchain

Co-Authors

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Trust Protocol

Blockchains and other Distributed Ledger Technologies allow for peer-to-peer value exchange without the need of a trusted third party.

Disruptive Potential

The technology finds application across different industries and has a particularly strong impact on the financial services industry.

Initial Coin Offerings

In 2017 venture funding in Blockchain startups via Initial Coin Offerings surpassed traditional equity-backed funding.

Entrepreneurs, startups, investors, global organizations and governments have all identified Blockchain and other Distributed Ledger Technologies (DLTs) as revolutionary technologies that will have significant impact on multiple industries as well as wide-reaching implications on our social and economic infrastructure.

Blockchain got introduced in 2008, when an unknown person or a group of people under the synonym Satoshi Nakamoto released their now famous white paper “Bitcoin: A Peer-to-Peer Electronic Cash System”.¹ Since then, Blockchain has primarily been recognized as the backbone technology behind Bitcoin, the world’s first digital cryptocurrency. With the astronomic rise in Bitcoin and other cryptocurrency prices over the last 1.5 years, the public’s attention shifted towards the underlying technology, realizing that Blockchain is much bigger than Bitcoin.

Human societies use two major protocols to interact and collaborate with each other: The exchange of information and the exchange of value. The fundamental functional difference between the two is that information such as photos, videos, documents or other forms of knowledge can be copied and shared with others whereas value exchange like barter or payments require the transfer of originals.

Over the last decades the internet has become the global standard for the exchange of information. Using the internet protocol suite to interconnect millions of smaller networks it allows for practically infinite exchange of information almost in real-time. However, since for payments and other

forms of value exchange sending copies is a terrible idea, it usually requires a trusted middlemen managing a ledger and underwriting the transfer of value (unless you’re handing-over cash directly to the other party). Blockchain is the first “open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way”². Thus it allows for payments, barter or any other form of value exchange without centralized monitoring, making Blockchain the first “trust protocol” of mankind.

For centuries modern society has been built upon all kinds of different databases, most of them monitored by centralized institutions like governments or banks. Eliminating the need for a middlemen to keep track of these databases is likely to have implications on the way our society functions with the potential to revolutionize not only the financial system but various aspect of our lives.

What is Blockchain?

A blockchain is a decentralized database that functions as a ledger. It is a continuously growing list of records that are bundled together in so called blocks. The ledger is distributed across many participants in a peer-to-peer network and gets constantly updated. By design a blockchain is practically resistant to modification of the recorded data as the data in any given block can only be altered by modifying all previous blocks which would require the control over a majority of computing power in the network.

¹ <https://bitcoin.org/bitcoin.pdf>

² Iansiti, Marco; Lakhani, Karim R. (January 2017), „The Truth About Blockchain“, Harvard Business Review.

Blockchain Global Startup Activity

Startup Output

Global Share of Startups
1.5% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
17.9% Global Startup Growth: 4.5%

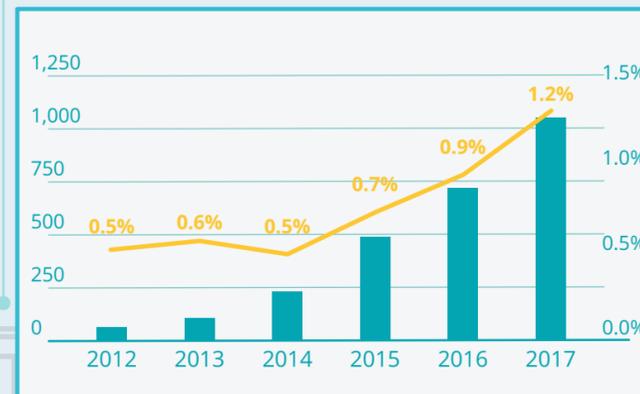
Funding (Excluding ICOs)

Total Funding Value Growth (2012 - 2017)
1321% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$376 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$5 million Global Median: \$4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

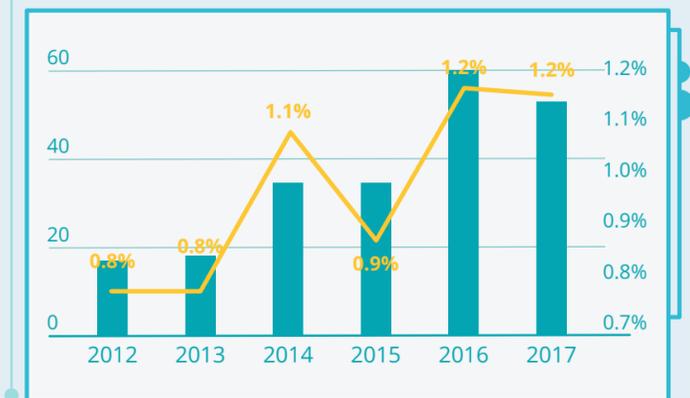


Exits

Exit Value Growth (2012 - 2017)
404% Global Average: 126%

Median Exit Value (2012 - 2017)
\$30 million Global Median: \$30 million

Number of Exits and Global Share of Exits



■ Number of Exits
 ■ Global Share of Exits

Key Drivers and Trends

Cryptocurrencies are disrupting the financial services industry. Similar to email for the internet, Bitcoin and other cryptocurrencies can be seen as the first breakthrough application for Blockchain technology. The current financial system is facing a number of challenges: It is centralized around central banks and large financial institutions, making it resistant to external innovation and vulnerable to attacks (45% of financial intermediaries suffer from economic crime every year).¹ On top of that, the system excludes a large proportion of the global population with 2 billion adults currently lacking access to formal financial services.²

Blockchain technology eliminates the dependence of intermediaries in value transactions, thus speeding up transaction processes and allowing for greater security and accuracy at a lower cost. Consequently, many startups are leveraging the technology while

“I want to extend banking to the 3.2 billion people who are going to come into the middle class over the next 15 years. So I need a much lower cost of keeping a ledger. Blockchain offers some intriguing possibilities there.”

Arvind Krishna
Senior vice president of IBM Research

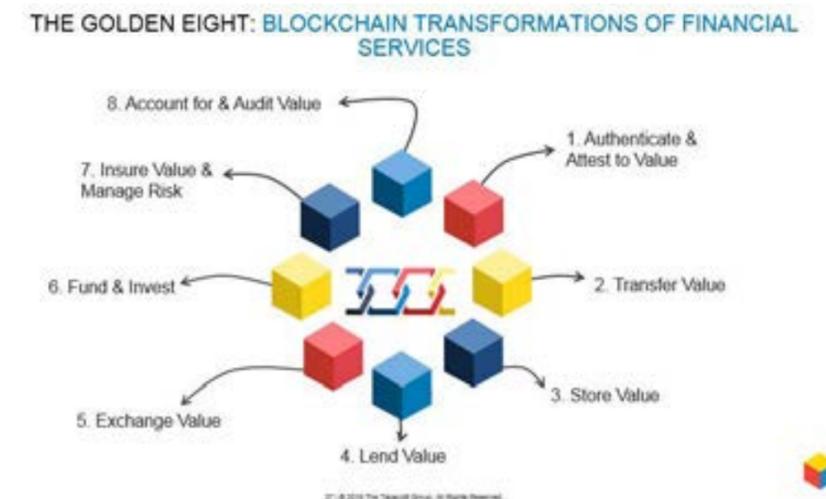
1 <https://www.wsj.com/articles/ibm-adapts-bitcoin-technology-for-smart-contracts-1442423444>

1 <https://www.pwc.com/gx/en/financial-services/publications/assets/pwc-gecs-2014-threats-to-the-financial-services-sector.pdf>

2 <http://www.worldbank.org/en/news/video/2016/03/10/2-billion-number-of-adults-worldwide-without-access-to-formal-financial-services>

also established firms in the financial industry are investing into blockchain-based solutions in order to reduce internal friction and costs.³

As incumbent firms built their business models precisely on the fact that a trusted middlemen was needed, Blockchain and other DLTs are fundamentally challenging core parts of the traditional banking industry. In their book “The Blockchain Revolution”⁴ Don and Alex Tapscott identify eight core functions of the traditional financial services industry that are going to be heavily affected and potentially disrupted by blockchain technology:



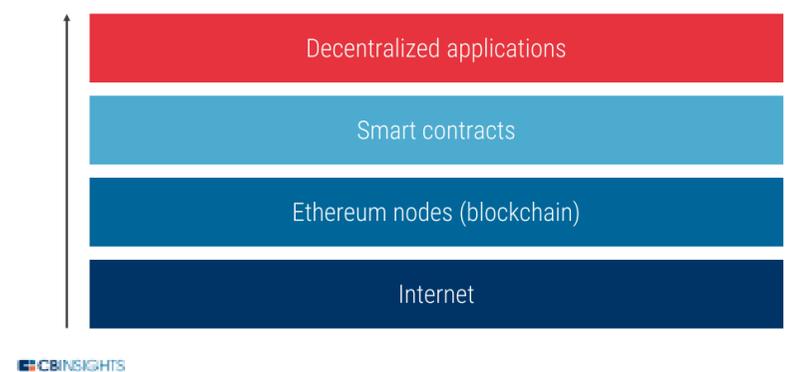
3 Santander: potential savings at \$20 billion a year. Capgemini estimates that consumers could save up to \$16 billion in banking and insurance fees each year through blockchain-based applications.

4 “The Blockchain Revolution”, Don Tapscott and Alex Tapscott, 2016

Distributed computing platforms and smart contracts allow for the development of decentralized applications. While the first Blockchains like the Bitcoin Blockchain functioned as two-dimensional ledgers for payments, distributed computing platforms like Ethereum, Neo or Golem are taking advantage of blockchain technology to run programs, services and applications across a network of individual computers globally on the blockchain. Often referred to as “world-computers” or “web 3.0” these platforms are eliminating the need for centralized servers.

On top of such platforms programs and applications can be developed. Coded as smart contracts they get written into the platform’s blockchain and operate as so called decentralized applications. These features allow programmers and entrepreneurs all around the world to facilitate blockchain technology and build blockchain based applications. As of January 2018, there were more than 40,000 applications built on the Ethereum blockchain alone.⁵

The Ethereum development stack



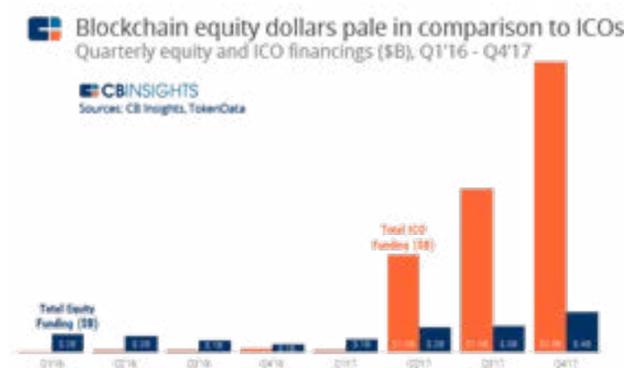
5 Number ERC20 tokens issued, Source: www.etherscan.io/tokens

Startup Example Lisk (Berlin, Germany)

The Lisk blockchain network builds a decentralized development platform and released a Software Development Kit (SDK) which is a framework written in JavaScript to deploy different blockchain networks next to the main Lisk network. Decentralised applications can be built on top of each blockchain.

Initial Coin Offerings: a revolutionary new way of venture funding. Initial coin offerings (ICOs) describe a new form of crowd-funding where blockchain companies sell their newly produced cryptocurrency in order to raise funds. These tokens can subsequently get traded on cryptocurrency exchanges and will rise or fall in value. In 2017, more than \$5.6 billion was raised through ICOs.⁶

When compared to traditional venture financing in the sector, ICOs typically raise well above the average amount of early-stage blockchain deals. The largest ICO in 2017 was completed by Tezos with \$230 million raised, followed by Filecoin (\$200 million), Sirin Labs (\$158 million) and Bancor (\$153 million).



6 According to „The State of the Token Market“ report by FabricVentures and Token-Data

Startup Example Datum (Hong Kong, China)

Datum develops a decentralized and distributed high performance database backed by a blockchain ledger. Their technology allows anyone to backup structured data like social network data, data from wearables, smart home and other IOT devices in a secure, private and anonymous manner. Datum also provides a marketplace where users can share or sell data on their own terms.

Blockchain and DLT provides the basis for a decentralized Internet. Data has become a new asset class, that gets produced by everyone but is owned and exploited by just a handful of companies through centralized servers. Decentralized database solutions backed by blockchain ledgers (e.g. Filecoin, Storj) allow for decentral data storage and provide a higher level of data privacy and safety.

Similarly, Blockchain technology is paving the way for a new, decentralized sharing economy allowing for home or car sharing without a central intermediary that guarantees for payments or contract compliance.

Blockchain Ecosystems to Watch

The map shows the most important global Blockchain ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on Blockchain. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

There are two major regulatory difficulties with regards to blockchain technology: Cryptocurrencies and ICOs. By definition, cryptocurrencies operate outside of the existing financial system. In fact, Bitcoin and blockchain technology have been invented to undermine existing norms. Cryptocurrencies are based on anonymity and make it much harder for governments or banks to track the ownership of money thus opening up ways for money laundering and tax evasion. ICOs avoid the restrictive investor laws by declaring that their tokens are not representing securities but rather provide future utility within decentralized networks thus allowing “regular” people to invest in high-risk endeavours. Governmental regulators are aiming to protect their citizens from these potentially risky or fraudulent investments. The Chinese government banned ICO funding in September 2017 arguing that the new way of crowdfunding had “seriously disrupted the economic and financial order.”¹

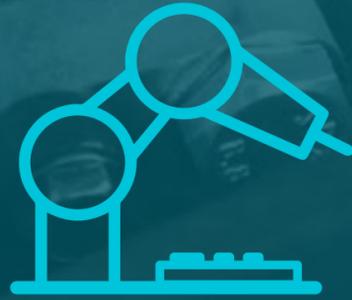
State governments play a central role in regulating financial transactions which is why it will be the responsibility of national policy to sort out the regulatory issues surrounding Blockchain as quickly as possible. Due to the decentralized and therefore international nature of Blockchains it will be crucial to design policies in an internationally consistent manner. Furthermore, those policies need to be flexible: Blockchain is an up-and-

coming, yet complicated technology. Policies must consider future developments and should be frequently reviewed and adjusted in order to be in sync with the technological developments. Different cryptocurrencies and tokens have different functionalities and should represent different novel asset classes. When adjusting tax standards and regulations in securities law or AML rules, the different natures of the tokens has to be taken into account.

Regulations have always struggled to keep up with advances in technology. However, Blockchain technology seems to be a whole new case since it is questioning the role of trusted intermediaries in positions of control within the current hierarchical system and thus the regulator itself. However, Public administrations will have no other option than to embrace it and should make use of Blockchains themselves to make their operations more efficient and transparent.

At the same time, innovation policy makers face an unique opportunity to position their ecosystems ahead of others with favorable regulations to Blockchain and distributed ledger technologies. While some countries try to maintain a high level of control others are already working on progressive frameworks to allow for these new technologies and funding mechanisms to evolve.

¹ <https://techcrunch.com/2017/09/04/chinas-central-bank-has-banned-icos/>



Sub-Sector Overview

Advanced Manufacturing & Robotics

Next gen Industrial IoT (IIOT)

IIOT will transform how manufacturing, with wide-ranging impact on efficiency and productivity. IIoT represents a \$85 billion opportunity by 2020.

3D Printing

3D and other forms of additive manufacturing have accelerated the democratization of design and manufacturing, with far-reaching implications for high-tech manufacturing.

China leads the world in industrial robotics

In 2016, the country was responsible for sale of 30% of all the robots in the world, more than Europe and the Americas combined.

The fourth manufacturing revolution is upon us and digitization of manufacturing is the way forward.

In 2017, when Desktop Metal announced plans for “Production System” 3D Printer (a metal 3D printing system for mass production of complex metal parts that is 100 times faster than the traditionally-used laser systems), the announcement was met with excitement and skepticism. But just a few months later, Popular Science magazine declared the product “2017 Best of What’s New” in engineering. Thanks to the product, the company has grown its fan base consistently, and in July last year, closed a Series D funding round of \$115 million from high profile investors, valuing the company at more than a billion dollars.

As the digital revolution continues to reshape the global economy and disrupt all industries, digitization and new computing capabilities are now changing the dynamics of the manufacturing industry. This industry, which has grown at snail’s pace, is now experiencing rapid improvements across the entire value chain.

Although the manufacturing sector stood at \$11.6 trillion in terms of value added in 2015, it is still under-digitized compared to other sectors. These developments are bound to have a far-reaching impact on the global economy.

What is Advanced Manufacturing & Robotics?

Advanced manufacturing is a broad set of enabling technologies, processes and practices that businesses from a wide range of sectors can adopt to improve their productivity and competitiveness.¹ It includes fields like industrial robotics, additive manufacturing / 3D printing, advanced materials, industry 4.0, nano-materials and industrial IoT.

1 <https://industry.gov.au/industry/IndustrySectors/Advanced-Manufacturing/Pages/default.aspx>

Advanced Manufacturing & Robotics Global Startup Activity

Startup Output

Global Share of Startups
1.3% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
15.3% Global Startup Growth: 4.5%

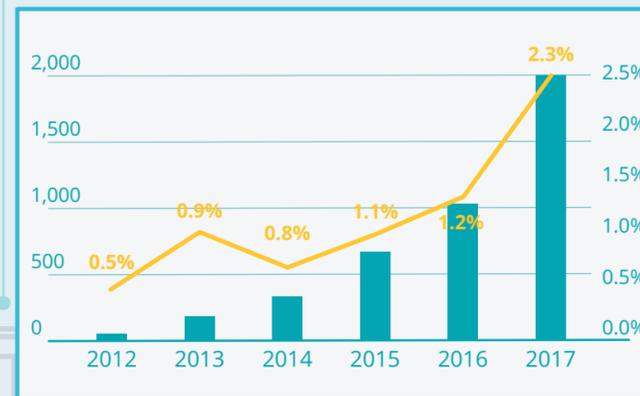
Funding

Total Funding Value Growth (2012 - 2017)
1386% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$460 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$5.2 million Global Median: 4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

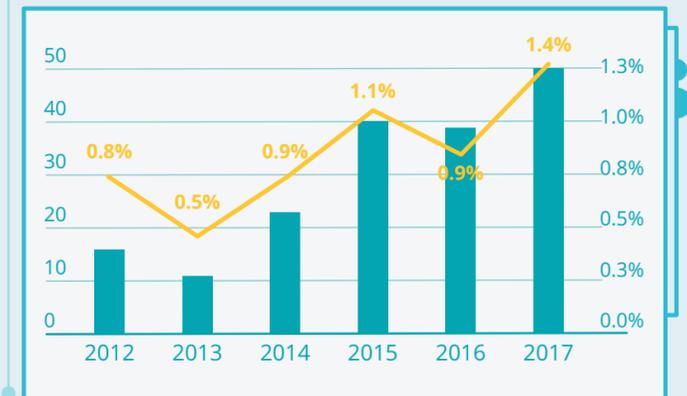


Exits

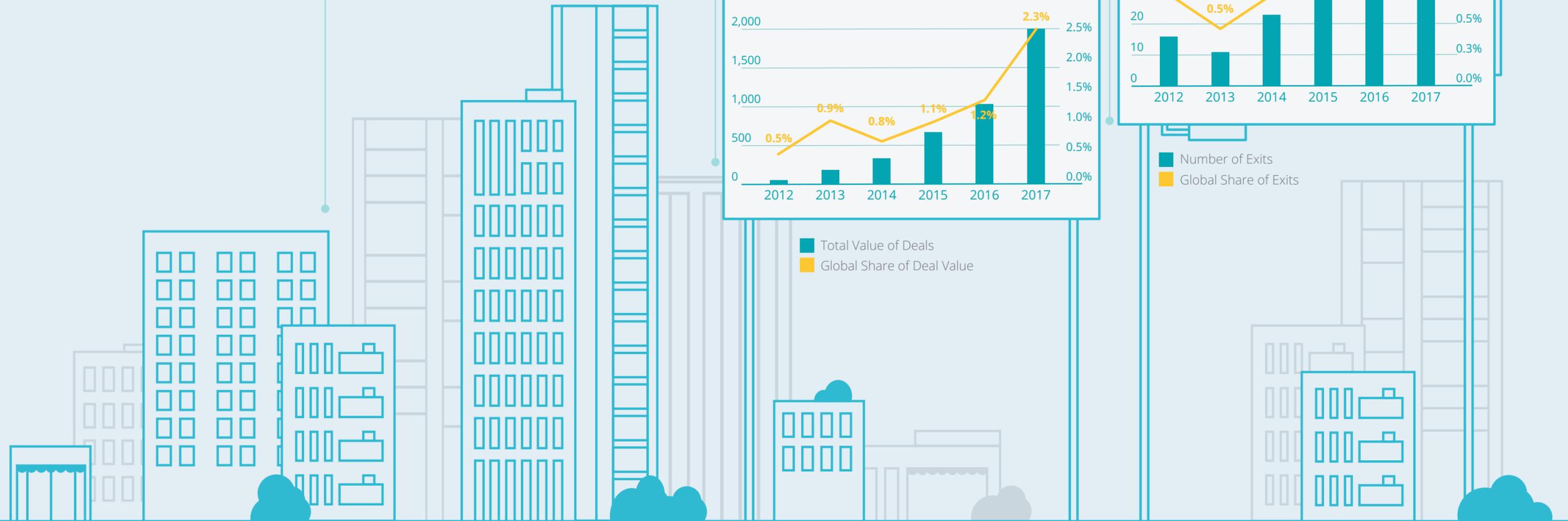
Exit Value Growth (2012 - 2017)
550% Global Average: 126%

Median Exit Value (2012 - 2017)
\$38 million Global Median: \$30 million

Number of Exits and Global Share of Exits



■ Number of Exits
 ■ Global Share of Exits



Key Drivers and Trends

Industrial IoT (IIOT) and industrial robots — the next industrial revolution. By integrating machine-to-machine communication, big data, and artificial intelligence, industries will be able to fuel innovation, boost revenues, create new business models, and transform their workforce. According to an estimate by Bain & Company, industrial sector will contribute \$85 billion in IoT by 2020.

Industrial robots are also moving into different and unstructured areas. Earlier robots were employed mostly in structured environments with defined tasks but the advancement in technologies has helped us to move robots into more ambiguous environments. For instance, harvesting crops like wheat and corn has been automated for a long time, but we now have robots that can do more skilled and difficult jobs like picking fruits.

The world is moving in a direction that is more conducive to the digitization and automation of manufacturing. Manufacturing powerhouses, especially in maturing economies, are currently powered by an aging workforce. Coupled with the predicted decrease in blue-collar workers in the next decade or so, future labor supply could be adversely impacted, making automation a necessity.

Additionally, lower-costs and inward policy outlook has spurred reshoring by various industry players across the globe over the last few months. One of U.S. President Donald Trump's key electoral agendas was "Made in America", a move aimed to reshoring U.S. manufacturing. Meanwhile, as the U.K. undergoes the Brexit process, U.K. companies are compelled to reshore supply chains and manufacturing.

Sub-Sector Overview: Advanced Manufacturing & Robotics

3D Printing — democratization of design and manufacturing. 3D printing technology is more than 30 years old but the recent impact of the newest technology has been nothing short of revolutionary. Democratization of manufacturing is perhaps its most important impact. Technology is now more accessible and economical, which reduces the barriers to entry in the manufacturing industries. Machines that used to cost several million dollars and software that used to cost several thousand dollars is much more affordable now. We have moved into an age where lower costs for prototypes have translated into mass manufacture more quickly and without as significant capital expenditure.

3D printing technology has recently expanded from materials like plastic and metal to carbon fiber and Kevlar. These materials, especially valuable for high-tech industries such as aerospace, defense, and automotives have rendered the production of the machines easier, faster and cheaper.

The robot race, with China on the lead. Advanced Manufacturing hubs like China, Japan, South Korea, Germany and the US are expected to drive the demand for technologies like 3D printing, computer integrated manufacturing, and industrial robots, which

Advanced Manufacturing & Robotics Example

Desktop Metal (Boston, MA, United States)

Desktop Metal, Inc. develops metal 3D printers that works with aluminum and titanium. The company was incorporated in 2015. The company has raised \$211.8 million in five funding rounds. Investors include corporate VC funds like GE Ventures, Lowe's Ventures, Saudi Aramco, BMW iVentures, etc.

are expected to have near- to medium-term impact across various industries. According to International Data Corporation (IDC), worldwide spending on robotics and related services will more than double by 2021, growing at an annualized rate of more than 22%, from \$97.2 billion in 2017 to more than \$230.7 billion in 2021.¹ Behind this spectacular growth is the preeminent manufacturing hub of the world: China.

Advanced Manufacturing & Robotics Example

Carbon (Redwood City, CA, United States)

Carbon is a technology company and manufacturer started in 2014 and based in Redwood City, California. It manufactures and develops 3D printers utilizing the Continuous Liquid Interface Production (CLIP) process. The company has raised \$222 million in four funding rounds. Investors include BMW, Nikon, General Electric (GE), JSR Corp, FIS, and Autodesk.

According International Federation of Robotics (IFR), China is the biggest market for industrial robots with a 30% share. The country has seen a major push in robotics from its government and businesses. The Guangdong province, the leader of manufacturing in China, has pledged an investment of \$154 billion to install robots.² China-based Foxconn, the world's largest contract electronics manufacturer, has said that the company will install more than a million industrial robots to overcome rising labor costs.

¹ IDC - Worldwide Semiannual Commercial Robotics Spending Guide 2017 (<https://www.idc.com/getdoc.jsp?containerId=prUS42880417>)

² US\$154 billion rise of the robots planned for Pearl River Delta manufacturing, South China Morning Post, 15 April 2015 (<http://www.scmp.com/lifestyle/technology/science-research/article/1754165/robotics-industry-booming-guangdong-insiders>)

Backlash over job loss. Startups working on these technologies, specially those linked to automation, face backlash over fear of job loss. According to Forrester Research, by 2027 close to 15 million new jobs will be created in the United States as a result of robotics and automation. However, these technologies will eliminate more than 25 million jobs within the same time period.³ Automation and robotics will have a major impact on blue-collar, white-collar, and government workers at various levels. Responsible agencies and stakeholders will have to work with these entities to address the issue. It's important to note, however, that in a globalized world, impeding or stalling developments in the field of automation nationally won't guarantee job security, since the competition is no longer bounded by nations.

Advanced Manufacturing & Robotics Example

UBTECH Robotics (Shenzhen, China)

UBTECH Robotics is a Shenzhen-based intelligent humanoid robots maker. It is engaged in R&D, manufacturing, as well as promoting and popularizing robots around the world. The company has raised \$520 million in three funding rounds. Investors include Tencent Holdings, CDH Investments, and CITIC Securities.

³ Forrester Predicts Automation Will Displace 24.7 million Jobs And Add 14.9 million Jobs By 2027, Forrester, 3 April 2017 (<https://www.forrester.com/Forrester+Predicts+Automation+Will+Displace+247+Million+Jobs+And+Add+149+Million+Jobs+By+2027/-/E-PRE9745>)

Advanced Manufacturing & Robotics Ecosystems to watch

The map shows the most important global advanced manufacturing & robotics ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on advanced manufacturing & robotics. Click on the ecosystem name to find out more about the local scene.

 Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Invest in training targeted talent. Advanced Manufacturing startups need not only strong coding and software skills, but also civil and mechanical engineering skills, as well as individuals trained in the operations of the factories themselves. Training specialized talent in local universities is a key component of the talent pipeline for this sub-sector.

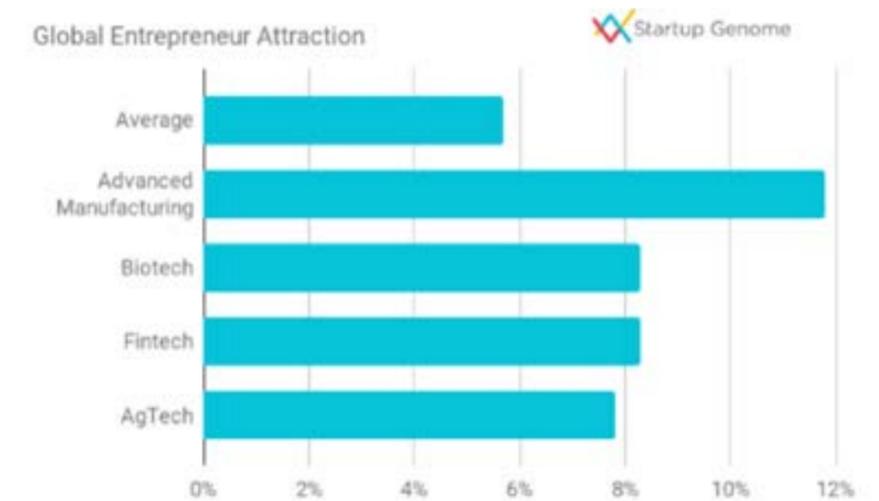
Take down barriers to attract founders and talent from outside. Many ecosystems have been able to counter their own lack of local trained talent by attracting people from outside their ecosystem. In many ecosystems, foreign entrepreneurs are the driving force of the Advanced Manufacturing sub-sector. According to Startup Genome data, of all the sub-sectors, this sub-sector ranks highest in the Global Entrepreneur Attraction index, indicating that a substantial number of startups are founded by entrepreneurs of other nationalities and that free movement of talent is one of the key criteria driving the development of this sub-sector.

For example, Shenzhen, also known as the “World’s Factory” and the hub of low-cost manufacturing, boasts only a handful of universities that supplies relevant talent. To spur innovation and boost entrepreneurship, the city has allowed free movement of people from outside the ecosystem. The businesses here are relaxed with respect to the employment contracts, and the local government offers tax subsidies for high-level foreign talent residing in the city.¹

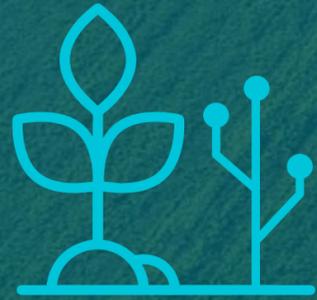
¹ Shenzhen is a hothouse of innovation, The Economist, 8 April 2017 (<https://www.economist.com/news/special-report/21720076-copycats-are-out-innovators-are-shenzhen-hothouse-innovation>)

Sub-Sector Overview: Advanced Manufacturing & Robotics

Build connections to existing manufacturing industry. Most successful Advanced Manufacturing startup ecosystems have close proximity and collaboration with the existing manufacturing industry. The importance of this connection works both ways -- for startups and corporates. In Munich, for example, BMW has emerged as one of the key players in helping Advanced Manufacturing startups by becoming a first line customer and an investor. It has a venture client BMW Startup Garage and venture fund BMW iVentures, both supporting their R&D efforts.



Consider mechanisms for higher funding amounts per deal, like matching funds. For startups to thrive in this sub-sector, they need access to more funding than their peers in other sub-sectors and longer timeframes for product development. Support from government, accelerators and incubators is critical.



Sub-Sector Overview

Agtech & New Food

Agriculture Sector

The global agriculture sector employs 1 billion people and contributes \$3.2 trillion annually to global output. Digitalization is opening up vast opportunities for innovation in the sector and is rapidly transforming parts of the global agriculture industry.

\$877 million

Venture capital investment into Agtech quadrupled from 2014 to 2017, from \$185 million to \$877 million. Yet this still only represented one percent of total VC investment in 2017, meaning there is considerable room for growth.

Policymakers

Policymakers have a huge role to play in development of Agtech sub-sector, catering policies to localized needs, connecting farmers and innovators, and providing tangible and intangible infrastructure support.

Until recently, “agriculture technology” referred to heavy equipment, not software. But the digitization has been rapidly transforming parts of the global agriculture industry. Pressure from rising food demand, urbanization, and water scarcity will continue to open up opportunities for innovation in a sector that employs 1 billion people and contributes \$3.2 trillion annually to global output.¹

The agricultural revolution of the 20th century succeeded in feeding billions of people and today, agriculture is one of the biggest industries in the world. But agricultural yields have not been increasing in many parts of the world, even as agricultural output needs to increase by an estimated 60 percent by 2050 over the levels of 2005-7, to fulfill the nutritional needs of a global population rising from 7.6 billion to 9.7 billion.²

At the same time, greenhouse gas emissions from agriculture are rising, food wastage is high, the supply of arable land is not increasing, and freshwater availability will face a 40 percent deficit by 2030.³ These

- 1 The World Bank - Agriculture, value added (<https://data.worldbank.org/indicator/NV.AGR.TOTL.CD?view=chart>)
- 2 FAO - WORLD AGRICULTURE TOWARDS 2030/2050, 2012 (<http://www.fao.org/docrep/016/ap106e/ap106e.pdf>). UN Department of Economic and Social Affairs - World population projected to reach 9.7 billion by 2050, 29 July 2015 (<http://www.un.org/en/development/desa/news/population/2015-report.html>).
- 3 FAO - SAVE FOOD: Global Initiative on Food Loss and Waste Reduction (<http://www.fao.org/save-food/resources/keyfindings/en/>); FAO - SAVE FOOD: Global Initiative on Food Loss and Waste Reduction (<http://www.fao.org/save-food/resources/keyfindings/en/>); FAO - WORLD AGRICULTURE TOWARDS 2030/2050, 2012 (<http://www.fao.org/docrep/016/ap106e/ap106e.pdf>); The United

trends present a challenge, but also an entrepreneurial opportunity for sustainable and innovative ways of producing, supplying, and storing food. Increasing digitization, driven especially by startups, will help make progress and ensure that the agriculture industry can meet growing 21st century demands. Governments, investors, corporate incumbents, and others are natural partners in this work.

What is AgTech?

“Agtech is scientifically-driven farm practices, equipment or processing including bio-engineered/transgenic crops, proprietary breeding, GPS/precision ag, water management and improved equipment, conservation-based best management practices, food manufacturing and related advancements.”⁴ In this report, Agtech includes, but is not limited, to agricultural bioscience, data-enabled agriculture, automation and robotics, supply chain and logistics, agricultural processing, foodtech and artificial meat, and contained farming.

Nations World Water Development Report 2015

4 Idaho State Department of Agriculture - Agtech: Opportunities and Challenges (http://www.pnwr.org/uploads/2/3/2/9/23295822/agtech_opportunities_and_challenges_oakey.pdf)

Agtech & New Food Global Startup Activity

Startup Output

Global Share of Startups
0.6% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
14.3% Global Startup Growth: 4.5%

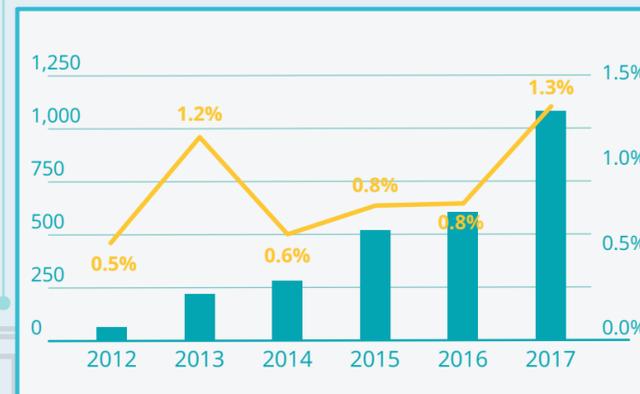
Funding

Total Funding Value Growth (2012 - 2017)
1143% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$320 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$4 million Global Median: \$4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

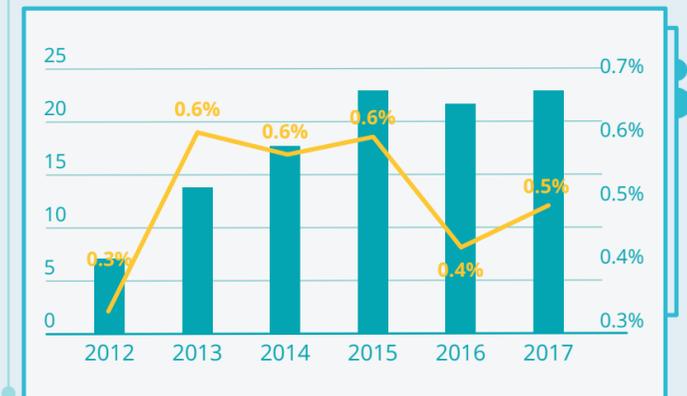


Exits

Exit Value Growth (2012 - 2017)
2054% Global Average: 126%

Median Exit Value (2012 - 2017)
\$27.4 million Global Median: \$30 million

Number of Exits and Global Share of Exits



■ Number of Exits
 ■ Global Share of Exits

■ Total Value of Deals
 ■ Global Share of Deal Value

Key Drivers and Trends

Agriculture employs over a large percentage of the world's population but contributes only 3.8 percent to the global value added (as % of GDP).¹ Agricultural productivity has increased substantially since the middle of the last century, however, the industry still finds itself contributing less than other sectors. Agriculture has been lagging other industries in terms of digitization and innovation. According to a McKinsey Global Institute's Industry Digitization Index, among major industries, agriculture is one of the least digitized industries.²

Given the size of the agriculture industry—global net farm income is \$120 billion and farm assets are around \$2 trillion—there is a huge opportunity for investments in digitization and automation of agriculture.³ All the factors discussed previously, point to the need of "Agriculture 2.0," which could be the Kodak moment for the agriculture industry if driven by automation and data science.

Corporates are increasing their activity in the Agtech space.

Climate Corp's \$930 million acquisition in 2013 set the tone for agriculture companies to invest in Agtech startups. Although, there have not been as major exits since Climate Corp's acquisition,⁴ there has certainly been an increase in corporate venture capital (CVC) investing in Agtech startups. According to PitchBook, CVC flow since 2013 increased from less than \$100 million in 2013 to

more than \$600 million in 2017 (Jan - Nov).⁵ The number of deals increased by a factor of five during the same timeframe, reaching 30 in 2017 (Jan - Nov). Unique corporates investing in Agtech have also increased drastically, from two in 2013 to 20 in 2016 to 32 in 2017, according to CB Insights.

Major players Monsanto and Syngenta both have venture capital arms investing in Agtech companies. Between 2012 to 2016, they were among the most active VCs (ranked #2 and #4 respectively in terms of number of investments).⁶ Corporates are also developing relationships with accelerators focused on the Agtech industry, hoping to access early stage startups.

And this may not be all. Traditional agriculture companies, apart from Agtech investments, are also investing in other startups focusing on data science, biotech, analytics, AI, IoT, etc. which can have substantial usage in agricultural practices.

Farming IoT and the 5G Revolution. Access to smartphones and internet is increasing for farmers across the globe. Farming ecosystem players from farmers, equipment manufacturers, and other agriculture companies are implementing IoT based technologies and reaping benefits. 5G connectivity could bring rural areas reliable, high speed internet enabling the application and data management of Smart Farming IoT. Smart Farming IoT will see application across wide range of activities related to agriculture solving multiple issues faced by the industry. Potential applications will include water management, fertigation, crop communication,

1 World Bank - DataBank: World Development Indicators (<http://databank.worldbank.org/data/reports.aspx?source=2&series=NV.AGR.TOTL.ZS>)

2 MGI - Digital America: A tale of the haves and have-mores, Dec 2015 (<https://www.mckinsey.com/industries/high-tech/our-insights/digital-america-a-tale-of-the-haves-and-have-mores>)

3 <http://www.kauffman.org/what-we-do/research/2014/04/agtech-challenges-and-opportunities-for-sustainable-growth>

4 <https://techcrunch.com/2017/05/13/vcs-see-fertile-ground-in-agtech/>

5 PitchBook - Agtech: A CVC case study, 8 Dec 2017 (<https://pitchbook.com/news/articles/agtech-a-cvc-case-study>)

6 <https://www.cbinsights.com/research/agtech-startup-investor-funding-trends/>

livestock safety and maturity monitoring, aerial crop monitoring, and drilling, seeding and spraying.

Local needs to drive innovation in Agtech clusters. Agriculture is a very segmented business. It can be segmented by various features which are unique to certain geographic regions and conditions. It may be segmented by type of land holding: big, medium, small; by type of soil; by type of crops; by type of irrigation capabilities; etc. Entrepreneurs might fail to come up with solutions that work across different farm holdings or crops or some other factor, and will have to tailor their solutions based on local needs and requirements.

Development of FaaS (Farming-as-a-service) model in countries with very small land holdings like India is one such example. In India, these FaaS startups have witnessed substantial investments and support from various quarters including government and corporates. According to a report by consulting firm Bain & Co, VC investments in FaaS in India have risen by ~5.5x from 2013 to 2016.⁷ The majority of these FaaS solutions are targeted towards farm management solutions that are mostly influenced by developed markets with high mechanisation.

Innovation in Supply Chain. According to FAO, around 33 percent of the food produced for human consumption gets wasted globally. Total cost of this wasted food is pegged close to \$1trillion.⁸ Despite this, most of the research in agriculture is toward increas-

⁷ Indian Farming's Next Big Moment: Farming as a Service, Bain & Co, Feb 2018 (<http://www.bain.com/publications/articles/indian-farmings-next-big-moment-farming-as-a-service.aspx>)

⁸ FAO - SAVE FOOD: Global Initiative on Food Loss and Waste Reduction (<http://www.fao.org/save-food/resources/keyfindings/en/>)

ing the yield of crops and not toward supply chains. According to Deloitte, up to two-third of the above stated 33 percent could be saved through more efficient and reliable supply chains.⁹ Supply chains present a huge opportunity for Agtech startups to exploit and help the agriculture sector and the global economy. Rerouting supply chains by reducing efficiencies through direct farm marketing (direct farm to consumers), waste reduction technology, and other technologies can help the startups provide solutions that are useful and sustainable.

Financial engineering in agriculture. The financial services industry has a huge role to play in agriculture going forward and going forward we are going to witness innovation in both, agriculture and financial services. Insurance in agriculture, for example, is an \$11 billion industry and has seen the rise of startups like Crop Pro, which has raised \$8 million from ag-focused venture funds Finistere Ventures and S2G Ventures and insurance provider GuideOne Insurance. Banking and payment services like credit assessment, valuations, supply chain payments and business forecasting are currently done the traditional way and could be a huge opportunity for startups to exploit. Similarity, Blockchain can help agriculture with transparency; mobile payments and credits with decreased transaction costs; and real-time management of supply chain transactions and financing.

Limited transformation at operating level. Agtech has boomed in terms of investment and corporate and government support. On the ground, however, the reality is not drastically different from what it was a few years ago. Farmer adoption, despite concrete efforts, is significantly lower than what it could have been. Multiple

⁹ Deloitte - From Agriculture to AgTech (<https://www.gita.org.in/Attachments/Reports/Deloitte-Transformation-from-Agriculture-to-AgTech.pdf>)

reasons are driving this.

Distribution of these Agtech solutions is one of the major hurdles. The traditional supply chain players are conservative and rigid in helping startups reach the farmers with the solutions. Entrepreneurs are developing solutions for farmers but do not have a strong linkage through which they can reach a wide audience of their products. Agtech solutions are very different from other tech solutions like softwares where there is no distribution chain and hence Agtech startups need people in the distribution chain who know farmers and can understand their issues.

At farmer level, it is hard for a lot of farmers to understand technologies and softwares. Not every farmer, especially in the developing countries, understands technology very well and thus face issues in utilizing the solutions offered by Agtech companies. In a lot of cases, even when the technology is installed and embedded, it is not completely utilized by farmers.

Agtech is underinvested. Despite seeing a fourfold increase in investment since 2014, Agtech remains one of the most underinvested sub-sectors in the global startup ecosystem. Long product development and sale cycles, and lower growth rates (compared to their software counterparts) make it a less attractive proposition for venture capitalists. According to PitchBook, in the US, venture capital investment in 2017, which was at record level for the sector, was just 1.7 percent of the total \$59 billion.¹⁰

Reactive approach of incumbents. While corporate investments in Agtech have substantially risen over the years, there

¹⁰ PitchBook - VC investment in US agtech keeps growing (<https://pitchbook.com/news/articles/vc-investment-in-us-agtech-keeps-growing-datagraphic>)

is still substantial unfulfilled potential. Corporate have usually taken a reactive rather than a proactive stance in investing in Agtech. According to a survey of agribusiness executives by BCG & AgFunder, more than 80 percent of respondents said that the primary intent of their investments was to defend or enhance their core businesses and only 10 percent of investments were linked to building new disruptive capabilities.¹¹

Small farms make adoption difficult. Farms in the developed countries, which are large in size, are seeing increased and faster adoption of latest technologies, from sensors collecting data to drones to robots, etc. Farmers in developing countries, where the crop yields are much lesser and farm holdings are much smaller (less than two hectares mostly), face issues in adopting these technologies or do not have many technologies which offer such incremental values. Agtech companies are mostly focusing on large, not small, farms. For Agtech startups, it is difficult to scale and expand such solutions and it further limits their potential of VC funding. Developing countries are witnessing innovation in Agtech like FaaS, and mobile apps for advice on weather, commodity prices and productive techniques, but more innovation is needed to attract VC funding and bring them at respectable level of yield and output.

11 BCG - Lessons from the Frontiers of the Agtech Revolution, October 2016 (<https://www.bcg.com/publications/2016/process-industries-building-materials-strategy-lessons-frontlines-agtech-revolution.aspx>)

Agtech & New Food Ecosystems to Watch

The map shows the most important global Agtech ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on Agtech. Click on the ecosystem name to find out more about the local scene.

 Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Innovation mostly takes place where the problem is and long-term efforts are required to provide innovation capabilities to clusters where farming is taking place.

Establish connections with local industry. Universities with focus on local industries act as the engine of R&D and economic growth for the region. In case of Agriculture, many agriculture hubs have established agriculture-focused colleges and universities which have in-turn transformed the local agriculture industry by bringing innovation and ultimately increasing productivity. For example, Piracicaba, a small city in the Sao Paulo state in Brazil, is one of the leading Agtech centres in Brazil. The presence and association of strong local industry and universities including ESALQ of Sao Paulo University (ranked #7 university in the world for Agriculture Sciences by US News & World Report) has helped the city generate 18% of the total Agtech startups in the entire Brazil. Ecosystem players need to facilitate collaboration between the local industry and universities to make marketable products and to make sure that technologies at the universities can be commercialized.

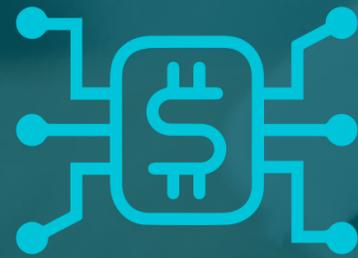
For entrepreneurs, it is next to impossible to develop one-size-fits-all solutions for farmers. The need for specific Agtech technologies rises from the specific agriculture communities — which all have very specific needs, so entrepreneurs need to provide solutions that are able to solve particular problems and are scalable. Startup founders need to focus on market pull rather than technological pushes in agriculture. This drives the need for more connections and conversations between the growers and entrepreneurs who can design solutions that not only solve the issues, but are implementable and sustainable for multiple farming communities.

In line with the above conversation, according to Startup Genome survey data, Agtech founders mostly focus on local markets and rank last in targeting global markets first. At 26.4%, Agtech founders are substantially behind the global average of 36.8% in targeting global market first.



Developing infrastructure to promote innovation. Digitization in agriculture is driven by smartphone accessibility and network infrastructure among other factors. Agricultural spaces are mostly far from city clusters and lack reliable internet connectivity. It then becomes the responsibility of public agencies to provide reliable internet infrastructure to farmers.

Similarly, funding and business support is predominantly based within city clusters rather than the regional farming areas that need them. It is necessary to enable easy access to capital and other financial services to farmers if they are to deploy advanced Agtech solutions.



Sub-Sector Overview

Fintech

Co-Author

Susanne Chishti

CEO at FINTECH Circle

Artificial Intelligence

AI and Machine Learning continue to take the Fintech world by storm, allowing brand new companies to quickly compete with established financial institutions.

Cryptocurrencies

Cryptocurrencies and the underlying blockchain technology have the potential to reshape the way our financial system works by providing a peer-to-peer value exchange solution.

Expansion

Various new Fintech applications are emerging across Insurtech (innovation across global insurance), Wealthtech (Fintech innovation across global investment management & private banking) and Regtech (innovation across compliance and regulatory reporting).

Rapidly advancing technologies combined with new business- and revenue models as well as changing demand for financial products and a multitude of new players are driving a new wave of Fintech innovation. In 2017, Blockchain and cryptocurrencies dominated the headlines, holding out the potential for revolutionising the way financial trades are cleared and settled and thus providing space to fundamentally rethink the way our financial system works. But there are many other kinds of technologies influencing the Fintech space and disrupting different parts of the financial services industry.

While the number of new Fintech startups is declining on a year-to-year basis since its high points in 2014 and 2015, capital continues to flow into the Fintech sub-sector with larger funding rounds becoming more frequent, showcasing investor confidence in the future potential of these firms and indicating the growing maturity of the sub-sector. According to KPMG's Fintech100 list, global Fintech innovation continues to spread locally with 29 different countries represented in the Fintech100, up from 22 countries in 2016.¹

In the global Fintech landscape China continues to dominate, outperforming the United States as the top Fintech country. Chinese Fintech companies take the top three places on the Fintech100, with Chinese firms accounting for five of the top 10 startups. China is the largest market for digital payments (China's mobile payments hit \$5.5 trillion last year, 50

times larger than the U.S. market of \$112 billion, according to Forrester Research). The economic powerhouse is also dominant in online lending, making up three-quarters of the global market.² The largest Chinese Fintech company, Ant Financial, has been valued at about \$60 billion, on par with UBS, one of the biggest traditional financial institutions in the world.

Over the last year we have seen clear trends in the Fintech ecosystem, moving away from "disruption" to "collaboration". Financial incumbents realize that Fintech companies can be their best partners in competing with tech giants such as Amazon, Facebook, Google in Western countries and Baidu, Alibaba and Tencent in China/Asia who are moving fast into the financial services sector.

What is Fintech?

Financial technology—Fintech for short—describes the evolving intersection of financial services and technology. The term can refer to startups, scaleups, technology companies, or even legacy providers. Broadly speaking, Fintech is anywhere technology is applied in financial services or used to help companies manage the financial aspects of their business, including new software and applications, processes and business models. Fintech products and services can be found within Retail, Corporate and Investment Banking, Asset Management, Transaction Banking, Insurance, CryptoFinance and several others.

¹ 2017 Fintech100 (<https://home.kpmg.com/xx/en/home/media/press-releases/2017/11/the-fintech-100-announcing-the-worlds-leading-fintech-innovators-for-2017.html>)

² <https://www.brookings.edu/blog/order-from-chaos/2018/02/08/whats-happening-with-chinas-fintech-industry/>

Fintech Global Startup Activity

Startup Output

Global Share of Startups
7.1% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
6.8% Global Startup Growth: 4.5%

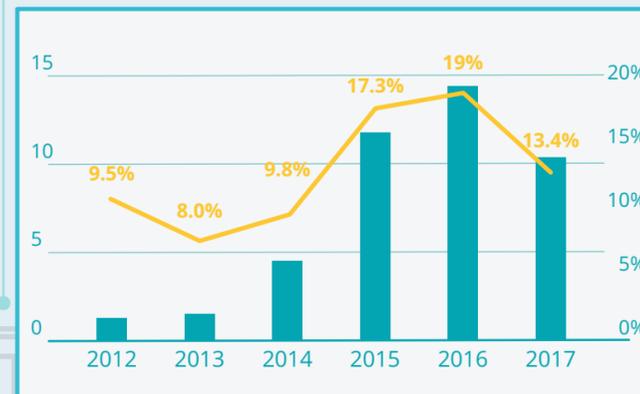
Funding

Total Funding Value Growth (2012 - 2017)
460% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$389 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$4.7 million Global Median: 4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding



Exits

Exit Value Growth (2012 - 2017)
580% Global Average: 126%

Median Exit Value (2012 - 2017)
\$32.2 million Global Median: \$30 million

Number of Exits and Global Share of Exits

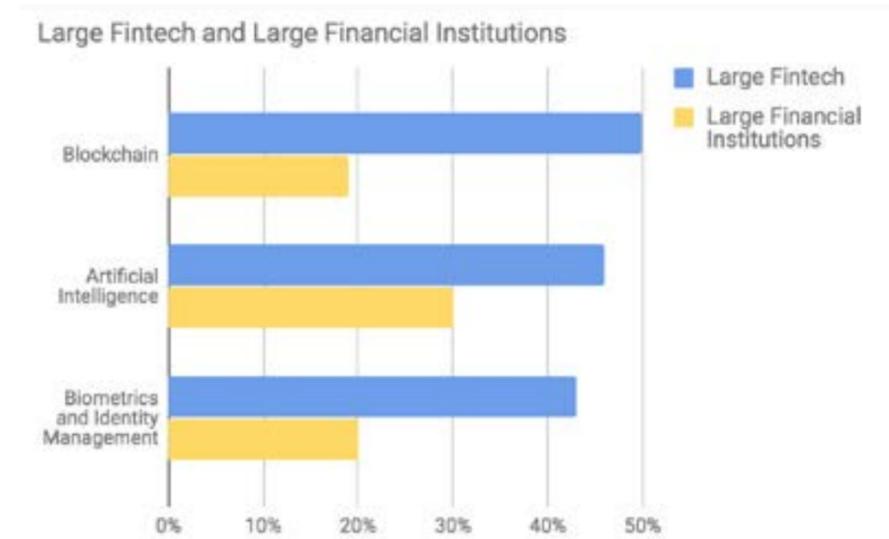


■ Number of Exits
 ■ Global Share of Exits

■ Total Value of Deals
 ■ Global Share of Deal Value

Key Drivers and Trends

The following chart shows the focus on emerging technologies in Fintech startups with more than 500 employees, as well as in large financial institutions. The most frequently mentioned technologies are Blockchain and Artificial Intelligence, as well as Biometrics and Identity Management. (Percentage of companies that identified these emerging technologies as the most relevant to invest in within the next 12 months).¹



WealthTech & Robo-Advisers--Automation services increase rapidly due to artificial intelligence. Artificial intelligence, big data and machine learning technologies are sweeping across all industry sectors. In financial services they are being incorporated into customer interactions, fraud detection, trading, and risk management. In particular, wealth management is rapidly adopting these technologies. AI-powered “robo-advisory services” help

¹ Source: PWC Global Fintech Report 2017 (<https://www.pwc.com/jg/en/publications/pwc-global-fintech-report-17.3.17-final.pdf>)

customers set up personalized portfolios and provide automated investment opportunities or offer digital financial advice based on mathematical rules or algorithms. At low cost, the technology gives more people access to wealth management services that were previously only accessible for the super wealthy. A.T. Kearney reports that assets under management by robo-advisors will total \$2.2 trillion by 2021.²

Startup Example

Betterment (New York City, United States)

Betterment is a smart automated investing service that provides optimized investment returns for individual, IRA, 401k and rollover accounts. The company offers an automated, goal-based investing service and enables users to manage their investments in a customized, diversified portfolio. Betterment has about 300,000 clients and \$12 billion in assets under management.

Blockchain--A revolutionary technology is capturing the Fintech space. Cryptocurrencies and the underlying blockchain technology allow for peer-to-peer interaction without the need for a trusted intermediary. As banks traditionally function as this trusted third party, blockchain technology is bound to disrupt and innovate across multiple segments of the financial landscape, challenging the very core of the banking business. If the technology succeeds banks might become less relevant in many parts of the financial system, to the advantage of the new digitally savvy operators.

² Hype vs. Reality: The Coming Waves of “Robo” Adoption https://www.atkearney.com/documents/10192/7132014/Hype+vs.+Reality_The+Coming+Waves+of+Robo+Adoption.pdf

With regard to venture funding, Initial Coin Offerings (ICOs) are one of the trends entrepreneurs currently pay close attention to. As an alternative and unregulated form of crowdfunding that is emerging outside the traditional financial system it allows start-ups to get funding by issuing tokens in exchange for established cryptocurrencies like Bitcoin. While ICO investments have seen strong growth in 2017, many scams have been reported and more regulators are expected to respond in 2018.^{3 4}

Startup Example

Ripple (Bay Area, United States)

Ripple offers a global real-time payment system that enables banks and financial institutions around the world to directly transact with each other without the need for a central correspondent. It is built upon a distributed ledger and native cryptocurrency abbreviated as XRP which is the third largest cryptocurrency by market cap to date (\$36.7 billion, as of March 6, 2018).

Biometrics and Identity Management--Higher security for mobile payments. Mobile payment systems and digital wallets are on the rise. With it comes an increase in demand for security and better recognition infrastructure. From technologies like face recognition systems, to other security tools such as iris detection and fingerprint recognition, biometric authentication will be used in a variety of bank and payment scenarios, such as withdrawing cash from ATMs, authenticating mobile bank apps. Additionally,

³ <https://www.wired.com/story/cryptocurrency-scams-ico-trolling/>

⁴ <https://medium.com/@wulfkaal/initial-coin-offerings-the-top-25-jurisdictions-and-their-comparative-regulatory-responses-4b8c9ae7e8e8>

behavioral biometric systems are increasingly being embraced by banks and other financial services organizations. Consultancy group Goode Intelligence has predicted that bank customers will be using biometrics as the predominant method of identifying themselves to access bank services by 2020.⁵

Old kids on the block--Financial firms and banks are jumping into Fintech. All major banks have woken up to Fintech, and are actively competing with Fintech startups in order to continue to serve their customers and keep their dominant position in the global economy (see Box: Financial Services Industry Size). Heavyweights like Barclays, Citigroup, Goldman Sachs and JPMorgan have significantly increased their activity in the Fintech space through investment into fintech startups, acquisitions or internal projects across data analytics, infrastructure, alternative lending, personal finance management, blockchain and others. Next to acquisitions, Financial institutions are increasingly viewing partnerships with fintech startups as the fastest and most efficient way to innovate and to improve the consumer experience or internal operations.

The trends towards "Open Banking" have been supported by regulation such as the EU's second Payment Services Directive (PSD2) which took effect early 2018. Banks must allow third parties, including Fintech startups and challenger banks, access to their customers' financial data including transaction history and spending patterns. In the blockchain and cryptocurrency space financial institutions are expected to not only partner with blockchain startups but also embrace digital assets as a new asset class going forward. First steps in this direction have been taken by the CME and CBOE, two of the largest future exchanges, who recently started trading

⁵ <http://www.goodeintelligence.com/report-store/view/biometrics-for-banking-market-technology-analysis-adoption-strategies-forecasts-20152020>

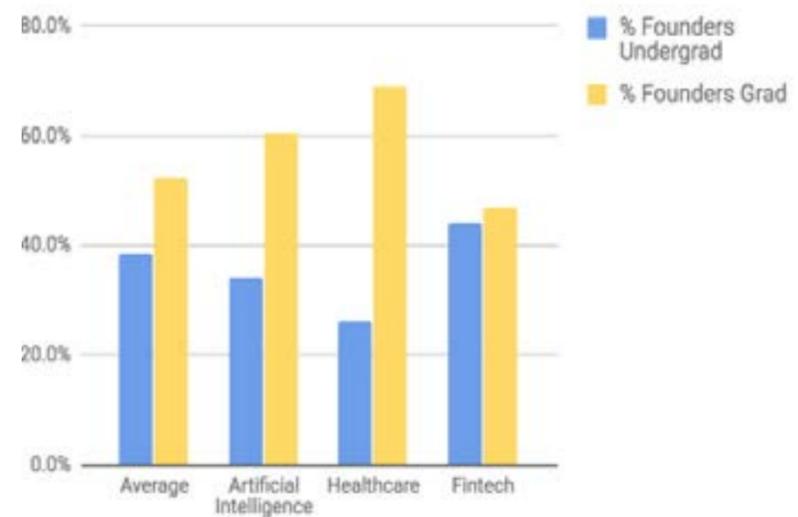
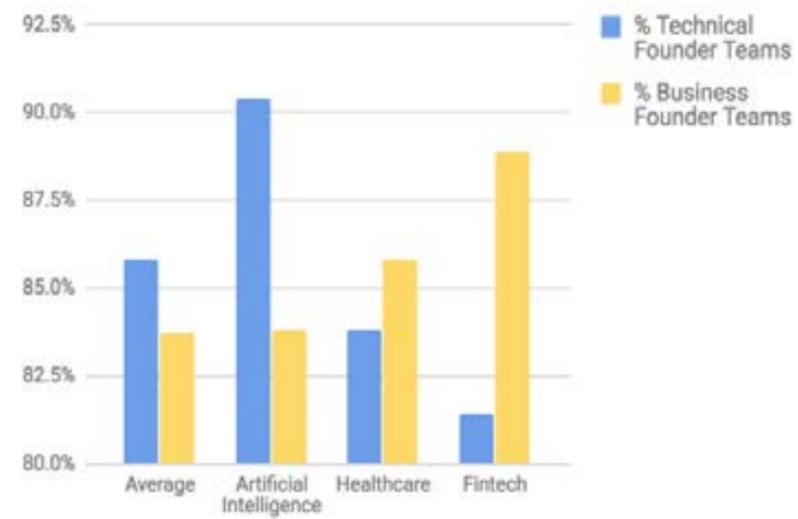
Bitcoin futures.

Global Financial Services Industry Size

- Global Annual Revenue of Financial Services Industry: **\$13.1 trillion**
- Compound annual Growth Rate of Financial Services Industry: **6%**
- Share of Financial Services Industry of Global Economy (GDP): **16.9%**
- Number of People Employed in Financial Services Industry Globally: **225,127,000**
- Share of People Employed in Financial Services Industry Globally: **7.8%**

Financial Technology or Technological Finance--Technology firms are encroaching in the financial space: Large tech companies are integrating their customers with their banking needs, leveraging their customer base and user data to provide banking services directly in a user-friendly environment. The most powerful examples are Alipay, a payment service that got developed by Alibaba's affiliate Ant Financial, which already boasts 520 million users and Tencent's WeChat-based Weixin Pay. In developing countries, large shares of the population are cut off from basic financial products—tech and telecoms companies are often first movers in terms of providing greater access to financial services for the 2.5 billion unbanked people.

Fintech founder--A special kind of entrepreneur: The background and experience of Fintech founders differ meaningfully from other startup sectors. Compared to other sub-sectors, a higher share of Fintech founders has a business background than a technical background. Likewise, among Fintech startups, we find a higher share of founders having only an undergraduate degree and a lower share with graduate degrees. The share of founders with only an undergraduate degree is also comparatively high. These two facts may indicate that entry barriers in terms of deep tech knowledge for starting a Fintech company are comparatively low. On the other hand, Fintech founders, especially those focused on B2B business models, need to possess strong domain expertise often gained by many years working in the financial services sector.



Fintech Ecosystems to watch

The map shows the most important global Fintech ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on Fintech. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Fintech startups typically face a complex regulatory environment that is slow to adopt change and was designed for traditional banks operating on now-outdated business models.

While going global early is key for every startup, many Fintech firms that wish to operate internationally often face restrictions on where they can store and transmit data, and need to comply with costly regulatory requirements. Only Europe allows “financial passporting” which is a huge benefit to financial services players (both incumbents and fintech startups) and defined as the right for a firm registered in the European Economic Area to do business in any other EEA state without needing further authorization in each country.¹

Perhaps because of these global regulatory difficulties, Startup Genome research finds that, compared to other sub-sectors, fewer Fintech founders say they are targeting the global market and developing globally leading products. At the same time, a much higher share of Fintech founders say they’re developing customized products for local markets.

To address these challenges and capture the full benefits of financial innovation, policymakers need to ensure that regulations encourage innovation in financial services and create a level playing field between incumbents and new entrants.

Promoting international harmonization of laws affecting the financial services sector including financial data interoperability is

¹ <https://www.investopedia.com/terms/p/passporting.asp>

crucial. Another important issue is cybersecurity: As most financial institutions as well as Fintech startups suffer from hacking (a typical financial services organization will face an average of 85 targeted breach attempts every year, a third of which will be successful), investment in cybersecurity and improvement of a secure financial infrastructure is needed.²

“Fintech is a global force changing our financial lives both as individuals and as companies. Underestimating these structural changes to the global financial ecosystem, will lead to many “Kodak” and “Nokia” case studies in Finance. The most important challenge now is how enterprise innovation can be combined with Fintech education. Cultural change and top management buy-in are required to turn historically closed financial organizations into open platform ecosystems willing to work with the best Fintech firms in strategic partnerships for the benefit of our customers.”

Susanne Chishti
CEO FINTECH Circle

² Source: Accenture High Performance Security Report 2016 (https://www.accenture.com/t20170216T011141__w_/us-en//www.accenture.com/t20170419T061542Z__w_/us-en/_acnmedia/PDF-44/Accenture-Building-Confidence-Solving-Banking-Cybersecurity-Conundrum.pdf#zoom=50)



Sector Overview

Health and Life Sciences

Co-Author

Arshad Ahmed

*Zaylan LLC and Strategic Advisor to
Disruptive Technologies at Novartis Oncology*

Bio-pharmaceuticals

The broader global Biopharma sub-sector is about \$1.1 trillion in size in 2015-16 and growing at mid single digits annually.

Medtech

The broader Medtech sub-sector generated \$475 billion in 2017 in revenue globally and is expected to grow 4% annually to \$575 billion by 2022

Digital Health

Digital Health is about \$100 billion in 2016 and expected to grow at 24% annually

Healthcare has long been known as a sector offering reliable returns to investors. With growing and aging populations and increasing prevalence of illnesses across the world, healthcare has seen steady growth compared to other sectors in the global economy.

In the United States, which contributes to more than 40% of global healthcare costs, the average growth in healthcare spending has been in the 4-6 % range, while the GDP growth has been in the 1.5-3% range.¹² In addition, healthcare is relatively less sensitive to economic cycles than other sectors. Combined with high rates of innovation driven by novel scientific discoveries, this makes healthcare a highly-attractive space for investors. We are on the cusp of major breakthroughs in biomedical sciences that will drive the next generation of medical treatment. The pace of discoveries made in fields such as genetics, biomed engineering, biomaterials, immunology, and cancer biology is accelerating at an unprecedented rate.

Healthcare is a large market with many different segments with around \$8 trillion in global spending.³ In the United States, healthcare spending, which stood at 17.5% of GDP in 2014, will increase to 20.1% by 2025, according to government projections.⁴

What is Health and Life Sciences?

Health and Life Sciences is the sector concerned with diagnosing, treating, and managing diseases and conditions. This includes drugs, medical technologies like diagnostics, monitoring and other devices (e.g. catheters, stents, etc.), hospital and physician costs, dental costs, home health care, unreimbursed insurance, and some other expenses related to healthcare.

The Biopharma, Medtech, and Digital Health sub-sectors are the focus of this report.

1 <https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nhe-fact-sheet.html>
2 <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=US>

3 <https://data.worldbank.org/indicator/SH.XPD.TOTL.ZS> and <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>
4 <https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/Proj2015.pdf>

Life Sciences & Healthcare Global Startup Activity

Note: Healthcare startups take longer time than companies from the other sectors to reflect in the database and this could impact the data for the year 2017.

Startup Output

Global Share of Startups
6.8% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
-0.3% Global Startup Growth: 4.5%

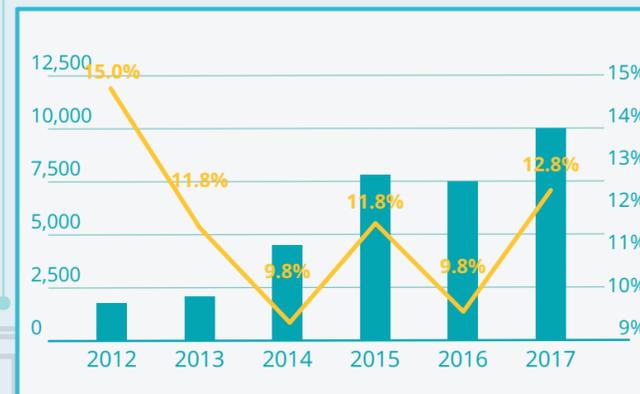
Funding (Excluding ICOs)

Total Funding Value Growth (2012 - 2017)
312% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$435 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$5 million Global Median: 4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

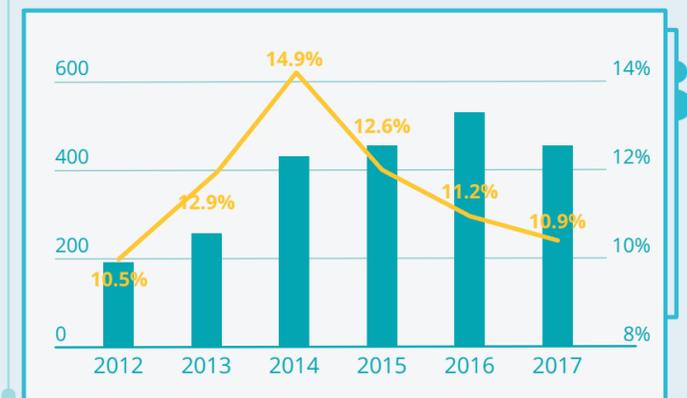


Exits

Exit Value Growth (2012 - 2017)
591% Global Average: 126%

Median Exit Value (2012 - 2017)
\$ 39.6 million Global Median: \$30 million

Number of Exits and Global Share of Exits



■ Number of Exits
 ■ Global Share of Exits

Key Drivers and Trends

Aging population and chronic disease. The overall global population is expected to reach 9.8 billion by 2050.¹ Combined with the general aging of the western population and some Asian countries such as China and Japan, this means an increasing incidence of chronic disease such as diabetes, cardiovascular, and autoimmune conditions.

With improved treatments entering the market and growth of “precision medicine”, cancer is increasingly become a chronic condition rather than an episodic one — similar to how cardiovascular health issues were transformed from an acute care condition to a chronic disease indication back in the 70s.

Rise in superbugs and infection. Increasing virulent strains of bacteria and viruses is leading to higher rates of hospital-acquired infections and growing incidences of viral infections such as hepatitis C. All these factors are culminating in an environment of rapid growth in healthcare spending across the globe — presenting new challenges and opportunities.

Healthcare reform and shift to value-based care. Healthcare reform has been at the center of political discourse in the United States, parts of Europe, and China, with governments making reforms to reduce inefficiencies and make healthcare available to a wider portion of the population. The Chinese government has taken steps to modernize healthcare and has budgeted close to \$600 billion in order to modernize its healthcare system.

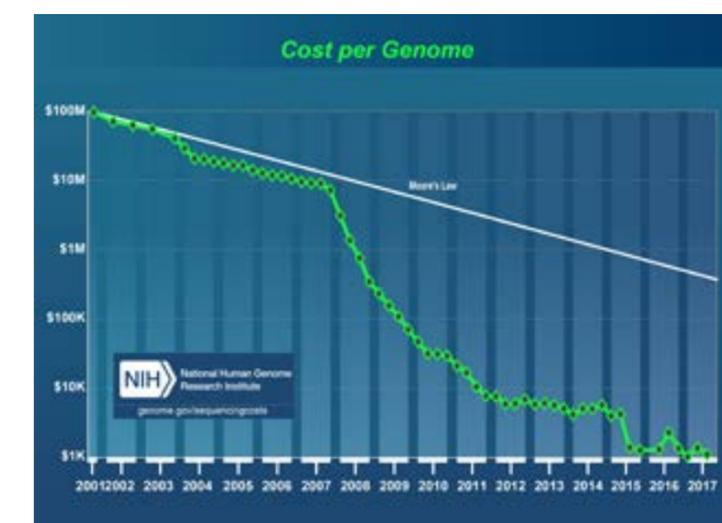
In the United States, the Affordable Care Act has shifted incentive alignment among stakeholders, moving away from a fee-for-service model to accountability or value-based payment systems. This

¹ <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html>

shift has had a major impact on how hospitals diagnose, treat and manage patients; and also on how suppliers of technology and tools align with the providers and payers. More than 50% of clinics in the United States are now under value-based contracts, which means that they are reimbursed based on outcomes rather than fee-for-service, and pharma and Medtech players are following suit.

Increasing rates of innovation. Rates of new discoveries and breakthroughs are rising. Several fields of biomedical sciences have taken massive leaps forward.

The field of genomics, for example, has made significant strides with the complete mapping of the human genome, followed closely by the cancer genome atlas, and then the microbiome. The cost of human sequencing has declined at a much faster rate than previously expected, thanks to new developments in next generation sequencing as well as data computing as shown in the figure below.



Another significant development is the field of gene editing, with the advent of CRISPR technology paving way for a new class of therapies as well as new methods for understanding basic biological functions.²

Besides biological sciences, there have also been significant developments in physical sciences, biomaterials, and nanotechnologies affecting the rate of innovation in the healthcare fields. New developments include things like the miniaturization in medical devices such as insulin pumps and patient monitoring technologies.

Governments across the world are funding approximately \$100 billion in research and there is an additional amount of more than \$200 billion invested by pharma and Medtech companies.³ These changes are creating opportunity for new business models and opening doors for new players. This also implies that existing structures and incumbents who are dependent on the old rules will increasingly face disruption from emerging startups.

² Clustered Regularly Interspaced Short Palindromic Repeats.

³ Chakma, J.; Sun, G. H.; Steinberg, J. D.; Sammut, S. M.; Jaggi, R. (2014). „Asia's Ascent — Global Trends in Biomedical R&D Expenditures“. *New England Journal of Medicine*. 370 (1): 3–6. doi:10.1056/NEJMp1311068. PMID 24382062.

Sub-Sector Overview

Biopharma

Introduction

During the past two years, investment in biopharmaceuticals has increased substantially around the world. In the field of cancer, over \$3 billion has been raised by only 15 companies such as Juno (recently acquired by Celgene for \$9 billion), Jounce, and Compass. Moderna Therapeutics in Boston, United States raised close to a \$1 billion to focus on a novel messenger RNA class of drugs. The Chinese government announced a \$6.5 billion VC fund exclusively focused on pharma and Biotech. And for the first time ever, the U.S. Food and Drug Administration (FDA) has approved a digital pill – a digiceutical which is a medication embedded with a sensor that can tell doctors whether and when patients take their medicine.

Immunotherapies have been revolutionizing cancer treatment. While the first generation of these drugs was launched by large pharma such as BMS and Merck, the origins of these breakthrough innovations can be traced back to VC-backed startups such as Medarax and Organon in the mid 2000s. Now, a gold rush has begun in cancer research, with about 1,200 clinical trials being conducted across the world, with more than half of this activity being led by VC-backed startups.

What is Biopharma

Biopharma is the sub-sector that includes any prescription or non-prescription spending on drugs to treat a disease or a health condition and is regulated by the health authorities. This does not include dietary supplements or any health foods, functional foods, or nutraceuticals. It also includes over-the-counter (OTC) drugs that do not require prescriptions.

Key Drivers and Trends

Growing biopharma spending. Biopharma spending was at more than \$1.1 trillion globally in 2015 and is expected to grow at a mid-single digit rate in line with the overall growth in healthcare. The market still faces patent cliffs, which will further increase the penetration of generics and put pressure on growth. However, the industry is also expecting a healthy pipeline of new and highly-potent therapies.

China contributed around \$117 billion in 2016 in biopharma spending and is projected to grow between 9-10% through 2020.¹²

Large and growing R&D budgets. The pharma sector invests more money in research than any other industry, with five of the world's 10 highest R&D budgets belonging to drug companies, with spending expected to grow. KPMG: Growing the pipeline, growing the bottom line 2013 KPMG: Growing the pipeline, growing the bottom line 2013 Going forward, part of this budget could be spent on early stage startups in order to secure novel targets and molecules to fill development pipelines.

Novel business models “beyond the pill”. With a highly-consolidated market and an industry that boasts EBITDA margins north of 40%, the emergence of machine learning and big data tech applications are creating novel business models and disrupting the entire value chain. We are seeing the emergence of “digiceuticals” and outcomes-based business models which look more like data businesses than traditional Biopharma. With rising computing power and the digitization of patient records there are new methods emerging for rapid and cost-effective drug discovery and clinical trials.

A next generation of Biopharma companies that leverages new technologies to their advantage are emerging and thereby challenging big Biopharma. Many new models are being deployed that charges payers based on “per patient per month” if certain outcome measures are reached.

Startup Example

Moderna (Cambridge , MA) in the Boston area

Moderna Therapeutics is pioneering messenger RNA therapeutics, — an entirely new drug modality that produces human proteins or antibodies inside patient cells, which are in turn activated intracellularly or secreted. This platform addresses currently undruggable targets and offers a superior alternative to existing drug modalities for a wide range of disease conditions. The company raised \$450 million in 2015 and another \$500 million in 2018 in last round from investors including Alexion Pharmaceuticals, AstraZeneca, Bill & Melinda Gates Foundation, Biomedical Advanced Research and Development Authority, and Boston Medical Investors.

1 <https://www.bloomberg.com/news/articles/2017-10-09/china-launches-overhaul-of-drug-approval-in-win-for-big-pharma>

2 https://www.trade.gov/topmarkets/pdf/Pharmaceuticals_China.pdf

Sub-Sector Overview

Medtech

Introduction

In 2017, FDA clearance of the iRhythm Technologies' Zio AT, a wearable biosensor that continuously monitors ECG and wirelessly informs physicians of clinically-actionable arrhythmias, highlights a transformation of the medical technology (Medtech) industry. Medtech is becoming a field focused on consumer empowerment, digital enablement, and precision medicine.

The broader Medtech industry (i.e., not just startups) in aggregate generated roughly \$475 billion in 2017 in global revenue. It is expected to grow 4% annually to reach \$575 billion by 2022.¹ Medtech providers will need to evolve from being product centric to patient centric in how they deploy their business models and go to market. They need to develop novel capabilities in order to seamlessly capture real-world evidence and invest in additive manufacturing, artificial intelligence, and data analytics to play a central role in an increasingly digital, patient-focused healthcare ecosystem. These new offerings will produce a huge new growth engine with the power to transform clinical care.

¹ Strategic Directions International, The 2017 Global Assessment Report for Life Science Tools, Kalorama Information The Global Market for Medical Devices, 8th edition, and The Worldwide Market for In Vitro Diagnostic (IVD) Tests, 10th edition

What is Medtech

The Medtech sub-sector is primarily focused on designing and manufacturing medical technological equipment, devices, and tools -- performing functions like diagnostics and drug delivery.²

Key Drivers and Trends

Industry consolidation is an ongoing trend, and 2017 was no exception. The biggest transaction was Becton Dickinson, which bought Bard for \$24 billion. This trend is a threat to startups as larger players tend to have a strategic advantage in locking up large accounts to master service agreements and contracting. However, consolidation can also create opportunities for startups as larger companies tend to be less innovative and leave space for nimble startups to innovate.

The regulatory landscape is shifting. The U.S. FDA announced plans to add a new voluntary alternative pathway for medical devices which would allow clearance upon demonstration equivalence by meeting objective safety and performance criteria. The idea is to offer more regulatory flexibility for medical device companies – promoting innovation while still ensuring safety and efficacy. Meanwhile, medical device regulations are tightening in the European Union, and even in China. The situation could mean more medical device development focusing on the U.S. market first. This trend may lower the entry barriers for startups.

Power is shifting to payers and providers. Payers/insurers and

² EY Medical technology report 2017: Pulse of the industry ([http://www.ey.com/Publication/vwLUAssets/ey-medical-technology-report-2017/\\$FILE/ey-medical-technology-report-2017.pdf](http://www.ey.com/Publication/vwLUAssets/ey-medical-technology-report-2017/$FILE/ey-medical-technology-report-2017.pdf))

providers are gaining more importance in the selection of medical devices. These new models include risk-based revenue sharing models where companies share the risks and profitability with the providers on an individual patient basis.

Evolving regulatory, reimbursement landscapes, cost & pricing pressures, ongoing structural changes at providers (hospitals and clinics), and payers are demanding an accompanying evolution in how Medtech sells to its customers. Technology advancements in sensors, next generation sequencing, use of real-world evidence (RWE) and predictive analytics, coupled with advances in artificial intelligence (AI), have primed the Medtech sector for disruption. Given this continued march of technology, industry convergence will continue to accelerate, lowering barriers to entry for new entrants and creating new opportunities for startups.

Startup Example

United Healthcare Imaging (Shanghai, China)

United Healthcare Imaging develops and manufactures advanced medical equipment and solutions. Its solutions cover areas of diagnostic imaging, radiotherapy, and medical information technology. The company has raised \$500 million at \$5 billion Valuation. Investors include China Development Bank Capital, China Life Insurance, and CITIC Securities International.

Sub-Sector Overview

Digital Health

Introduction

Statistics show that 30% of U.S. smartphone owners use at least one health app, many of which allow individuals to track various health measures.¹ More than 70% of U.S. physicians routinely use electronic medical records (EMR/EHR) to review patient history and place orders of medical products and services. Proteus (a startup) and Novartis (a large biopharma) announced programs for “digital pills” or digital therapeutics (aka digiceuticals) with Proteus, gaining FDA approval for this novel class of medicines. These developments point to a broad-based shift in the healthcare sector — a shift towards digital technologies to improve patient outcomes and quality of care. The above developments are taking place at a time when cloud computing and AI/ML technologies have seen significant developments and maturity with increasing adoption in the healthcare field.

¹ (e.g., blood pressure, heart rate, physical activity, sleep)

What is Digital Health

Digital Health is defined as any health-oriented product and/or a service that is based on data and software. It is composed of the following type of products and services:

- 1 Telehealthcare: Infrastructure and connectivity to facilitate remote exchange of clinical data between a patient and their clinician
- 2 mHealth: mobile phone applications relating to health and/or wellbeing and connected wearable devices,
- 3 Health analytics: software solutions and analytical capabilities used to assimilate data with the goal to improve patient outcomes (the field of digital therapeutics is part of this segment), and
- 4 Digital health systems: digital health information storage and exchange of digitized patient medical records.

Key Drivers and Trends

Digital health today is a relatively small market compared to other sectors of healthcare. It brought in around \$100 billion in sales in 2016, but it is projected to rise more than 24% annually.²

The most mature of these segments is Health Systems, which is composed of data management systems such as Electronic Health Record/Electronic Medical Record (EHR/EMR), Electronic Data Interchange (EDI), and Health Information Exchanges (HIE). This segment has already plateaued in growth in the United States

² Digital Health in the UK, An industry study for the Office of Life Sciences, Monitor Deloitte Sep 2015 AND Statistica

and the European Union, as most providers have adopted electronic health records as part of their routine practice. However, as new applications layers and plug-ins develop, we are likely to see a resurgence in this field. Just as the EMR/EHR segment has grown since 2007/8, we are now seeing growth of HIEs and other interoperability solutions that transfer data between systems. All other segments such as telehealth, mhealth, and health analytics are experiencing high single digit to double digit growth rates due to the general shift to digital health.



Startup Example

iCarbonX (Shenzhen, China)

iCarbonX is developing an artificial intelligence platform to facilitate research related to the treatment of diseases, preventive care, and precision nutrition. This approach is considered as an essential element to enable the future development of personalized medicine. It raised \$199 million from China Bridge Capital, Tencent Holdings, and Vcarbion,

Health and Life Sciences Ecosystems to Watch

The map shows the most important global health and life sciences ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on health and life sciences. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive





Sub-Sector Overview Cybersecurity

Co-Author

Omri Baumer

CTO at MassChallenge (Boston)

\$6 trillion

Estimated cyber crime damage costs by 2021.

Fighting cyber crime with Artificial Intelligence

Developments in AI and machine learning are allowing companies to deploy these technologies in cybersecurity. Combined with a shortage of human talent to fight cyber crimes, this means that companies are relying on artificial intelligence to take on and manage the workload.

IoT devices to grow 2x by 2020

Internet of Things devices are expected to grow as much as 2 times over by 2020, requiring new cybersecurity models. From voice-activated home devices, to self-driving cars, to smart city infrastructure, the use of internet-connected devices is growing, opening up the opportunity for new security models

The 2017 Equifax hack affected credit data of over 140 million people, exposing highly sensitive personal and financial information and costing the company \$4 billion in market cap in the first week of breach announcement alone. Spectre and Meltdown, two hardware vulnerabilities in modern processors, were discovered to affect chips by top manufacturers like Intel, AMD, and ARM. Gartner estimated that worldwide spending on cybersecurity products and services were at \$86.4 billion in 2017, and the International Data Corporation expects that spending to grow to \$100 billion by 2020.

In addition, cyber crime damage costs are expected to hit \$6 trillion annually by 2021. Data, especially the kind targeted in the Equifax breach, will be the main target for hacker attacks. Microsoft predicts that by 2020, data volumes online will be 50 times greater than today — and we expect a similarly explosive growth in vulnerabilities to be exploited.

For years, technology has enabled the creation of highly-optimized systems with very high performance. But these systems have grown so complex that they open up unknown vulnerabilities. The very elements that have made our processing chips so fast are also responsible for

the vulnerabilities in Spectre and Meltdown. As Lux Capital's complexity scientist Sam Arbesman lays out in his book, *Overcomplicated*, some of the technology we are creating is literally beyond the limits of human understanding — even of its creators.

This has made cybersecurity not only something IT departments care about, but a core function in many industries and even a geopolitical concern. Think about the North Korean cyber warfare strategy, for instance. From autonomous vehicles to connected home devices to the financial sector, as economies become more digitized, new major challenges and opportunities for startups and ecosystems arise.

What is Cybersecurity?

Cybersecurity is the body of technologies, processes, and practices designed to protect networks, computers, programs, and data from attack, damage, or unauthorized access.

For our purposes it includes application security, information security, network security, disaster recovery / business continuity planning, operational security, and end-user education.

Cybersecurity Global Startup Activity

Startup Output

Global Share of Startups
0.7% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
4.6% Global Startup Growth: 4.5%

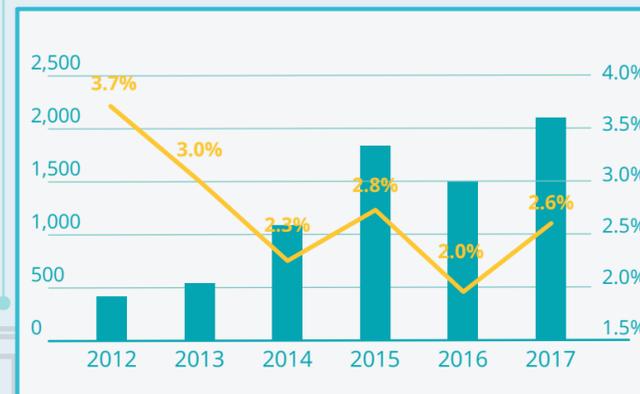
Funding (Excluding ICOs)

Total Funding Value Growth (2012 - 2017)
332% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$600 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$6.5 million Global Median: \$4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding



Exits

Exit Value Growth (2012 - 2017)
96.3% Global Average: 126%

Median Exit Value (2012 - 2017)
\$38 million Global Median: \$30 million

Number of Exits and Global Share of Exits



Key Drivers and Trends

Cybersecurity as core function in industries not previously associated with it. The rising cost and incidence of cyber crimes has made protection against them a core priority in many companies not previously closely engaged with it.

Airbnb acquired the digital identity proofing startup Trooly. In June 2017, Honeywell acquired NextNine, a provider of security management solutions and technologies for industrial cyber security, while Microsoft acquired Hexadite, an Israeli startup that uses AI to identify and protect against attacks. Uber, Docker, Dropbox, Twitter, GoDaddy, and others have founded the Vendor Security Alliance (VSA), a coalition determined to establish cybersecurity standards that businesses can use to assess how secure third-party providers really are.

Cybersecurity Example

Tanium (Emeryville, California, United States)

Tanium is a security and systems management solution that allows real-time data collection at enterprise scale. Tanium Inc. was incorporated in 2004 and is based in Emeryville, California. The company has raised \$406 million in seven funding rounds.

This shift first happened in finance and banking, and we expect cybersecurity to become an even more prominent core banking function. In 2017, for example, Mastercard purchased Brighterion, a software company specializing in AI. Brighterion's technology

delivers greater insights from every transaction to assist in making even more accurate fraud decisions. NASDAQ acquired Sybenetix, a regulatory technology firm. Sybenetix has created software that learns the behavior of people within an organization and can flag any suspicious activity to the attention of compliance teams.

Fighting cyber crime with Artificial Intelligence. Developments in AI and machine learning are allowing companies to deploy these technologies in cybersecurity. Combined with a shortage of human talent to fight cyber crimes, this means that companies are relying on AI to take on and manage the workload. One such company is Booz Allen Hamilton, which is utilizing AI to more efficiently allocate human security resources. AI decreases the number of threats to the firm so that workers can focus their efforts on only the most critical attacks.

In addition, smaller companies that can't afford to bring in large cybersecurity staffs are gravitating to AI, using lower-cost services provided by companies like Trustwave Holdings.

Blockchain-based data storage to protect against breaches. The distributed and cryptographic nature of data recorded in the blockchain opens up the possibility to eliminate the centralized systems that are susceptible to breaches. While still too costly to deploy at scale compared to the centralized systems we use, blockchains are truly a new paradigm with a high potential to shape cybersecurity in the years to come.

The explosive growth in data and processing power opens new cyber threats and opportunities. While Moore's Law no longer holds, according to MIT Tech Review, the processing power of chips and data transmitted on the web continues to grow. Combined with the growth in the digitization of traditional business and economies, the opportunities for cybersecurity startups will continue to grow in hard-to-predict ways.

Cybersecurity Example

Avast Software (Prague, Czech Republic)

Avast Software is a Czech multinational cybersecurity software company that develops antivirus software and internet security services. Avast holds the biggest share of the world market for antivirus applications[3] and its portfolio includes a wide array of security-related products targeting both consumer and corporate markets, such as Avast Antivirus and Avast SecureLine (virtual private network) for Android, Microsoft Windows, iOS and macOS platforms. The company has raised \$100 million in two funding rounds. The company has also made five acquisitions including AVG Technologies in July 2016 for \$1.3 billion.

Internet of Things devices -- with their counterparts in industry and automotive applications -- are expected to grow as much as 2 times over by 2020, requiring new cybersecurity models. From voice-activated home devices to self-driving cars to smart city infrastructure, the use of internet-connected devices is growing. There is a new generation of internet-connected devices that open up the opportunity for new security models — including for privacy,

when many of us are carrying robots in our pockets and homes that are capable to listen in to what we are saying. Estimates suggest we could reach 20 billion to 30 billion connected devices globally by 2020, up from 10 billion to 15 billion devices in 2015.

Auto manufactures, for example, are expected to spend \$80 billion in software in 2020, and grow that to nearly \$170 billion by 2025. Cybersecurity spend by this group is predicted to grow by 25% during the same period, according to analysis by Frost and Sullivan.

In addition, smart cities present a huge market opportunity of \$1.56 trillion. By 2025, 26 smart cities are expected to be established, however, dependence of ICT infrastructure makes the entire sector vulnerable to both malicious attacks and unintentional incidents.

The costs of cyber attacks are growing over 20 percent a year, opening up vulnerabilities. According to Accenture, the global average cost of cybercrime has grown from \$7.7 million in 2015 to \$11.7 million today — with 23% annualized growth. In addition, a major global cyber attack could trigger \$53 billion in economic

Cybersecurity Example

Zscaler (San Jose, California, United States)

Zscaler is a global cloud-based information security company that provides Internet security, web security, next generation firewalls, sandboxing, SSL inspection, antivirus, vulnerability management and granular control of user activity in cloud computing, mobile and Internet of things environments. It provides a cloud-based approach to security as a service. The company has raised \$148 million in two funding rounds.

losses, a figure on par with a catastrophic natural disasters like U.S.' Superstorm Sandy, according to a study of Lloyd's of London.

This has increased the need for new models, like cybersecurity insurance markets — which in turn beget new cybersecurity policies for pricing insurance rates. Companies will spend an estimated \$7.5 billion on cybersecurity insurance in 2020, up from an \$2.5 billion in 2015, according to a recent projection by PricewaterhouseCoopers.

In addition, the rising costs and frequency of attacks has implications for incident response. With all the new alerts coming in and the shortage of talent, companies are creating new, faster, and more effective way to respond to new detected threats These include deception and automation, or collaboration.

Cybersecurity Ecosystems to Watch

The map shows the most important global cybersecurity ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on cybersecurity. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Invest in training and attracting highly qualified talent. As Startup Genome data shows, Cybersecurity founders and their teams are among the most educated and technical compared to other startup sub-sectors.

Lack of skilled labor is severely hindering ecosystems aiming to be cybersecurity-focused. According to a report by Boston Consulting Group, by 2022, the shortfall of cybersecurity professionals is projected to reach 1.8 million people. Meanwhile, Frost & Sullivan put this figure at 1.5 million by 2020.

Investing in traditional STEM programs at the university level and alternative education programs like IBM's P-TECH educational model (Pathways in Technology Early College High School) should be a focus to ecosystems. Similarly, ecosystems should consider programs like Israel Tech Challenge's Cybersecurity Fellows, which trains adults directly with industry experts in their companies.

Focus your cybersecurity efforts on industries where the ecosystem is already strong. According to Accenture, the three industries with highest cybercrime cost are 1) Finance, 2) Energy, and 3) Aerospace and Defense. Focusing the startup communities cybersecurity efforts around existing local industries like finance in Frankfurt, for example, and energy in Houston will give local startups an edge in this sub-sector.

Become an ecosystem anchor tenant. Many successful startup ecosystems are able to thrive because of a strong, local anchor tenant. Anchor tenants are major institutions that serve as local hubs for knowledge creation and talent -- bringing people to the ecosystem, training them, and releasing them in the community. Silicon Valley had both defense labs and radio transistor companies to fuel its early days. Tel Aviv counts on one of the world's most sophisticated militaries. Seattle has Microsoft, and now Amazon, for decades bringing in and training top talent.

Anchor tenants can be either public or private, for-profit (like companies) or non-profit (like universities). Cybersecurity has the distinction of being a sub-sector where the government, local or national, can be an anchor tenant.



Sub-Sector Overview

Cleantech

Rising global energy demand

By 2040, global energy consumption is projected to increase by 28% according to EIA (U.S. Energy Information Administration). This growth will be driven mostly by developing Asia (especially China and India) and other regions like Africa, the Middle East, and South America.

Big Green Opportunity

The Big Green opportunity did not manifest in numbers, yet. After an exceptional 2011, Cleantech VC funding has remained consistent by measure of value and deals, hovering around \$5 billion. Cleantech has produced only three unicorns to date.

Decentralization

Declining costs have pushed the implementation of new energy production and distribution technologies, garnering substantial interest from users and policymakers. New grid edge technologies could unlock value of more than \$2.4 trillion over the next 10 years.

Venture capitalists have been cautious with Cleantech investments since the bust of 2012. However, with increasing realization about global warming and climate change, various stakeholders are stepping up efforts to bring about a green change by promoting Cleantech.

In 2007, renowned venture capitalist John Doerr predicted, “Green technologies—going green—is bigger than the internet. It could be the biggest economic opportunity of the 21st century.”¹ VC investment rose by several billion dollars in the span of just two years², and with oil prices surging, there was near-universal agreement that Cleantech was the next big thing. The road to the Cleantech future, however, hit a rut. Since 2011 — a record year for VC investment into the sub-sector — low oil prices, cheap natural gas, lower than expected venture returns, and other factors have dampened the fever.

Nevertheless, Cleantech remains not only important for governments and companies but also a potential growth area. In 2014, even amidst the Cleantech bust, the World Bank pegged the total Cleantech opportunity at \$6.4 trillion in developing countries, including \$1.6 trillion for SMEs.³ Because global energy demand is projected to continue growing while

climate change remains a concern, the entrepreneurial opportunity in Cleantech remains. It may just take a bit longer for that Cleantech future to develop.

What is Cleantech?

Cleantech or clean technology is an umbrella term which is used to define technologies which optimize the use of natural resources, produce energy from renewable sources, increase efficiency and productivity, generate less waste and cause less environmental pollution. Cleantech is comprised of sustainable solutions in the fields of energy, water, transportation, agriculture and manufacturing, including advanced material, smart grids, water treatment, efficient energy storage and distributed energy systems.

- 1 TED - Salvation (and profit) in greentech, May 2007 (https://www.ted.com/talks/john_doerr_sees_salvation_and_profit_in_greentech/transcript)
- 2 Wired story: https://www.wired.com/2012/01/ff_solyndra/.
- 3 Opportunity for 10 year timeframe starting 2014 | Source: World Bank - New Report Identifies Major Clean-Tech Market Opportunity for Small Businesses in Developing Countries, Sep 24, 2014 (<http://www.worldbank.org/en/news/feature/2014/09/24/new-report-identifies-major-clean-tech-market-opportunity-for-small-businesses-in-developing-countries>)

Cleantech Global Startup Activity

Startup Output

Global Share of Startups

2.1% Global Average: 4.3%

Startup Growth (2008-2016 annual average)

-9.7% Global Startup Growth: 4.5%

Funding

Total Funding Value Growth (2012 - 2017)

147% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)

\$389 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)

\$4.3 million Global Median: \$4.7 million

Exits

Exit Value Growth (2012 - 2017)

491% Global Average: 126%

Median Exit Value (2012 - 2017)

\$37.6 million Global Median: \$30 million



Key Drivers and Trends

Increasing commitments for Cleantech investment. In recognition of the global importance of Cleantech, investments — or, at least, commitments to invest — are rising from public and private organizations. National governments all over the world have reaffirmed their commitments to Cleantech and announced new investment plans, especially China. In 2017, Clean Energy Investment in China was 14% higher than the total Clean than those of the U.S., Japan, Germany, India and UK combined¹. While the U.S. Federal government is currently dismantling its Environmental Protection Agency, several state have come together in the U.S. Climate Alliance to work toward positive environmental targets. In emerging market countries, the International Finance Corporation, an arm of the World Bank, estimates that the Paris Agreement has created nearly \$23 trillion in opportunities for climate-smart investments by 2030². To jumpstart this, the World Bank set up a \$5.8 billion Clean Technology Fund to help scale low-carbon technologies.

High-profile individuals are also putting their money and influence into Cleantech. Breakthrough Energy Ventures, backed by Doerr, Bill Gates, Jeff Bezos, Vinod Khosla, Jack Ma, and 15 others plans to invest \$1 billion over the next 20 years in Clean energy. In 2016, the Oil and Gas Climate Initiative (OGCI), a group of ten large oil and gas companies, announced plans to invest \$1 billion in technologies to reduce carbon emissions.

Declining cost and increasing adoption of renewables. Renewable energy, in various forms, is the fastest-growing energy source in the world. And, according to the U.S. Energy Information Administration, renewables usage is expected to grow by 2.3% per

year to 2040³. Falling costs mean that some forms of renewable energy are now able to compete with traditional energy sources without public subsidy. Within only a few years, the International Renewable Energy Agency projects that electricity costs from renewable sources will be “consistently cheaper” than from fossil fuel sources⁴. Battery-based energy storage will play a major role in the coming years to mitigate the intermittent nature of some renewable energy sources.

Startup Example

Kite Power Systems (Glasgow, Scotland)

Kite Power Solutions (KPS) is developing a disruptive technology to produce renewable energy from the wind. The founders believe that kites offer untapped opportunities to harness winds high above the earth and generate electricity at a lower cost than wind turbines. KPS has received funding from the UK Department of Energy and Climate Change (DECC) Energy Entrepreneurs Fund (EEF) and other private sector funders including Shell, E.ON, Schlumberger, and Innovate UK, among others.

Convergence of energy and internet of things (IoT). Sensors in sewers, sensors in pavement, advanced materials in windows and construction — Cleantech growth is converging with advances in the Internet of Things (IoT), creating new opportunities in the design of “smart cities” all over the world. Rising urbanization and efforts to reduce carbon emissions are pushing stakeholders to look for solutions which can help reduce energy consumption. Increasingly, this is enabled by digital technology.

¹ <https://www.bloomberg.com/news/articles/2018-01-16/china-s-hunger-for-solar-boosts-clean-energy-funding-near-record>

² IFC - Climate Investment Opportunities Total \$23T in Emerging Markets by 2030, 7 Nov 2016

³ EIA - International Energy Outlook 2017 (<https://www.eia.gov/outlooks/ieo/>)

⁴ IRENA - Renewable Power Generation Costs in 2017 (<http://www.irena.org/publications/2018/Jan/Renewable-power-generation-costs-in-2017>)

The convergence of these political and technological trends creates a double-sided opportunity for startups and investors. Digital innovations drive widespread deployment of IoT technology in connecting homes, offices, and industries with public infrastructure, improving services, and allowing better energy management across an urban area. At the same time, the new smart city infrastructure will create growth in energy demand, necessitating further innovation and investment in Cleantech. The two areas, Cleantech and IoT, thereby reinforce each other and help create multiple entrepreneurial opportunities.

Startup Example

Totem Power (New York, United States)

Totem Power is a distributed energy storage product that includes expansive smart city functionality. The platform combines solar energy and energy storage, Wi-Fi and 4G communications, electric vehicle charging, and smart lighting into a single, powerful product that weaves these capabilities directly into the built environment. It creates new opportunities for placements in cities, communities, and enterprises, where they deliver on the promise of smart utility.

Decentralization and Digitization. Decentralization of power grids will also be a prominent feature of future energy markets. Declining costs of distributed energy resources (DERs)⁵ have enabled installation of energy production, efficiencies, and storage technologies at the consumer and local levels. These technologies open

5 Distributed energy, also district or decentralized energy is generated or stored by a variety of small, grid-connected devices referred to as distributed energy resources (DER) or distributed energy resource systems. (Source: Maryland Clean Energy Centre)

up an entirely new front for both startups and incumbent energy firms.

According to research by the World Economic Forum (WEF), new grid edge technologies⁶ could unlock value of more than \$2.4 trillion over the next 10 years⁷. Major utility players have been acquiring and investing to compete in the changing market. Utility investment in DERs has increased substantially, from roughly \$200 million in 2012 to \$1 billion in 2016, according to Greentech Media⁸.

Exelon, the Chicago-based energy company, has been one of the most active investors on this front and has a dedicated venture fund called Constellation Technology Ventures. The fund has 15 active investments with 13 of them in grid-edge technologies. Major investments include Bidgely, an energy monitoring and management solution for energy saving, and PosiGen, provider of residential renewable energy and energy efficiency solutions.

Blockchain, which has rapidly gained support across various organizations and industries, is set to revolutionize the energy sector as well. According to various experts, blockchain technology can overcome issues like red tape and data management issues that the energy sector faces. While the adoption and usage of blockchain may be minimal during the initial years, over time it has the capability to completely automate how all buildings buy and sell power to and from the power grids based on real-time pricing.

6 Grid-edge refers to the varying hardware, software and business innovations that are increasingly enabling smart, connected infrastructure to be installed at or near the "edge" of the electric power grid. (Source: World Economic Forum)

7 WEF - The Future of Electricity: New Technologies Transforming the Grid Edge, March 2017

8 GTM - Utility Investments in Distributed Energy: Trends Among North American and European Utilities, Mar 2017

Stalled VC investment in Cleantech Sector. Cleantech funding has declined since the highs of 2011. According to a Brookings

Startup Example

Terramera (Vancouver, Canada)

Terramera is developing high-performance plant-based alternatives to conventional chemical pesticides, to make organic farming cheaper and more productive. The Vancouver-based Cleantech company has raised \$22 million to date, and is a founding member of the British Columbia-led Digital Technology Supercluster.

Institution analysis, VC funding fell in the United States by 30% from \$7.5 billion in 2011 to \$5.2 billion in 2016. The number of deals fell from 649 in 2011 to 455 in 2016⁹. In terms of share of all VC funding, Cleantech more than halved, from 16.8% in 2011 to 7.6% in 2016. Although 2011 was an exceptional year in terms of Cleantech VC funding, the value of deals has remained consistent during 2012 to 2016, hovering around \$5 billion.

Why the decline in funding? Over the last few years, cheaper natural gas and oil, and poor returns (when compared to other sectors like software) have made Cleantech less attractive for venture investors. Venture capitalists prefer investments which offer high and quick scalability — and large payoffs. Cleantech, in this regard, is not yet a sector which offers these capabilities. According to an MIT working paper published in 2016, during the time frame 2006-2011, Cleantech companies were far behind software and

9 Brookings - Clean energy's shifting reality: Venture capital recedes, but what's next?, 30 May 2017

Medtech sectors in terms of returns, and farther ahead in likelihood of failure¹⁰.

The United States, the largest VC market, saw Cleantech patent activity fall from 2014 to 2016, according to research by the Brookings Institution¹¹. Consequently, in its annual ranking of Renewable Energy Country Attractiveness Index, Ernst & Young placed the United States third behind China and India¹². In the previous four rankings, the United States was placed first in attractiveness.

High (profile) failure. In other technology sub-sectors, there are dozens of unicorns: startups with billion-dollar valuations. These act as beacons, attracting talent and investment and buzz, and are the vanguard of acquisition or public offering. In Fintech, for example, there are over two dozen unicorns. There are three dozen in eCommerce, over 20 in Healthtech, and over 30 in Internet Software and Services.

In Cleantech there are three unicorns: Rubicon Global, Bloom Energy, and ReNew Energy . Cleantech also suffers from a dearth of major IPOs. At the same time, several high-profile failures have plagued Cleantech. Photovoltaic system manufacturer Solyndra, which received government subsidies, went bankrupt despite raising more than \$1 billion. Solar cell technology developer Abound Solar raised more than \$600 million and subsequently failed. KiOR, a biomass startup, filed for bankruptcy after launching an IPO which valued the firm at more than \$1.5 billion.

A high likelihood of failure in Cleantech — as noted by the MIT report — can be attributed to a long product development cycle, costly prototyping, and capital-intensive scaling requirements. The withdrawal of some incumbent companies has also hurt growth. In 2016, for example, Houston-based Cleantech accelerator Surge Ventures closed its operations, citing lack of industry backing and loss of tech talent in the city as the major reasons.

Startup Example

Upside Energy (Northwich, United Kingdom)

Founded in 2013, Upside Energy reduces greenhouse gases by enabling people to make smart choices about when to use energy through its AI. The company has developed a cloud service that aggregates energy stored in systems already owned by people and businesses to create a virtual energy store. This is then used to sell back to the grid and help balance the demand and supply. The company shares revenue from these services with device owners and manufacturers. The company has raised \$6 million from investors like Legal & General, SYSTEMIQ and Bulldog Innovation Group.

¹⁰ Venture Capital and Cleantech: The Wrong Model for Clean Energy Innovation, July 2016

¹¹ Brookings - Patenting invention: Clean energy innovation trends and priorities for the Trump administration and Congress, 26 April 2017

¹² EY - Renewable energy country attractiveness index (<http://www.ey.com/gl/en/industries/power---utilities/ey-renewable-energy-country-attractiveness-index-our-index>)

Cleantech Ecosystems to Watch

The map shows the most important global Cleantech ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on Cleantech. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Of all the sub-sectors we have analyzed, Cleantech presents perhaps the most difficult mixture of politics, economics, and idealism. Urgent action is needed, but incentives for urgency are lacking. Cleantech startups are key to a greener global future, but they need support in navigating the political and economic hurdles.

Open up public resources to startup innovation. Startups in the Cleantech sector need access to much wider and capital extensive resources than startups in most other sectors. Allowing innovators access to city-level infrastructure, assets, and data to test and pilot their innovations could provide a huge boost to startups in the sector. Smart city initiatives also represents a huge opportunity for city-level policymakers to work with entrepreneurs and deploy their solutions.

Create space for collaboration. Government and industry players need to collaborate with universities and research labs to support startups and help with financing of new innovations and technologies. In Canada, Sustainable Development Technology Canada (SDTC) is an example worth noting. It is an “arm’s length foundation” (independent from universities) for development and demonstration of Cleantech technologies. These technologies are developed through partnership with government, private industry and academia and are funded by SDTC on behalf of the government of Canada.

Develop long-term policies incentivizing innovation. Despite improvements in the economics of renewable energy generation, much progress still depends on political action, whether in the form of subsidies, a carbon tax, or something else. Stable and enabling public policy environments are a prerequisite for development of the Cleantech cluster in any ecosystem. Various stakeholders in the innovation cycle need long-term policies and outlook of how the policies will develop to help them make the best decisions on investments and product development.

Expanding the funding base. More cost competitiveness among renewables seems not to have made Cleantech a reliable source of venture investment returns because of long development timelines that are, for now at least, unavoidable. Additional sources of funding may be necessary. Players like pension funds, institutional investors, family offices, and sovereign wealth funds might be incentivized to invest, due to their ability to tolerate a longer arch of returns. Policymakers also need to encourage corporations to be financially, as well as strategically, involved in the Cleantech startup ecosystem.



Sub-Sector Overview

Edtech

Co-Author

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Co-Founder, HolonIQ

\$250 billion

Global spending on technology is forecast to grow to \$250 billion by 2025.¹ Over \$4 billion is currently being invested each year in edtech to capture the opportunity.²

China Dominates

In 2017, China represented over half of global Edtech startup investment. China delivers fewer but much larger deals focussing on K12 and language learning.

AI enters the Classroom

Having moved beyond powering efficiency, AI is making its way into core learning processes. Whilst AI is unlikely to replace the role of the teacher in the short term, there is huge potential for personalisation and learning support.

While education underpins economic, social and financial prosperity for every country in the world, it is arguably one of the last sectors to innovate through technology. At the same time, experts predict 1 billion additional students worldwide by 2050,¹ driven by population growth (in emerging economies in particular), increased participation in education, longer time at school and an increased need for reskilling due to labor market shifts.

Global education expenditure is projected to grow at 8 percent annually to \$8 trillion by 2020.² Despite this sizable investment, current education models and incumbent systems are unlikely to be able to service the future global demand for education. In the 10 years to 2025 education technology expenditure is projected to grow at 17 percent per year to \$250 billion.³ The growth rates we are likely to see as a result are incredible. Spending on technology at the elementary and secondary levels is growing at 30%, 20% in higher education and 10% in corporate training.⁴

Several themes underpin the EdTech sector and its growth. Technology, bandwidth and immersive devices are enabling much greater access to learning resources. There is a massive fragmentation of content around the world, much of which is very similar and aimed at the same learning

outcomes. Internationalization of education and the workplace is concentrating curricula around globally trusted brands and certificates. There is a growing focus on “return on investment” and workforce training, exacerbated by labor skills shortages, the need for job preparation, re-skilling, and continued professional development. In emerging markets, credentials for employment and career progression have particular salience.

What is Education Tech?

Education Technology, or EdTech, generally describes the digitization of education services and business models. For some, EdTech translates into a landscape of software providers or vendors delivering technology solutions to schools at all levels. For others, EdTech captures new and emerging models of delivering better and smarter learning.

1 IBIS Capital - <https://www.prnewswire.com/news-releases/global-report-predicts-edtech-spend-to-reach-252bn-by-2020-580765301.html>

2 Techcrunch - <https://beta.techcrunch.com/2017/09/22/forget-what-youve-been-told-about-edtech/>

1 UNESCO - <https://en.unesco.org/news/global-learning-crisis-costing-129-billion-year>

2 IBIS Capital

3 IBIS Capital

4 IBIS Capital

Edtech Global Startup Activity

Startup Output

Global Share of Startups
2.8% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
7.4% Global Startup Growth: 4.5%

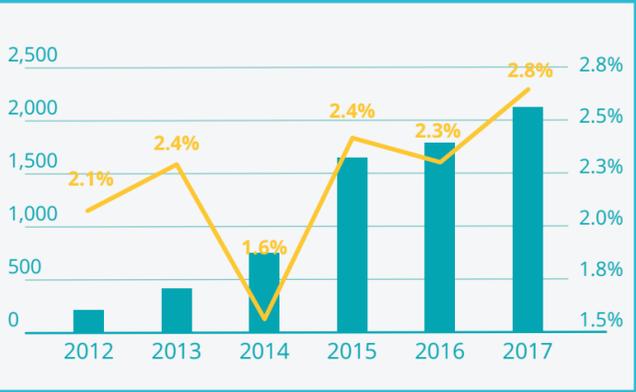
Funding (Excluding ICOs)

Total Funding Value Growth (2012 - 2017)
291% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$320 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$4.1 million Global Median: \$4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

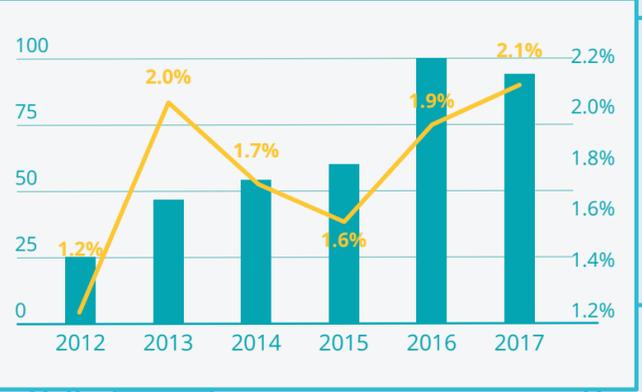


Exits

Exit Value Growth (2012 - 2017)
462% Global Average: 126%

Median Exit Value (2012 - 2017)
\$30.2 million Global Median: \$30 million

Number of Exits and Global Share of Exits



■ Number of Exits
 ■ Global Share of Exits



Key Drivers and Trends

When rising demand and expensive supply meet growing dissatisfaction and technological potential, it usually means an area is ripe for startup disruption. This is precisely what is happening in the education sector across the world.

The global middle class is exploding, particularly in emerging economies—in Asia alone, the middle class will number three billion by 2030.¹ With greater affluence comes greater demand for education. Yet it isn't clear if current educational systems can meet this demand: UNESCO predicts that by 2025, 98 million qualified students worldwide will be excluded from higher education due to a shortage of university seats.

Even if there were places available for these students, many will not be able to afford it: the rising cost of education has become a matter of heated debate in many countries. In the United States, increases in university tuition have outpaced nearly every other category of consumer spending, including some areas of health care. Since 1997, college tuition has risen nearly 200 percent fueling startups focused on student loans.²

At the same time, many are anxious about the changing nature of work, the potential threat posed by automation, and the new skills required to succeed. This has generated growing dissatisfaction with current educational offerings, as schools across the spectrum rush to figure out how to prepare students for the emerging new world of work. This, of course, presents an opportunity for educational providers, as millions of people will also seek new training.

¹ OECD - http://oecdobserver.org/news/fullstory.php/aid/3681/An_emerging_middle_class.html

² Data.gov - <https://catalog.data.gov/dataset/college-scorecard>

New delivery models will need to be invented, and this is where technological potential comes in.

Bootcamps and massive open online courses (MOOCs) are by now well-known, and their associated organizations are entering the corporate training market and partnering with existing educational institutions. Meanwhile, large technology companies such as Google, Apple, Amazon, and Microsoft are trying to figure out how they can capitalize on the intersection of education and technology. And, in every part of the education market, startups are behind the move to mobile, social, personalized, and gamified learning. Through these channels, technology promises to overall every part of education.

One device per student. There are nearly 60 million students enrolled in primary and secondary schools in the United States (both public and private), and over 20 million Chromebooks are used each week by teachers and students in U.S. schools.³ Thirty million of those students use at least one of Google's apps for educational purposes. In all advanced economies, driven by online testing mandates and government policy, schools are moving rapidly toward a day of 1:1, one device per student.

An explosion of online learning content, lower-cost devices, and increasing connectivity has fueled the rapid shift toward 1:1. However, while 95 percent of schools in the US are connected to the Internet, only 20 percent of them have enough bandwidth to handle the streaming demands of media-rich, 1:1 learning. In developing economies, connectivity is improving and mobile only

³ NYT - <https://www.nytimes.com/2017/05/13/technology/google-education-chrome-books-schools.html>

Startup Example

Byju (Bangalore, India)

Byju's is India's leading provider of supplemental school curriculum classes for Class 6-12 & Test Prep Training with over 10 million students. India has the largest K-12 education system in the world and BYJU, one of the largest EdTech companies in the world, believes technology can help address common challenge in Indian schools: poor student outcomes, low access to good teachers, and an over-emphasis on exams.

or first applications are growing explosively with the global middle class population.

From Learning to Work—The Pathway to Employment. Education is increasingly under pressure to remain relevant and provide evidence of impact, especially by ensuring learners have skills for careers of the twenty-first century. However traditional internship, work experience and placement models are not scalable. Hence we are seeing a surge in “learning to work” solutions.

As education becomes even further attuned to fulfilling future workforce skills needs and consumer interest for “just in time, just enough, just for me” training, the ability for learners to maintain a personal, persistent and alternative means of recognizing their skills has created demand for alternative credentialing models and technologies. Blockchain technology is increasingly being used to support alternative credentialing solutions.

Social Learning: technology enabling more human connection.

Despite software's rapid penetration into education, educators, parents, and mentors remain at the heart of the learning process. To be successful, platforms must help facilitate more meaningful connections between people with varied goals like increasing social capital and learning to read. One of the most unique and

Startup Example

Udacity (Silicon Valley, United States)

Udacity is one of the few unicorns in EdTech, and part of a massive trend to find new ways of helping people develop market-ready skills in high demand technologies. A degree or certificate may tell an employer about your education, but it won't necessarily highlight your specific skills. Udacity is leading the rise of “microcredentials,” namely nanodegrees and digital badges, that aim to do just that. Students conduct part-time, mentor led online study over 12 weeks and receive dedicated support to find a job with employers looking for these specific skills.

promising characteristics of technology is its ability to transcend physical boundaries and expand a learner's circle of supporters. Smart education technologies recognize that human emotion is tightly bound to the learning process, and the best tools are built around this reality.

AI: Augmenting Human Learning with Machine Learning. Artificial intelligence is here. Students are already using it with homework help apps and more AI-assisted products will be supercharging teachers very soon. The most powerful AI tools improve on

existing human processes and make workflows more efficient. The need for automation is more acute with large class sizes when the assessment and feedback demands on educators are heavy. As a result, higher-ed institutions have been early adopters of AI-assisted tools.

Startup Example

VIPKID (Beijing, China)

Tackling the tutoring market in China, VIPKids has built a popular platform connecting children ages 5-12 with native English speakers for one-to-one online language lessons. Upwardly mobile parents want their children to learn English with native speakers, and there just aren't enough English teachers of that kind to go around in the country. VIPKids has half a million registered students in China and around 3,000 instructors on its platform. Instructors are based mainly in the United States, but also Canada, Mexico, the United Kingdom, Germany, Italy, Spain, Costa Rica, Dominican Republic, and East and Southeast Asia.

Startup Example

Liulishuo (Shanghai, China)

With its AI English teachers, Liulishuo uses artificial intelligence to assess a student's English-speaking ability and analyze their learning needs in order to create a tailor-made online teaching program. Liulishuo or ‘Lingo Champ’ offer a personalized and adaptive language learning experience to 50 million learners in over 150 countries around the world.

Edtech Ecosystems to Watch

The map shows the most important global Edtech ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on Edtech. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

EdTech is a complex and challenging startup sub-sector. Diverse stakeholders, fragmented decision making and principally government funded customers with economically unsustainable business models make getting started incredibly challenging.

Connect with education, build access networks. Thriving Edtech ecosystems all feature deep connectivity to the incumbent education system. Innovative and supportive universities, school systems, students, teachers and administrators are all key stakeholders. Access to users is challenging given education's 'gatekeeper' model and the sensitive nature of the data. Decision making on the customer side is fragmented because Edtech users (teachers and students) are not the buyers (administrators, policymakers). This can make traction difficult, as can long sales cycles that are inherent in dealing with publicly-run systems.

Crowdsource problems from institutions and teachers. Despite the bifurcation of user and customer, teachers and institution leaders can be engaged in identifying problems that need solving. Some organizations, like Teach for America, are also helping teachers become entrepreneurs. This type of "user entrepreneurship" has been successful in other sub-sectors and can be powerful in an area like education.

Educate government and policymakers. Education is a public policy-laden sector, so the regulatory environment is a big determining factor in whether Edtech innovations can make their way into the market. Including public leaders in conversations about problems and solutions (with educators) may help create alignment and a shared desire to adopt new innovations.

Find the right investors, educate the rest. The right investor can make a huge difference for Edtech startups. With long sales cycles and fragmented markets, patient investors are needed as well as those who are interested in mission-oriented investing. The expectations of investors should be adjusted correctly so that support does not diminish.

"The potential of an EdTech ecosystem cannot alone be measured by deal volume, capital, monthly active users or quarterly cash flow. Instead, we must bring metrics that center around learner impact. Innovation in education is about fundamentally changing the way students learn. The challenge for 'scaling' in EdTech is not fundamentally about new technology. The change is about people: teachers, faculty members, students, parents and community members alike. Building EdTech ecosystems requires understanding its unique attributes, and scaling not based on the perceived profit opportunity but because it's an opportunity to impact a public good that transforms people's lives."

Patrick Brothers

Co-Founder, HolonIQ



Sub-Sector Overview

Gaming

\$3.6 billion

Global VC funding in Gaming reached \$3.6 billion in 2017, growing at a CAGR of 21% since 2012. The average funding size during the period has increased by more than four times to more than \$9 million.

Mobile Gaming

Mobile gaming overtakes console and PC gaming to become the largest segment. In 2017, mobile gaming revenues stood at \$50.4 billion, followed by console gaming with \$33.3 billion and PC gaming with \$32.3 billion.

eSports

eSports is one of the fastest growing segments. The segment revenues are supposed to reach between \$1.5 billion to \$2.4 billion in 2020 from \$498 million in 2016. It is gaining recognition around the world and will be one of the medal events at the 2022 Asian Games in China.

During the last few years, the gaming industry has gone through drastic changes. Smartphone gaming, which was non-existent some time back, has now overtaken console and PC gaming.

An interesting example is Pokemon Go: Pokemon Go was launched in July 2016 in the US, Australia, and New Zealand, and within 14 hours became the top grossing app in the App Store beating all the previous records.¹ On some days, smartphone users spent more time on the game than any other game and app including Facebook, Instagram, and Snapchat.² The game helped its partners and promoters in multiple ways: thanks to the partnership with Pokemon Go, McDonald's Japan was able to post a profit for the first time in 2 years while Nintendo's³ share price grew by more than 200 percent.

The game developer Niantic Labs started as an internal startup within Google Labs. It was spun off after Google's restructuring as Alphabet Inc. During the spinoff, Google, Nintendo and the Pokemon Company invested around \$30 million in the company. Trying to carry on the success of

Pokemon Go, the company announced plans to launch AR based Harry Potter and raised \$200 million for its development, valuing the company at more than \$3 billion.

While PC and console gaming has been present for a while, it is mobile gaming which has revolutionized the gaming industry completely. Gamers universe has expanded, and gaming is moving beyond traditional gamers to casual gamers, who form the majority of users now. Google Play and iOS, both have games as the #1 category in terms of worldwide downloads and worldwide revenues, ranking above categories like social networks, music, books, lifestyle, entertainment, etc.⁴ In 2016, games generated 75 percent of iOS App Store revenue, and 90 percent of Google Play revenue.⁵

What is Gaming?

According to TechTarget, Gaming is the running of specialized applications known as electronic games or video games on game consoles like Xbox and PlayStation or on personal computers or mobile phones.

- 1 Quartz - Pokémon Go is making \$1.6 million each day in the US from iOS users paying for silly virtual goods (<https://qz.com/729935/pokemon-go-is-making-1-6-million-each-day-in-the-us-from-ios-users-paying-for-silly-virtual-goods/>)
- 2 SensorTower - Mobile Users Are Spending More Time in Pokémon GO Than Facebook (<https://sensortower.com/blog/pokemon-go-usage-data>)
- 3 which owns a small stake in The Pokemon Company, which licenses its intellectual property to game developer Niantic

- 4 AppAnnie - 2017 Retrospective: A Monumental Year for the App Economy (<https://www.appannie.com/en/insights/market-data/app-annie-2017-retrospective/>)
- 5 AppAnnie - How Gaming Apps Drove App Revenue in 2016, 1 March 2017 (<https://www.appannie.com/en/insights/market-data/gaming-apps-maintain-revenue-stronghold/>)

Gaming Global Startup Activity

Startup Output

Global Share of Startups
4.7% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
-4.2% Global Startup Growth: 4.5%

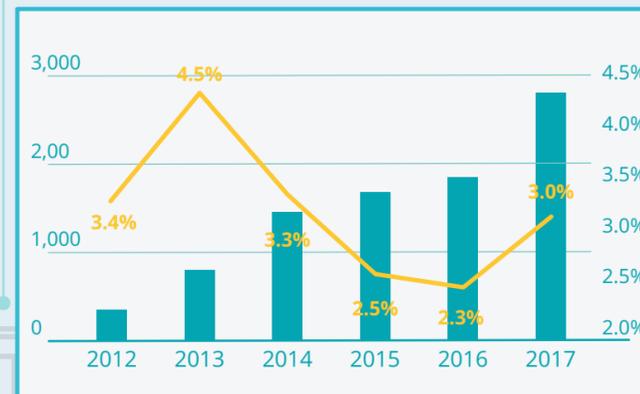
Funding (Excluding ICOs)

Total Funding Value Growth (2012 - 2017)
225% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$350 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$4.1 million Global Median: 4.7 million

Series B+ Funding Value (\$B) and Global Share of Funding

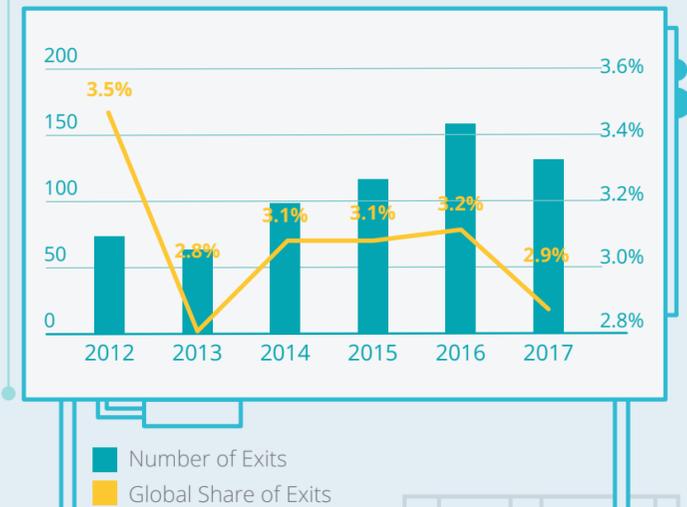


Exits

Exit Value Growth (2012 - 2017)
142% Global Average: 126%

Median Exit Value (2012 - 2017)
\$30 million Global Median: \$30 million

Number of Exits and Global Share of Exits



Key Drivers and Trends

According to Newzoo, a gaming industry market research firm, global gaming software revenues were estimated at \$116 billion in 2017, up 10.7 percent year on year compared to 2016. The industry growth is driven by smartphone gaming boom, which is gaining market share quickly and also driving the overall industry.



Going forward the overall gaming market is expected to reach \$143.5 billion by 2020, growing at a CAGR of 8.2 percent from \$104.8 billion in 2016. By then, mobile gaming is expected to contribute more than 50 percent of the total gaming revenues.¹

In terms of geographic markets, China and US are the major market contributing \$32.5 billion and \$25.4 billion respectively. Asia-Pacific, as a whole, is expected to contribute \$57.4 billion or 50 percent of all consumer spend on gaming.

1 Newzoo - New Gaming Boom: Newzoo Ups Its 2017 Global Games Market Estimate To \$116.0bn Growing To \$143.5bn In 2020 (<https://newzoo.com/insights/articles/new-gaming-boom-newzoo-ups-its-2017-global-games-market-estimate-to-116-0bn-growing-to-143-5bn-in-2020/>)

Mobile gaming overtakes console and PC gaming

In 2017, mobile gaming was the biggest segment with \$50.4 billion, overtaking console gaming (\$33.3 billion) and PC gaming (\$32.3 billion).²

Traditional video games catered to a smaller population as there is substantial cost attached to investing in consoles and/or PCs and gaming titles. Mobile games, thanks to ubiquity of smartphones, are available to everyone. They also have multiple sources of revenue - game purchase, in-app purchases, advertisements, and subscription based models, etc. While the average revenue per user is limited in these models, the smartphone penetration gives access to a huge number of users which cannot be captured by PC or consoles.

Mobile gaming field has also provided a huge opportunity to start-ups to compete and win. Most successful smartphone games have actually been from startups and not traditional major gaming studios.

To stay relevant in the mobile gaming boom, traditional console players have been investing, acquiring and working with smaller gaming studios. Ubisoft, for example, acquired Blue Mammoth Games in Mar 2018, 1492 Studio in Feb 2017, Ketchapp in Sep 2016, among others. The company also partnered with newly established Station F in Paris to lead the Gaming & Entertainment program and lend its expertise to startups in this space. Other major gaming giants like Electronic Arts, Activision Blizzard and

2 Newzoo - New Gaming Boom: Newzoo Ups Its 2017 Global Games Market Estimate To \$116.0bn Growing To \$143.5bn In 2020 (<https://newzoo.com/insights/articles/new-gaming-boom-newzoo-ups-its-2017-global-games-market-estimate-to-116-0bn-growing-to-143-5bn-in-2020/>)

Take-Two Interactive have followed similar pattern and partnered and/or invested in mobile gaming startups.

eSports has seen one of the most spectacular rises in the media and gaming industry over the last few years. It has impacted not only the professional gamers but also the viewers, advertisers and service providers, becoming an industry on its own. So much so that in 2016, YouTube gaming content (517 million) and Amazon Twitch (185 million) viewers were much higher than HBO (134 million), Netflix (93 million) and ESPN (90 million) subscribers. Also, each member of winning team at 2016 The International, an annual Dota 2 eSports tournament, won \$1.83 million, more than the amount \$1.8 million won by Dustin Johnson at US Open 2016 golf tournament.

eSports revenues, which includes media rights, advertising, sponsorship, merchandize, tickets and game publishing fees, etc., could reach \$1.5 billion to \$2.4 billion in 2020 from \$498 million in 2016, depending how these factors play out. The rise and mainstream recognition of eSports can be reinforced by the fact that it will be a medal event at the 2022 Asian Games. It might not be wrong to say that this is just the beginning for eSports.

AR/VR/MR—next generation gaming. Games like Pokemon Go have paved the way for the next generation gaming with Augmented Reality foraying into the gaming industry. Since its release many new games have come up based on the AR technology. Similarly, Virtual Reality (VR) and Mixed Reality (MR) are also set for disrupting the gaming industry. Although, there have not been any major hits

as of now, we can expect gaming studios to churn out a number of VR/MR/AR games. Over the next five years, AR and VR are expected to grow substantially, AR could represent upto \$90 billion in revenues while VR could represent \$15 billion³ in revenues. Majority of these revenues are expected to be driven by the gaming studios across the world.

Startup Example

Improbable (London, United Kingdom)

Improbable is a London-based startup that develops distributed simulation software for video games and corporate use. The company has created SpatialOS, a computation platform that enables the creation of massive simulations and virtual worlds for use in video games and corporate simulations. The company has raised \$554 million in its four funding rounds.

Gaming studios expanding into entertainment companies.

Gaming studios are also evolving beyond just gaming enterprises and developing into complete entertainment companies. They are turning the games into full entertainment franchises including movies, cartoon series, web series etc. Gaming companies excel at interactive entertainment and tend to gather relatively strong fan following.

Ubisoft transformed Assassin's Creed franchise in comic books and a movie. Ubisoft utilized Lapins Crétins (Raving Rabbids) for a TV series, merchandise, comic books, VR-based amusement park

ride, and automobile publicity for Renault. Ubisoft also created its own comic book publishing house, Les Deux Royaumes, to transpose video game titles to comic books and its own film production company, Ubisoft Motion Pictures. After the grand success of Angry Birds, Rovio expanded the game into cartoon series (Angry Birds Toons, Angry Birds Stella, Piggy Tales), a feature film (most suc-

Startup Example

MZ (Silicon Valley, United States)

MZ, previously known as Machine Zone, develops Realtime™ technologies, leveraging real-time data streams to enable real-time messaging and analytics. The company is best known for its freemium mobile MMO strategy games Game of War: Fire Age and Mobile Strike, The company has raised \$263 million in five funding rounds.

cessful Finnish movie of all time despite getting negative reviews), merchandize like Toys, and amusement parks. Seriously Digital Entertainment is set to follow Rovio's footsteps and plan to turn the game into TV shows and movies.

China emerges as the biggest gaming ecosystem in the world.

China has world's largest smartphone users (three times than the U.S.) and internet users (more than two times than the U.S).⁴ As already discussed, China ranks above every other country in terms of gaming revenues.

China is big not only in terms of consumers but also producers.

⁴ <https://www.internetworldstats.com/top20.htm>

³ Ubiquitous \$90 billion AR to dominate focused \$15 billion VR by 2022, Digi Capital, January 2018 (<https://www.digi-capital.com/news/2018/01/ubiquitous-90-billion-ar-to-dominate-focused-15-billion-vr-by-2022/#.WnRC-KiWbIU>)

China-based Tencent (#1) and NetEase (#6) are among the top ten biggest video game companies in the world. Although, most of the Chinese companies' customers have been domestic, the developers are now looking beyond the home country now and are aggressively trying to focus on the western markets.

Gaming Ecosystems to Watch

The map shows the most important global gaming ecosystems. It includes the top high performance ecosystems according to VC investment as well as ecosystems that have a special focus on gaming. Click on the ecosystem name to find out more about the local scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Gaming market is flooded with hundreds of new releases everyday. Gaming startups, irrespective of the platform, need strong support from policymakers to scale and become torchbearers of the local gaming ecosystem. Growing a local superhero is of prime importance for any ecosystem. A local superhero in the form of successful company or entrepreneur who has made it big puts the entire ecosystem in the global map and increases attention and involvement from all the players including local agencies, venture capitalists, angel investors, local talent, etc. Helsinki, for example, has had some presence of the gaming industry over the years but it was the development of Rovio and Supercell which catapulted Helsinki onto the global map for members of the gaming cluster. The success led to government incentivizing entrepreneurship and innovation in gaming and was followed up by venture capitalists pouring money into ecosystem. Most of the gaming startups in Helsinki have received some form of government assistance at some point of time.

Policymakers can promote the activity in the gaming cluster through multiple approaches. Policymakers can drive technology adoption and education to pave a way in development of gaming sub-sector. Gaming industry has witnessed the long term plans of the government and agencies helping ecosystems develop strong industry expertise. In Stockholm, the move by government to subsidize internet and PCs was a big step in encouraging youngsters to develop interest in general gaming and it also encouraged them

to learn and experiment in the field. Many gaming specific educational and vocational programs were also launched during the same time which helped these enthusiasts to take forward their interests as careers.

On the other hand, steps taken to attract foreign talent and companies also boosts the local ecosystem. In Quebec province, the production of multimedia titles tax credit lets companies claim upto 37.5 percent of labor expenditures for the entire lifecycle of the product. It is one of the core reasons why Ubisoft maintains an office in the Province.

Scandinavia, as a region, punches above its weight in terms of churning out successful gaming studios. The history of it actually traces back to the late 80s and early 90s when the video gaming industry still in the early phase with 16 bit colors and Atari consoles dominating the industry. It was during this demo scene that saw gatherings of enthusiasts to show off capabilities and experiment with new things. These enthusiasts were the ones who set up the first set of gaming studios which launched the initial hit titles and then helped startups during the mobile gaming boom. It is important that these movements are supported, encouraged by the policy makers. It is important to identify these and if provided with support and guidance, they can be the ones who are innovating for the entire industry value chain.



Sub-Sector Overview

Adtech

Co-Author

Aidin Tavakkol

CEO and Founder at LimeSpot

\$500 billion

Global ad spend is approximately \$500 billion, and digital ads make up approximately 40% of that.

New interfaces

While startup activity is slowing down in Adtech, new interfaces like Augmented Reality and Virtual Reality are opening up new opportunities for Adtech companies.

Shift in public policy and opinion

The prevalence of targeted ads has made the public increasingly worried about privacy, which is shaping policy. For example, the European Union's General Data Protection Regulation (GDPR) rules on data protection will begin enforcement in 2018.

From internet search to video to social media, Advertisement Technology has shaped the internet as we know it.

Google and Facebook, two of the top 5 biggest companies in the world, have started and grown primarily on their AdTech strengths. And along the way, these incumbents and others have shaped the ad market as we know it. Digital ad spending has been growing as a total share of the market, while print, billboards, and broadcast has been stable or declining.

Total ad spend globally is over \$500 billion -- though it's growing at a slow pace of about 3-4% -- and digital ad spend is slated to overtake television as the biggest medium for ad revenue for the first time ever in 2017, estimated to take about 40% of the total advertising spend pie.

However, this does not mean that the landscape is rosy for AdTech startups. The incumbents in the market -- Facebook and Google -- have an essential duopoly, making the landscape harsh for startups. The sub-sector is a victim of its own success, as defended by VC partner Suranga Chandratillake at Balderton Capital in a Financial Times interview.

Google and Facebook have a near duopoly on the market, capturing about over 60 cents out of every online ad dollar in the US, and about half of the digital ad spend globally. Ad-blocking apps have grown as a response to consumer's annoyance with increasingly targeted and prevalent ads. Backlash against "fake news" and the perceived use of AdTech for interfering with political processes -- as some argue happened in the last U.S. presidential elections -- puts additional pressure on AdTech companies, most notably Facebook.

What is Adtech?

Advertisement Technology (Adtech) captures different types of analytics and digital tools used in the context of advertising and marketing. This includes extensive and complex systems used to direct, convey, or monitor advertising to target audiences of any size and scale. Typical application fields are conversion/optimization, email marketing & mobile marketing, online & display advertising, search engine optimization and social media marketing.

Adtech Global Startup Activity

Startup Output

Global Share of Startups
3.3% Global Average: 4.3%

Startup Growth (2008-2016 annual average)
-6.9% Global Startup Growth: 4.5%

Funding

Total Funding Value Growth (2012 - 2017)
50.3% Global Funding Value Growth: 377%

Median Seed Deal Value (2012 - 2017)
\$400 thousand Global Median: \$350 thousand

Median Series A Deal Value (2012 - 2017)
\$4 million Global Median: \$4.7 million

Exits

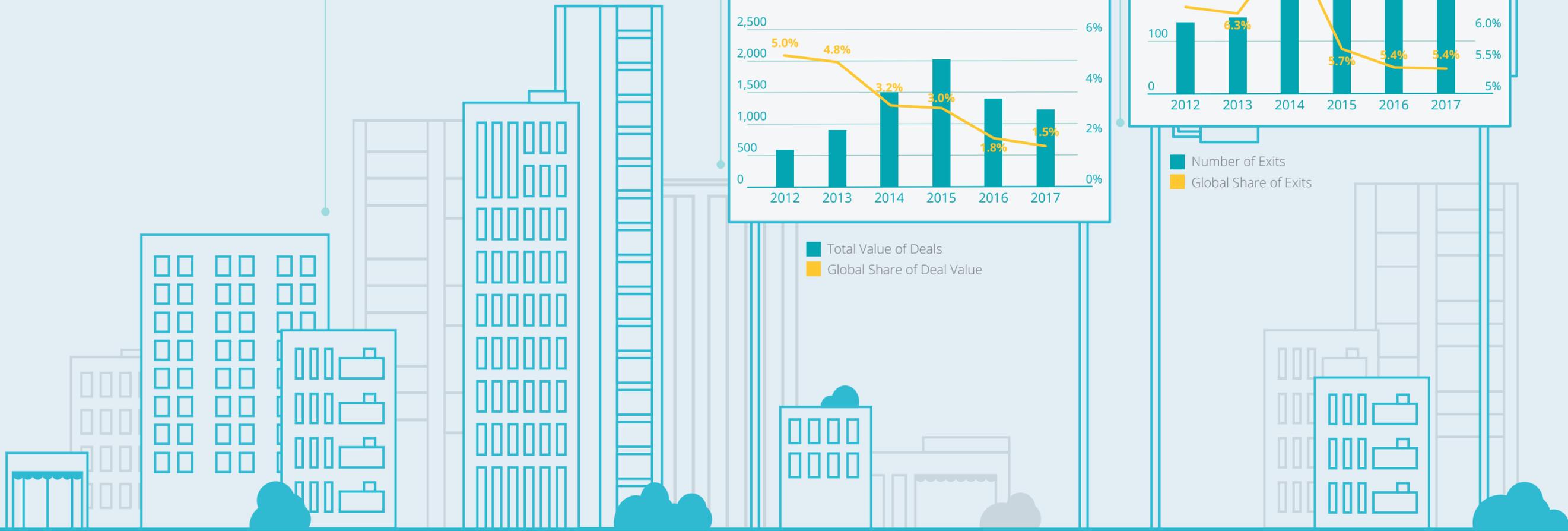
Exit Value Growth (2012 - 2017)
13.4% Global Average: 126%

Median Exit Value (2012 - 2017)
\$30.2 million Global Median: \$30 million

Series B+ Funding Value (\$B) and Global Share of Funding



Number of Exits and Global Share of Exits



Key Drivers and Trends

The walled gardens of Google and Facebook capture over 50% of the total global market. The defining driver of the current Adtech space is the consolidation of Google and Facebook as the two key players in the field. The notable exception to this rule is China, where Baidu, Tencent and Alibaba garner about 73% of the market.

Increased digital ad spend and digital media consumption. Driven by growing connectivity, digital ad spend and digital media consumption continues to grow. Internet penetration is growing globally, estimated to include 58% of the world's population by 2021, up from 44% in 2016 according to Cisco. In addition, average traffic per user is estimated to double in the same time period, with video and mobile use leading this growth.

Startup Example

AppNexus (New York City, US)

AppNexus is a software platform for optimizing online advertising. The company has raised \$321 million in 11 funding rounds.

Developments in Artificial Intelligence and Machine Learning -- combined with cookies and big data -- made ads increasingly more targeted. About 90% of online ads are targeted, based on user data like online behavior. The wealth of data from internet users' digital trail is being increasingly leveraged with AI tools to create more effective and persistent ads.

Rise of new forms of content and user interfaces. While the traditional digital ad space of display, social media, and search are heavily dominated by Google and Facebook, we're seeing the

"In the VR space things happen at light-speed—many times faster than in other parts of Tech we've experienced. Large corporations and media companies are very active, even aggressive, and coming in with very large budgets: our deals with ILMxLAB and Nissan have happened in record times, followed by immediate actions."

Yoni Koenig and Ilya Druzhnikov
Founders, Exit Reality

emergence of new forms of content and user interfaces that can be ripe with opportunity for startups. Virtual and Augmented Reality, wearable, voice-activated devices, and even unmanned stores like Bodega kiosks, cashierless Amazon Go stores, and Walmart's latest patent with plans to build literally inside-your-home retail locations open up new channels and opportunities for Adtech startups to build upon.

While this is a major opportunity, we have yet to see homerun startup successes on this. London-based Blippar, an Adtech startup focused augmented reality, reportedly reached unicorn status, though it is yet to show major traction, and a Financial Times report has expressed concerns over their burn rate.

Adblocks disrupt the Adtech business model, breaking at the seams of ad-supported internet. As many as 1 in every 4 web users use adblocks. Google Chrome -- the dominant browser with 60% market share -- is implementing ad filtering. Adblock software use is growing by as much as 30% per year. This is a direct threat

to the Adtech business model, and Prof. Ben Shiller and Prof. Joel Waldfogel at Brandeis University and the University of Minnesota respectively estimate that a 20 percent increase in adblock use corresponds to about 30 percent decrease in revenue. This is a major challenge for startups, and also an opportunity to build better business models and tech that can be robust against this trend.

Startup Example

Panchi (Hangzhou, China)

Panchi focuses on providing online and mobile advertising services to small and medium enterprises in China. It has raised 220 million in 2 fundings rounds.

Public's attitude towards data sharing for ads is changing -- and moving the regulatory environment with it. The prevalence of targeted ads has made the public increasingly worried about privacy, and that is shaping policy. For example, European Union's General Data Protection Regulation (GDPR) rules on data protection begin to be enforced in 2018, preventing global firms to market the data of individuals in the EU without obtaining their specific consent to use their data.

Adtech Ecosystems to watch

The map shows the most important global AdTech ecosystems. It includes the top high performance ecosystems according to VC investment and exits as well as ecosystems that have a special focus on AdTech. Click on the ecosystem name to find out more about the local Fintech scene.

● Click ecosystem to read their deep dive



Key Insights for Ecosystem Builders

Focus on the new Adtech tech frontier. While the digital ad spending in the traditional channels of display banners, social media, and search are overwhelmingly dominated by Google and Facebook, the new generation of ways users interact with the web are a more open field for startups. AR/VR, wearables, and voice-activated devices have opened major opportunities for Adtech that have yet to be created and fully explored.

The new map for Adtech entrepreneurship. While mature economies' markets are particularly dominated by incumbent players, developing economies experiencing growth in internet and mobile connectivity have a more favorable outlook for startups -- especially the ones with local roots. India and China have great examples of strong startups growing in Adtech.

Build on connections to adjacent industries. New York City and Los Angeles have strong Adtech scenes, in no small part because of their legacy industry strengths adjacent to Adtech: traditional advertising and entertainment. All across the world, ecosystems with thriving traditional industry activity in media and entertainment -- like Istanbul, Turkey for Central and Eastern Europe, and Rio de Janeiro, Brazil for South America -- should consider a focus in Adtech for building regional leadership. Connections to adjacent industries can be built through startup + corporate events, "reverse pitches" -- where corporates pitch startups on the challenges they are facing, and linking students from local universities to the startup scene.



Sub-Sector Overview

Consumer Electronics

Maker movement

Thanks to open-source learning kits, availability of 3D printing, and electronic development kits, various makers are able to create all types of tech-related prototypes and products at low costs.

China as the place to be

China is responsible for the biggest number of unicorns in Consumer Electronics sub-sector.

Hardware challenges

2017 saw some of the biggest failures in the Consumer Electronics space, including Pebble, Jawbone, Juicero, NJOY, Fuhu, Zeebo and Hello. After three strong years (2014-2016), 2017 witnessed a drop in venture funding and exits.

The Consumer Electronics sub-sector has been evolving over time with new products introduced every passing year and the startup boom adding dynamism and innovation to this sector.

Smartphones are a great example of how the Consumer Electronics space has transformed over the last few years. Starting with basic models featuring 52 MHz processors, we now have smartphones with octa-core processors which clock more than 2.4 GHz. By adding new and more complex features to smartphones every year, smartphones have made many everyday products such as iPods and digital cameras nearly obsolete.

While incumbents like Apple and Samsung continue to hold the majority share of the market, their status is threatened by newer players who have captured a sizeable market. During Q3 2017, Xiaomi, a China-based startup founded in April 2010, held a 7.4% share of the \$478 billion smartphone market against Samsung's 22.3% and Apple's 12.5%.^{1,2} It was also the fastest-growing brand with increasing overseas smartphones shipments (60% YoY). Given its success in smartphone business, the company has expanded into other product categories like smart TVs, VR players,

fitness bands, consumer drones, and self-balancing scooters. In wearables, as of Q3 2017, Xiaomi, along with Fitbit, held the lead in shipment volumes, beating the likes of Apple, Huawei, and Garmin. The company, which was once perceived as a low-cost basic smartphone manufacturer, is now one of the top five smartphone makers in the world, ranking better than the companies like LG, Sony, and ZTE; and continues to focus on R&D for new-gen products.

What is Consumer Electronics?

Consumer Electronics are electronic or digital equipment including devices used for entertainment, communications and home-office activities as well as other wearables. Apart from traditional consumer electronic products like TVs, smartphones, our research includes consumer IoT, AR/VR devices, fitness and wearables, consumer drones, consumer robots, consumer hardware, among others

¹ Statista, Global revenue from smartphone sales from 2013 to 2017 (<https://www.statista.com/statistics/237505/global-revenue-from-smartphones-since-2008/>)

² Statista, Global market share held by leading smartphone vendors from 4th quarter 2009 to 3rd quarter 2017 (<https://www.statista.com/statistics/271496/global-market-share-held-by-smartphone-vendors-since-4th-quarter-2009/>)

Key Drivers and Trends

The Maker Movement at the heart of the Consumer Electronics startups. Traditionally, electronics, have been linked to high-skills and high-investment requirements. Now, armed with open-source tools, availability of 3D printing capabilities, and electronic development kits, various makers are able to create all types of tech-related products. These resources and capabilities have helped facilitate the “democratization of hardware.” Companies like Arduino and Raspberry Pi are incrementally adding users and enthusiasts to the movement by providing them with open source hardware and software at low cost. Maker communities like Hackster, Hackaday, and RepRap have proved instrumental in the exchange of knowledge by connecting makers and fostering innovation.

Smartphones growth stalls but new product categories emerge. The global smartphone market is seeing the global demand plateau. Emerging markets, which were the main growth engines have witnessed falling growth rates. According to IDC, global shipments of smartphones marginally fell (by 0.1%) in 2017 compared to 2016.¹

Yet wearables, one of the larger categories of newer consumer electronics, has seen consistent growth in user adoption and is expected to see the same trend going into the future. They are becoming more personal with increasing reliance. According to latest Gartner study, global shipments of wearable devices are expected to rise from \$266 million in 2016 to \$504 million in 2021, growing at a CAGR of 13.7%.

¹ Apple Passes Samsung to Capture the Top Position in the Worldwide Smartphone Market While Overall Shipments Decline 6.3% in the Fourth Quarter, According to IDC, IDC, 1 Feb 2018 (<https://www.idc.com/getdoc.jsp?containerId=prUS43548018>)

Since 2014, AR, VR and MR have seen continuous launch of products and services like Google Cardboard, Oculus Rift, and Google Glass; which has kept the consumer interest growing. The consumer segment for AR/VR will be dominated by Gaming and is expected to reach \$9.5 billion by 2021.²

Meanwhile, consumer IOT products are predicted to see more adoption as consumers move towards smart homes and connected lifestyle with voice controls becoming the principal user interface for these products. Apple, Google, and Amazon continue to fight on several technology forefronts, including voice control devices. The products have received warm response and users are expected to increase at a CAGR of 29% from 2015 to 2021. The market, which is still at a nascent stage, was valued at \$1.6 billion in 2015 and is expected to cross \$15.8 billion in 2021.³

Hardware is hard—Startups fail and funding drops. Over the last few years, there have been players who have garnered great investor and consumer attention but fallen flat.

In July 2017, Jawbone announced that it was selling off its assets. The company received over \$930 million over a 10-year period and became the second-costliest VC-backed startup failure of all time. The company was said to be too focused on aesthetics and design rather than quality and durability. In Sep 2017, Juicero, which had raised \$120 million from investors like Kleiner Perkins Caufield & Byers and Alphabet, announced that it was suspending

² Worldwide Spending on Augmented and Virtual Reality Expected to Double or More Every Year Through 2021, According to IDC, 03 AUG 2017 (<https://www.idc.com/getdoc.jsp?containerId=prUS42959717>)

³ Wavestone: The rise of Intelligent Voice Assistants, 2017 (<https://www.wavestone.com/app/uploads/2017/09/Assistants-vocaux-ang-02-.pdf>)

sales of its products and looking for a buyer for the company and its IP. The company was branded as one of the most overhyped and misguided startups after a Bloomberg report and revelations by YouTube consumer electronics enthusiasts tore apart the company's product calling it very expensive and something that consumers could do without.

2017 has been a difficult year for Consumer Electronics startups with VC funding estimated to drop by 25% from \$4.4 billion in 2016 to \$3.3 billion.⁴ The market has become difficult as the number of success stories have dropped while major failures have increased dramatically over the last year. Apart from Jawbone and Juicero, NJOY, Fuhu, Pebble, Zeebo, and Hello have sunk despite raising substantial amounts (all more than \$50 million).

Consumer electronics ventures face a lot of issues not only in the development of products but also in commoditizing the product. While these startups are able to attract a few initial customers through various platforms like Kickstarter, they face difficulties in building a brand for thousands of loyal customers. Competition brings enormous pressure, severely impacting the margins and increasing customer acquisition costs.

4 CB Insights

Deep Dives

North America

Atlanta
Austin
Boston
Chicago
Edmonton
Houston
Los Angeles
Montreal
New York City
Ottawa
Phoenix
Quebec City
Seattle
Silicon Valley - Bay Area
Tampa Bay
Toronto-Waterloo
Vancouver

Europe & Middle East

Amsterdam-StartupDelta
Bahrain
Barcelona
Berlin
Frankfurt
Greater Helsinki
Istanbul
Jerusalem
London
Malta
Munich
Paris
Stockholm
Tel Aviv

Asia-Pacific

Bengaluru
Beijing
Hong Kong
Kuala Lumpur
Manila
Melbourne
New Zealand
Shanghai
Shenzhen
Singapore
Sydney
Taipei City

Ecosystem Deep Dives

North America

Atlanta

Austin

Boston

Chicago

Edmonton

Houston

Los Angeles

Montreal

New York City

Ottawa

Phoenix

Quebec City

Seattle

Silicon Valley - Bay Area

Tampa Bay

Toronto-Waterloo

Vancouver

Ecosystem Deep Dive

Atlanta USA

Atlanta, Georgia is home to three tech unicorns -- Kabbage and GreenSky in Fintech, Rubicon Global in Cleantech -- a strong corporate environment including twenty-six Fortune 1000 headquarters, and approximately 275,000 students enrolled in higher education.

Sub-Sector Strengths

 **Fintech.** This sub-sector commanded the highest share of VC investment in Atlanta in the past six years -- tied with AI, Big Data and Analytics -- with 22% of total VC dollars. Success stories include the unicorn Kabbage, which raised \$250 million from Softbank in 2017 and has loaned \$3.5 billion to U.S. small businesses; and GreenSky, the most valuable online lender in the U.S. with a valuation of \$4.5 billion and the second most valuable American Fintech unicorn, behind Stripe. Atlanta is also home to BitPay, the bitcoin payment service pioneer, which has raised \$62.5 million in total funding, and processed more than \$1 billion in bitcoin payments in 2017 alone.

Local assets include Atlanta's financial industry, with three Forbes 1000 corporations -- SunTrust, Invesco, Intercontinental Exchange -- with a combined market capitalization of over \$75 billion, and the broader Fintech sector employing 30,000 professionals in Georgia.

 **AI, Big Data, and Analytics.** With 70 colleges and universities in the metro area, including Georgia Tech -- whose computer engineering graduate program is ranked #5 in the U.S. -- Atlanta has a solid flow of relevant talent. Some of these schools have direct ties to AI, Big Data, and Analytics challenges, like the Georgia Tech Autonomous Racing Facility, and Georgia State University's Legal Analytics Lab.

Notable Atlanta exits include Rainmaker Group, the analytics company for real estate and hospitality acquired for \$300 million by RealPage in 2017; and Nexidia, the big data solution provider acquired for \$135 million by NICE Systems in 2016.

 **Adtech.** Atlanta is in the top 15 ecosystems for Adtech investment among the 100 ecosystems we benchmarked globally. While global levels of Adtech investments declined since 2015, Adtech VC investment in Atlanta grew consistently from 2012 to 2017, with approximately \$57 million invested in 2017. Five percent of the VC investment in Atlanta went to Adtech companies from 2012 to 2017. Notable exits since 2012 include: Pardot, acquired by ExactTarget for approximately \$100 million (and then ExactTarget by Salesforce); Silverpop, acquired by IBM for approximately \$270 million; and Vitruv, acquired by Oracle for more than \$300 million.

"Atlanta has all the ingredients to be a top technology hub. Its 70 colleges and universities produce a rich talent pool, while the presence of many major corporations provide a rich set of B2B customers and B2C channels. Entrepreneurs benefit from a robust support network including a friendly business climate and low cost of doing business, combining to make Atlanta the best kept secret for starting and scaling a company."

Jennifer Sherer, Ph.D.

Vice President, Innovation & Entrepreneurship
at Metro Atlanta Chamber

Startup Genome Member

The **Metro Atlanta Chamber (MAC)** serves as a catalyst for a more prosperous Atlanta by focusing on retaining and recruiting companies, attracting top talent and strengthening connections that drive Atlanta's innovation and entrepreneurial culture.

Ecosystem Partners

Advanced Technology Development Center (ATDC), Atlanta Tech Village, Engage, Enterprise Growth Institute, Entrepreneurs Organization (EO), Flashpoint, FlatironCity, Hypepotamus, IgniteHQ, Invest Atlanta, LaunchPad2x, Prototype Prime, Sandbox ATL, Startup Atlanta, TechSquare Labs, Techstars Atlanta, TiE Atlanta

“Atlanta has produced a number of the most important digital marketing platforms including MailChimp, Pardot, SalesLoft, Terminus, and CallRail, not counting over 100 more startups in operation today. With a critical mass of companies in this category, and thousands of experienced people, Atlanta will continue to be one of the top markets in the world for digital marketing software.”

David Cummings
CEO, Atlanta Tech Village

The Atlanta Adtech ecosystem includes a high-profile bootstrapped company, MailChimp -- with over \$500 million in revenue -- and the first VC-backed tech IPO of 2018 in the U.S.: Cardlytics, with a market cap of \$273 million.

“The startups Tech Square Ventures invests in are increasingly applying AI, machine learning, or data analytics in some form. Just down the street are leading corporations in data intensive sectors like Fintech, logistics, and information security. Combine that with the talent and innovation out of Georgia Tech and Atlanta is a great place for us to invest and for entrepreneurs to build their companies.”

Blake Patton
Managing Partner, Tech Square Ventures

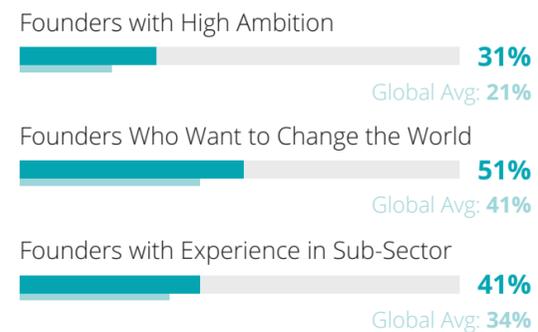
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Austin USA

Low taxes and favorable real estate costs provide a solid foundation for startups based out of the Texan capital. With hubs like Austin Technology Incubator, located at University of Texas, and Techstars Austin, the city has a rich startup support ecosystem too. South by Southwest conference ensures that the local community gets exposure to globally leading knowledge and international funding. In 2017, venture capital investors poured around \$1.2 billion into local startups, up from \$942 million in 2016. No wonder that local success stories like Mozido emerge. The company is a global provider of trusted and inclusive digital commerce and payment solutions for both developed and unbanked markets (total funding \$307 million).

Sub-Sector Strengths

 **AI, Big Data & Analytics.** Over the past 6 years, 19% of all VC investment in Austin went into AI, Big Data & Analytics startups. Austin's AI legacy goes back all the way to the Microelectronics and Computer Consortium (MCC), the first, and one of the largest computer industry research and development consortia in the United States. Today this legacy is being continued by Austin-based AI startups like the fast-growing SparkCognition which raised close to \$56.5 million in Series B Funding. SparkCognition is

building AI solutions for applications in Oil and Gas, Defense, Security and other sectors. Another promising Austin-based startup is Tethr, a company using AI to analyze customer calls, which raised \$15 million in Series A funding.

 **Cleantech.** In 2015, the Austin Cleantech sector directly employed nearly 20,000 people and contributed around \$2.5 billion to the region's GDP. Cleantech employment is estimated to grow by 11% by 2020 in Austin, nearly double the national rate of 6%. A local startup success story worth mentioning is Hylion, a company that is developing a hybrid system for tractor-trailers that reduces their fuel consumption up to 30% with an ROI of less than 1 year. It raised \$21 million in Series A funding in September 2017.

 **Healthtech.** Healthtech startups have been among the city's most high-profile innovators for years, leveraging world-class learning institutions like the Dell Medical School at the University of Texas or the newly established Merck IT Hub. One prominent startup is Medici, a healthcare application that is reconfiguring the patient-doctor relationship. With separate applications for patients, doctors, and hospitals, Medici allows patients to contact their doctor through their smartphone. The company raised a remarkable \$24 million in Series A funding soon after their product launch.

"Austin has always been a great place to create new industries at the intersections of other industries. Although other cities might excel in one particular industry, typically you'll see cross-industry interactions start much faster here in Austin... creating new innovative areas. This behavior emerges out of our supportive, open-door culture, and is the root of new emerging applications of tech not seen before in one particular area."

Kevin Koym
Founder & CEO Tech Ranch

Ecosystem Partners

3 Day Startup, Tech Ranch, Austin Technology Incubator, University of Texas Austin, BuiltIN, Central Texas Angel Network, St. Edward's University, WeWork, Techstars Austin, Capital Factory

“Austin is poised for an absolute explosion in the AI space. All in one city, you bring together academic powerhouses and industry leaders with startup innovators and corporate customers. What falls out is the perfect setting for ecosystem acceleration.”

Brance Hudzietz
Emerging Technologies Ambassador at Capital Factory

Founder Mindset



Founder Know-How



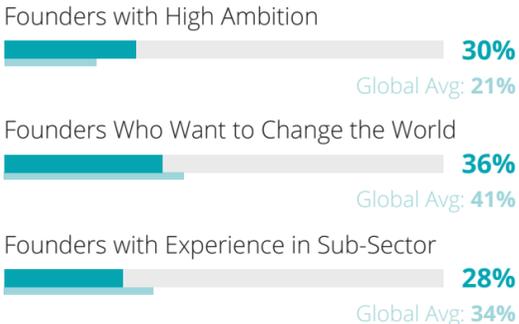
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Boston USA

Boston is home to one of the strongest startup ecosystems in the world¹. With Harvard and MIT attracting some of the best and brightest, and dozens of other universities in the greater area, the city is a natural breeding ground of world-leading innovation. While top-notch accelerator MassChallenge is rather sub-sector agnostic and supporting the best ideas across the board, the ecosystem shows a strong tendency toward the following three sub-sectors.

Sub-Sector Strengths

 **Biotech.** Boston is a global Biotech powerhouse. The metro area is home to more than 1,000 Biotech companies², top-class academic research centers, universities and life science centers with over 46,000 scientists, researchers, and staff, and over 21,000 students in related fields. For 21 consecutive years, Boston has received the most funding from the National Institute of Health of any U.S. city³. Over the past 6 years an astonishing 31% of local VC investment went into Biotech - more than any other sub-sector in Boston. There are many local success stories, including unicorns

¹ According to the Startup Genome Global Startup Ecosystem Ranking 2017

² <https://www.massbio.org/about>

³ <https://www.boston.gov/departments/economic-development/healthcare-and-life-sciences>

like Moderna Therapeutics, a company developing messenger RNA-therapeutics. The company, which produces human proteins for antibodies inside patient cells, raised \$500 million in Series G funding and stands at a \$7.5 billion valuation. Ginkgo Bioworks, another Biotech unicorn, designs custom microbes for customers across multiple markets. It is currently valued at over \$1 billion, after receiving \$275 million in its latest Series D funding round.

 **AI, Big Data & Analytics.** AI, Big Data & Analytics is the second largest sub-sector in Boston. Between 2012 and 2017, some 17% of all VC funding went into AI, Big Data & Analytics startups. In September 2017, IBM announced a \$240 million investment to create a new Watson AI lab with MIT. It is intended to be pioneering research on AI whilst catalyzing startups, too. A notable example is Affectiva, an MIT Media Lab spin-off that is pioneering emotion-recognition AI, analyzing roughly 5.7 million facial expressions.

 **Advanced Manufacturing & Robotics.** The greater Boston area boasts over 35 academic robotics research labs, centered around established robotics companies like Amazon Robotics, Boston Dynamics, and iRobot; as well as shared workspaces like CIC and MassRobotics. Recent success stories include warehouse robotic companies 6 River Systems and Locus Robotics, which raised \$15 million and \$25 million each in 2017 respectively.

“The Boston area is a great environment for robotics companies to start and grow. It has a unique combination of robotics research labs, a strong base of established robotics companies, a large number of VC’s that follow the industry - recently making investments in advanced manufacturing companies like Veo and Humatics for example - and an established ecosystem for startups.”

Tom Ryden

Executive Director at MassRobotics

Ecosystem Partners

4GenNow, Cambridge Innovation Center, Capitalnetwork, Carlton PR marketing, Health Innovators, Mass Challenge, TechStars, Greentownlabs, Cybersecurity Factory, City of Boston, Boston New Technology, LearnLaunch, StartHub.Org, DCU FinTech Innovation Center, New England VC Association, Workbar

"MA is known for being forward-thinking when it comes to robotics, being the home of MIT, IRobot and now MassRobotics. Usually associated with large-scale manufacturing and automation, we're seeing more consumer-facing robotics. We are hopeful that upcoming applications answer issues that aren't just nice-to-haves but address large-scale problems such as growing social inequity."

Marie Meslin

Executive Director at The Capital Network

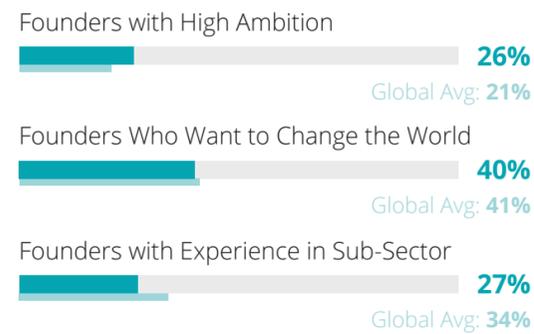
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Chicago USA

GrubHub, Gogo, Orbitz, Groupon—Chicago has seen some impressive startup success stories over the last years. The city has been consistently ranked first for VC returns and reported an astonishing amount of around \$1.5 billion in VC investment in 2017. Universities like the Illinois Institute of Technology, Northwestern University, and the University of Chicago have top-notch programs in Entrepreneurship, Computer Science, and operate startup incubators. Support organizations like 1871, Techstars Chicago or Catapult Chicago work toward creating the next big success story.

Sub-Sector Strengths

 **Fintech.** Chicago is the epicenter for Fintech activity in the American Midwest, with more than 23% of all local VC investment having gone into Fintech startups over the past 6 years. The local center of gravity is FinTEEx, a community of the leading organizations within Fintech and Financial Services, working together to promote collaboration and drive Fintech innovation. Chicago's flagship Fintech startup is Avant, an online lending platform that became the leading provider of credit alternatives to middle income consumers in the US. It has already raised roughly \$1.8 billion in total funding to date.

 **AI, Big Data & Analytics.** A few hours outside of Chicago, the University of Illinois at Urbana-Champaign runs one of the U.S.'s top-10 programs for Artificial Intelligence, Robotics, & Cybernetics; fueling the local AI startup scene with highly-trained talent. A notable startup in this space is Narrative Science, a company creating an advanced natural language generation AI that learns and writes like a person—automatically transforming data into intelligent narratives. The company has raised around \$43 million in funding to date. Chicago also boasts successful scaleups like Uptake Technologies: an industrial predictive analytics provider that raised \$117 million end of 2017, currently valued \$2.3 billion.

 **Adtech.** For decades, Chicago was the biggest powerhouse in the U.S. advertising industry—second to only New York City—boasting some legendary agencies like Leo Burnett Company. It is fitting, then, that Chicago has a buzzing Adtech ecosystem today. The city is home to numerous successful Adtech startups such as Signal, a cross-channel marketing company that has raised around \$80 million in funding. The company is providing cloud-based marketing technologies for brands and digital agencies alike.

“As the center of Chicago’s tech and entrepreneur community, we believe that company builders in the Fintech industry can grow and thrive here. We know that founders in this highly regulated sector must rely on the expertise of others and we believe Chicago has more industry veterans and experience than any other city.”

Howard Tullman
CEO at 1871

Ecosystem Partners

Catapult Chicago, University of Chicago, Matter Chicago, mHUB, The Shift Chicago, 1871, WorldChicago

“University-based entrepreneurship continues to expand in Chicago as more students are interested in Fintech, AI and Big Data and Analytics. Additionally, alumni and industry partners are increasingly turning to places like the Polsky Center to get support for their venture and to drive economic impact through entrepreneurship and industry-spanning research.”

E.J. Reedy

Director, Strategic Initiatives at Polsky Center for Entrepreneurship and Innovation at the University of Chicago

Founder Mindset



Founder Know-How



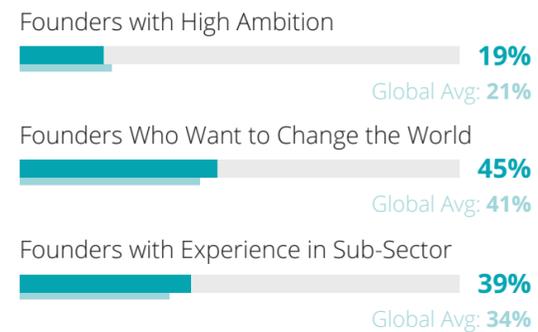
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Edmonton Canada

New Member

At a median age of 36.3 years, Edmonton is home to Canada's second-youngest population. Access to a motivated and skilled labor pool is strong, especially with the contribution of the University of Alberta, one of the top five research universities in Canada with more than \$500 million in annual external research funding. The city also offers a highly cost-competitive business environment in the global comparison, as confirmed by KPMG, with no provincial retail sales-tax, no provincial capital taxes and no payroll taxes.

Sub-Sector Strengths

 **AI.** A critical driver of Edmonton's AI ecosystem is the Alberta Machine Intelligence Institute (AMii), a research lab at the University of Alberta. It is one of three institutes granted a combined \$125 million as part of the national government's AI Strategy. This local expertise reinforces international resource attraction. Renowned AI company DeepMind, acquired by Google in 2014 for more than \$500 million, set up its first international lab in the city. Local startup success stories that leverage AI are SAM, which monitors social media using AI to detect emergencies; Gfycat, a GIF-hosting powerhouse known for its use of AI in fighting deep-fakes, and the first AMii spin-off, PFM Scheduling Services, which automates scheduling in complex unionized environments.

 **Health and Life Sciences.** The region's intellectual asset in Health is rooted in a network of prestigious post-secondary institutions. University of Alberta, for example, has made a number of medical breakthroughs such as a treatment for Type 1 diabetes known as the Edmonton Protocol, and a new heart transplant protocol for children. Another success coming out of the University is DrugBank, a pharmaceutical knowledge base for machine learning and precision medicine with more than 3,500 academic citations and 12 Million page views annually. A new accelerator by TEC Edmonton and pharma company Merck is a driving force for future startup creation.

 **Big Data & Analytics.** Edmonton's culture of analytics has been confirmed on various occasions. In 2016, Edmonton received the Canadian Open Data Award for Accessibility by the Open Data Society of BC and Open North. In Canada's Open Cities Index for 2017, Edmonton received the highest score for impact of its open data program. The city government is also the first organization in Canada and the U.S. to adopt the International Open Data Charter—a commitment to implement global best practice standards. As part of the Open City initiative, the Analytics Centre of Excellence (ACE) was launched, providing best practices, research and training for analytics across the city.

"If you dare to take an idea to reality, to build, to make something, Edmonton is your city. The convergence of our health system and our strength in artificial intelligence and machine learning put us on the leading edge. The possibilities for Edmonton are inspiring: global products, scaling companies, and driven founders dedicated to diversifying our economy for generations to come."

Cheryll Watson

VP Innovate Edmonton at Edmonton Economic Development Corporation

Startup Genome Member

Edmonton Economic Development is an agency of the City of Edmonton, cultivating the energy, innovation and investments needed to build a prosperous and resilient economy.

Ecosystem Partners

Edmonton Research Park, TEC Edmonton, Startup Edmonton

"I'm extremely excited about Edmonton's AI community, not only from my perspective as Chair of AMii but as a mentor and investor as well. World class research combined with technical talent and a supportive ecosystem is a recipe for high growth, and most importantly, world-changing tech."

Bruce Johnson

Chair at Alberta Machine Intelligence Institute

"When asking people in Edmonton for help, their response isn't 'What's in it for me?'. Instead, they ask 'how can I help?'. It's incredible to have that kind of support when you are just starting out."

Dan McEleney

Co-Founder at Gfycat

"Edmonton is the starting place of successful companies such as BioWare, Investopedia and Invidi, and the home of up and coming companies such as Showbie, Drivewyze, Leeven, Jobber, SAM and Visio."

Kristina Williams

President and CEO at Alberta Enterprise Corporation

Ecosystem Demographics

Metropolitan GDP

\$88 bn

Global Avg: \$267 bn

Metropolitan Population

1.3 m

Ecosystem Performance

Ecosystem Value

\$77 m

Global Median: \$4.1 bn

Startup Output

100 - 250

Global Avg: 1,700

Growth Index

6.1

Funding

Early-stage Funding per Startup

\$171 k

Global Avg: \$252 k

Market Reach

Foreign Customers



Talent

Experienced Software Engineers



Experienced Growth Employees



Visa Success Rate



Startup Experience Index

4.9

Founders Demographics

Women Founders



Immigrant Founders



Resource Attraction

Entrepreneurs **NA**
Global Avg: 300

Startups **NA**
Global Avg: 83

Ecosystem Deep Dive

Houston USA

Houston is among the 30 largest ecosystems in the world in number of tech startups, and has received approximately \$250 million in VC investment in 2016. It is home to major NASA facility, and the 4th biggest concentration of large corporates in the U.S.

Sub-Sector Strengths

 **Health and Life Sciences.** Health startups have the biggest share of VC investment in Houston, bringing in 24.2% of the VC money in the ecosystem from 2012 to 2017 -- twice as much the concentration of Health investments globally.

Houston startups have one of the strongest traditional healthcare clusters to build upon. Healthcare employs over 325,000 people in the city, and is the second biggest employment sector. Houston's Rice University is ranked as a top 10 university globally for Biomedical Engineering. In addition, Houston is home the Texas Medical Center (TMC) -- the world's largest medical center.

Major exits in the sub-sector include Constellation Healthcare Technologies, acquired for \$311 million, and Cardon Outreach, which provides tech solutions to healthcare facilities, acquired for \$400 million.



AI, Big Data, and Analytics. investments in Houston for this sub-sector have quadrupled in just two years -- twice as fast as the global growth rate for the sub-sector in the same period. Investments in AI, Big Data & Analytics now makes up 16.2% of the total VC investments in the ecosystem.

Traditional industry assets are part of this growth, especially the energy industry. Houston is home to the world's biggest concentration of Forbes 2000 energy companies, and Oil & Gas-focused AI startups like Arundo Analytics are growing their client base and footprint, with Arundo recently raising over \$25 million.



Advanced Manufacturing and Robotics. Home to a NASA manufacturing facility, universities ranked in subjects like nanotechnology, and mechanical engineering, and a growing AI cluster -- a crucial input in robotics -- Houston has the potential for becoming an Advanced Manufacturing and Robotics hub.

Notable startups in the area include MacroFab, the electronics manufacturing platform, which has raised \$5.8 million; and re:3D, the maker of 3D printer Gigabot, which is manufactured in Houston. Initially funded by Startup Chile, re:3D is a mostly bootstrapped venture that recently won a \$1M Creator Award from WeWork.

"This is a unique time for Houston. We are home to a diverse set of major industries like Energy, Health-care, Aerospace and Manufacturing that are ready to be disrupted. We also see an increasing amount of Third Wave startups accessing the hard assets of the industrial complex through corporate and university partnerships. The next 20 years in Houston are going to be very exciting."

Jon Nordby

Director of Strategy, Houston Exponential

Startup Genome Member

Houston Exponential is building the next global innovation ecosystem in Houston by convening startups, corporation, investors, academia and the government to leverage assets and coordinate efforts. We enable the startup ecosystem by connecting and attracting the resources that high-growth, high-impact firms need to thrive in the third wave economy.

Ecosystem Partners

Circular Board, Fannin Innovation Studio, Houston Angel Network, Houston Technology Center, JLaBS, Mercury Fund, Redlabs, Rice University - McNair Center for Entrepreneurship, Rice University - Owl Spark, Rice University - Rice Alliance for Entrepreneurship, Station Houston, TMCx, Unconventional Capital, University of Houston - Hatch Pitch

"We believe that Houston will be in a select group of global cities that lead the digital industrial shift. Houston combines a mix of software and data science talent with deep technical and business expertise in a range of capital-intensive, engineering-oriented industries including energy, logistics, chemicals, and manufacturing."

Stuart Morstead
Co-founder and COO of Arundo Analytics

"Houston sits at the intersection of international business, aeronautics, energy, healthcare and big data, offering a distinct advantage in solving problems of global significance during this age of AI. I expect to see Houston emerge as a leader in the advancement of machine learning, as industry expertise takes on renewed importance in innovation."

Carolyn Rodz
Founder & CEO, Alice

Founder Mindset



Founder Know-How



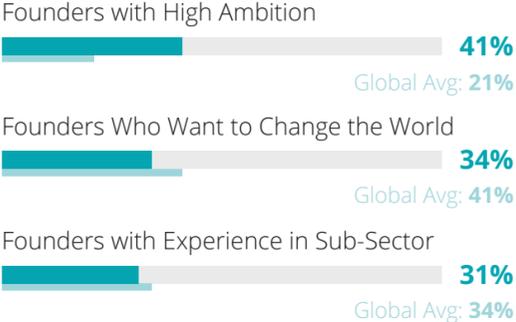
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Los Angeles USA

Los Angeles is the second most populous city in the U.S. and boasts the third largest startup ecosystem of the country behind Silicon Valley and New York. With more engineering graduates than any other U.S. metro region, the ecosystem has a deep talent pool to draw from. Los Angeles also offers world-leading vertical expertise in select areas, and saw some impressive startup exits in 2017. The ecosystem is currently home to 13 unicorn companies.

Sub-Sector Strengths

 **Gaming.** Between 2012 and 2017 5% of all local VC investment in LA went into Gaming startups. Los Angeles just took over San Francisco as the city with the highest number of gaming companies in the country, including the headquarters of many of the U.S.'s top game developers. Of the most notable is Tencent-owned Riot Games, the gaming giant primarily known for its world success, League of Legends. Up-and-coming is GameMine, a game publisher that develops, licenses and acquires mobile games. The company now has customers in more than 135 countries, and secured a \$20 million Series A round in May 2017.

 **Transportation.** Los Angeles may be as renowned for its traffic as for its entertainment scene. In February 2018, the region once again topped the list of areas with the worst traffic congestion for the sixth year in a row. Partially out of necessity, the LA region is at the forefront of new developments in the Transportation sub-sector. Next to big players like SpaceX and Hyperloop One, there are a number of up-and-coming companies like NEXT Trucking, a logistics startup that connects small and medium-sized trucking companies with shippers. It recently raised a \$21 million Series B round from Sequoia Capital.

 **Cleantech.** Between 2012 and 2017 5.7% of all local VC investment went into Cleantech startups. In 2015 Mayor Eric Garcetti released LA's first-ever Sustainable City plan with the ambitious objectives of 1) becoming the first large "zero waste" city in the U.S., 2) attracting \$2 billion in private Cleantech investments, and 3) increasing the greenhouse gas efficiency by 75%. Los Angeles Cleantech Incubator (LACI) is the City's official Cleantech business incubator with the mandate to accelerate the commercialization of clean technologies and products. In partnership with the city's most important educational and research organizations—UCLA, USC, Caltech and Jet Propulsion Laboratory—LACI is supposed to play an important role in reaching the Mayor's objectives by 2035.

"The gaming sector has continued to be a pillar of the Los Angeles startup community. With a pedigree in both tech and entertainment, LA continues to lead in gaming - and now eSports innovation. This position will only grow in the upcoming years with the expansion of gaming into AR/VR."

Dan Dato

Co-founder at Cross Campus

Ecosystem Partners

Bixel Exchange, Mucker Capital, WeWork, Bixel, Cross Campus

Founder Mindset



Founder Know-How



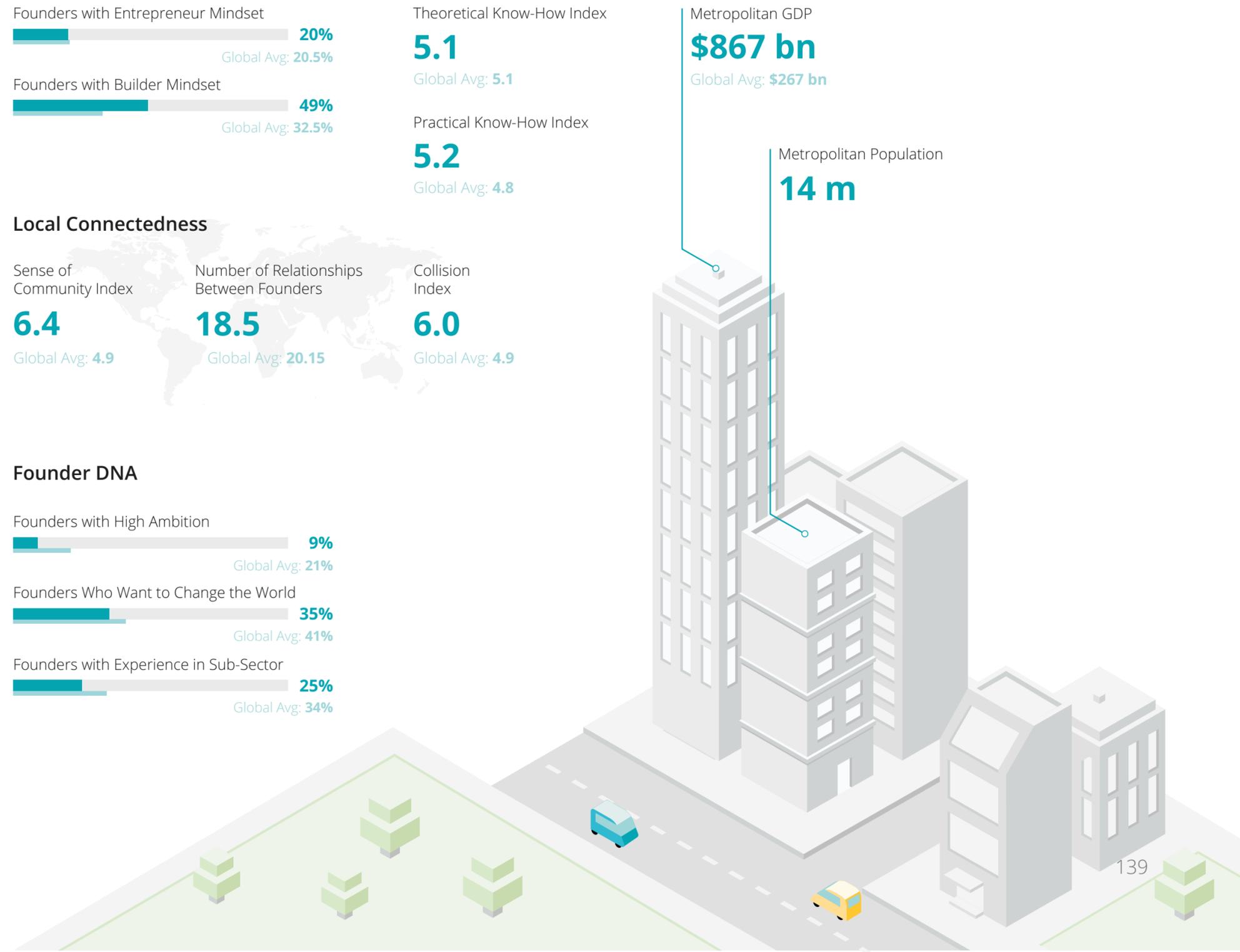
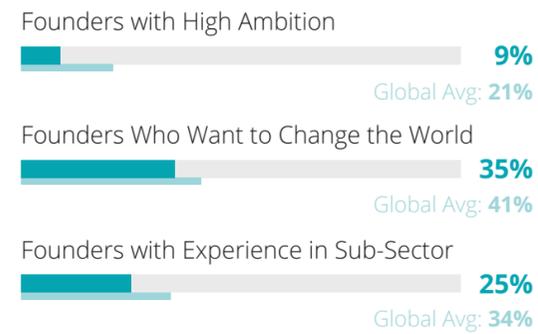
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Montreal Canada

Entrepreneurs and startups can find a good home in Montreal, which offers them cultural attractions, an affordable cost of living, and a large pool of more than 90,000 skilled ICT workers. World-class universities such as ETS, Polytechnique Montreal, University of de Montreal, UQAM, McGill University and Concordia University continue to feed the ecosystem with talent and research. The city also hosts Startupfest, an event that has grown into a global gathering of entrepreneurs, founders, investors, and mentors. Montreal-based companies received \$727 million in VC across 132 deals in 2017 according to CVCA.

Sub-Sector Strengths

 **AI, Big Data & Analytics.** Montreal boasts one of the world's largest concentration of AI scientists in the world and the world's largest and most prestigious group of Deep Learning researchers, the Montreal Institute for Learning Algorithms (MILA). The ecosystem is considered a leading global AI hub, generating 19% of foreign direct investment in 2016. Major players such as Facebook, Google, Samsung, and Microsoft have recently invested in Montreal to take advantage of this expertise. Element AI raised \$102 million in Series A funding in 2017, the largest round for an AI startup in the world.



Advanced Manufacturing & Robotics. The broader Montreal manufacturing sector contains 3,240 companies, including many SMEs, and accounts for around 120,000 jobs. Montreal's startups and research centers are particularly dynamic in the fields of collaborative robotics, smart manufacturing, additive manufacturing, smart textiles and advanced materials. The Government of Québec invested nearly \$400 million over 3 years to support innovative manufacturing initiatives.



Gaming. Montreal is the center of the Canadian Gaming industry, hosting almost 35% of all Gaming studios in the country. The city boasts more than 10,000 game development professionals. With the city playing host to world leading publishers (eg, Ubisoft, Electronic Arts, Warner Brothers, Gameloft), Montreal is a proving ground for up-and-coming talent, and fertile soil for entrepreneurial developers to strike out on their own. With a startup-friendly cost of living, Montreal also has a dynamic "indie" game sector including the world's biggest cooperative of indie studios and startups, created in 2016 to sustain the growth of its members (137 member companies, representing more than 1200 employees). The provincial government supports the sub-sector with a tax credit for multimedia labor, which can refund up to 37.5% of eligible employee salaries.

"Montreal has everything it takes to enable entrepreneurs and investors to realize their more ambitious projects: access to major international markets, highly skilled workforce, diversity of its industries and a strong, growing, economic momentum. The culture of innovation that is part of our DNA has made our city THE place to start a new project."

Valérie Plante

Mayor at City of Montreal

Startup Genome Members

The **City of Montreal's** administration offers a range of resources and an ideal fiscal environment to transform the groundbreaking ideas of local talents into lasting successes.

Centech is an incubator focused on supporting early stage hardware and deep-tech companies.

Real Investment Management is an early-stage venture capital firm that backs entrepreneurs and builds ecosystems where they thrive.

Ecosystem Partners

Notman, Arche Innovation, District 3, Startup Fest, Capital Intelligent, PME MTL, Innocité MTL, Réseau Capital, Montréal Inc, Mtl Newtech, HEC, Mtl Lab, Quartier de l'innovation (QI)

“Montreal is home to the largest and most prestigious group of deep learning researchers worldwide and is the most active city in Canada for VC investment. The city’s thriving startup ecosystem developed thanks to a collaborative bottom-up approach.”

Sylvain Carle
Partner at Real Ventures

“Montreal, the first student city in North America, has an impressive talent pool. One of our strengths is advanced manufacturing, materials and robotics notably in medtech, aerospace and mobility.”

Richard Chénier
Director at GM Centech

“Montreal is world-renowned for game development. We are literally bursting at the seams with talent. Montreal’s game ecosystem is a rich mix of the big players, mid-sized independents and super innovative startups that all work together to deliver amazing games to fans across the globe.”

Jason Della Rocca
Co-Founder at Execution Labs

Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

New York City USA

New York is the second highest performing ecosystem in the world, home to more than 7,000 startups, and it is the American ecosystem with the most unicorn companies after Silicon Valley. As such, it's one of the most exciting ecosystems in the world, with more than \$71 billion in Ecosystem Value. The NYC tech ecosystem has grown a lot in the past 5 years, going from about \$2.3 billion invested in tech startups in 2012 to approximately \$13 billion invested in 2017. The city now has more than 326,000 technology jobs.

Sub-Sector Strengths

 **Advanced Manufacturing and Robotics.** NYC is the city with the most 3D printing activity in the world, with 2.7% market share.¹ The city is also home to New Lab, a public-private partnership focused on the Advanced Manufacturing sub-sector, with a space hosting over 100 companies. Notable startups include Shapeways, the 3D printing marketplace that has raised \$77.5 million; Nanotronics, the company building advanced automated microscopes that has raised \$71 million; and littleBits, an open source library of electronic modules that has raised \$62.3 million. The city also has the Futureworks NYC program, which has an accelerator, a network of affordable manufacturing spaces, and a soon to be opened shared innovation space at the Brooklyn Army Terminal.

 **Cybersecurity.** With the massive local presence of finance, media, retail, and healthcare companies — which are highly dependent on sensitive data — it's no surprise NYC has a growing Cybersecurity sub-sector. The ecosystem has more than 100 Cybersecurity companies, a recent influx of top Israeli Cybersecurity startups opening NYC offices, and more than \$1 billion in VC investments in the sub-sector for 2017. Notable local startups include Mark43, the law enforcement software company that has raised \$77.8 million, and Forter, the retail fraud prevention company, which raised \$50 million.

 **Health and Life Sciences.** Between 2012 and 2017, about 9.2% of the VC funding in the ecosystem went to Health startups. Unicorns include Oscar, the health insurance startup valued at \$3.2 billion; and Flatiron Health, acquired by Roche in 2018 for \$2.1 billion in what was the largest VC-backed exit out of New York in the past five years. The ecosystem is supported by major local assets: nine academic medical centers, \$1.6 billion in National Institutes of Health funding research in 2016, and 450,000 local jobs. The sub-sector is also being accelerated by the city's 10-year, \$500 million LifeSci NYC initiative, on top of the state's \$620 million incentives commitment. The initiative includes a \$150 million VC fund, wet laboratory and co-working spaces, and a new R&D center.

“New York City’s vibrant tech industry is booming with record highs in companies, jobs, and investment. As the talent capital of the world, and an epicenter for diversity and culture, there’s never been a better time to expand or start a company in New York City.”

James Patchett

President and CEO, NYCEDC

Startup Genome Members

NYC Economic Development Corporation is focused on promoting economic growth across New York City and strengthening the city's competitive position.

Tech:NYC is a network of tech leaders working to foster a dynamic, diverse, and creative New York.

Ecosystem Partners

Digital.NYC, Flight VC, General Assembly, Gust, NationSwell, Quake Capital, Rubicon VC, Runway VC, Sandbox, TechHubNYC

¹ Q12018 3D Printing Trends by 3D Hubs.

NYC is the ecosystem with the most unicorns in the U.S. after Silicon Valley. Local unicorns include WeWork, one of the most valuable startups in the world, valued at \$20 billion; Infor, the enterprise software startup, at \$10 billion; AppNexus, the web advertising platform, at \$2.2 billion; Sprinklr, the social media management startup, at \$1.8 billion; Warby Parker, the eyeglasses startup, at \$1.7 billion; and Peloton, the tech-enabled fitness startup, at \$1.2 billion.

“New York is the center of culture and innovation. We are lucky to have the confluence of existing markets and industries along with the creative culture to drive a truly diverse tech ecosystem. For that reason, and many others, we have no doubt that the future of tech will be centered here, in New York.”

Julie Samuels

Executive Director, Tech:NYC

“With its density of customers, investors, and a ton of smart people solving the challenges of a digital future, New York City provides a pipeline critical to quickly scale today’s Cybersecurity companies.”

Simon Towers

Managing Director, TechHubNYC

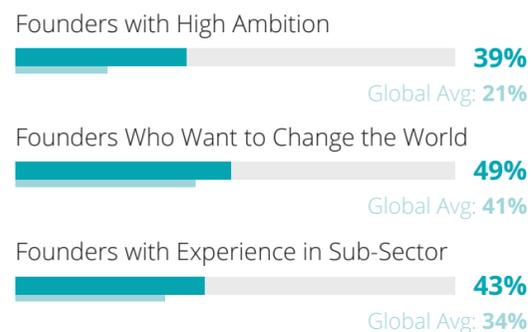
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Ottawa Canada

The capital of Canada thrives on a science-based economy. It is home to the National Research Council, has the country's highest R&D spending per capita, and educates around 25,000 students specializing in STEM fields. The startup ecosystem is gaining steam, with Shopify at the forefront, the e-commerce company that went public in 2015 at a valuation of \$1.27 billion. From 2016 to 2017, local VC investments doubled in key areas such as AI and Big Data, suggesting the emergence of vertical key focus areas.

Sub-Sector Strengths

 **Big Data & Analytics.** From Shopify to Canada's financial intelligence unit FINTRAC, Ottawa is home to a wide range of organizations that leverage big data for their products and services. Poised to be one of the next success stories coming out of Ottawa is Klipfolio, which raised \$16.8 million to date to further develop its leading real-time business dashboard. Emerging startups thrive due to this local knowledge network, such as MindBridge AI, which automatically detects anomalous patterns of activities, unintentional errors and intentional financial misstatements.

 **AI.** It's no surprise that Ottawa was the first Canadian city to test an on-street autonomous vehicle that communicated with live city infrastructure. Ottawa has formed a thriving cluster around Artificial Intelligence, with autonomous vehicles as a key application. Ottawa is home to Canada's largest technology park, Kanata North Technology Park, and geographically well positioned within Ontario's wider autonomous vehicle cluster. Overall, there are around 150 Ontario companies and organizations involved in the autonomous vehicle industry, employing almost 10,000 people.

 **Cybersecurity.** Ottawa's Cybersecurity startups draw from the presence of key organizations in the Security space. The Canadian Cyber Incident Response Centre and the Canadian Communications Security Establishment are both located here, as well as the Canadian Cyber Threat Exchange, which helps guard many of the leading Canadian companies against cyber attacks. The world's fourth-largest network security company Fortinet operates a large R&D center in Ottawa and works with Canada's federal government on improving its IT infrastructure. Startup activity is a key component of the Cybersecurity cluster, especially around Big Data and Analytics. An important startup in this space is Interset, an AI & machine learning platform that detects insider threats, which raised \$24 million to date.

"Ottawa is emerging as a global leader in 5G, SaaS, AV, AI and cybersecurity. The level of homegrown STEM talent keeps rising and both public and private partners continue making significant investment in our business community. Multinationals like Nokia, Ciena, Ericsson and Amazon are expanding local operations, while local disruptors such as You.i TV, Ross Video, Klipfolio, and Shopify will hire thousands in the coming years. It's an incredible time to be in Ottawa."

Michael Tremblay

President and CEO at Invest Ottawa & Bayview Yards

Startup Genome Member

Invest Ottawa delivers economic development programs and initiatives that increase entrepreneurial momentum, wealth and jobs in the City of Ottawa and its surrounding region.

Ecosystem Partners

Capital Angels, Entrepreneurship Algonquin, La Cite College, Lead To Win, Startup Garage, Kanata North BIA, L-Spark, ID Gatineau

“Ottawa is primed to be a world-class tech ecosystem. To drive this forward, we need to close the gaps between industries and build a stronger community that supports startups and innovation on all levels.”

Harley Finkelstein

Chief Operating Officer at Shopify

“Ottawa’s has a deep bench of cybersecurity engineering talent, showcased by companies such as Entrust, CheckPoint and SonicWall. The Global Cybersecurity Resource (GCR) accelerator, located in Bayview Yards, supports SME’s by providing access to expertise, resources and new global markets. It’s an exciting time for cybersecurity in Canada’s Capital.”

Bruno Couillard

President and CTO at Crypto4A

“MindBridge AI’s target markets are the upper echelon of the financial, business and government markets which are easily accessed from Ottawa. All of these combined have enabled MindBridge Ai to accelerate its time-to-market and attract over 110 customers in 6 countries in less than 12 months.”

Eli Fathi

CEO at Mindbridge AI

Founder Mindset



Founder Know-How



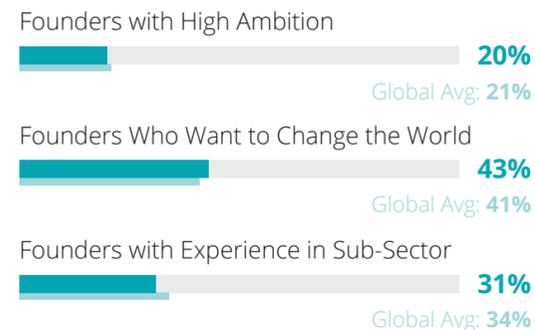
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Phoenix USA

New Member

Located in the American Sunbelt, Phoenix, Arizona in an ecosystem with growing momentum. Developments in the ecosystem include about \$300 million in VC investments in 2016, startup collectives like #yesphx, and PHX Startup Week.

In addition to a lot of bottom-up activity, Arizona has a local government supportive to startups. For example, there is state level legislation being proposed to create a “sandbox” environment for Fintech and Blockchain companies. Similarly, Arizona has promised to keep the autonomous vehicle industry free of regulations, attracting companies like Uber, Lyft, and Waymo.

Sub-Sector Strengths

 **Cybersecurity.** There are over 10,700 people employed in Cybersecurity in the Phoenix metro area, and 5,000 more open jobs. The ecosystem has had major wins with companies like LifeLock, which IPO'd in 2012 and was acquired by Symantec for \$2.3 billion in 2017; and Trusona, the Cybersecurity startup deploying no-password authentication, which raised a \$10 million round in 2017 from top VC investors like Kleiner Perkins Caufield & Byers.

 **Edtech.** The Phoenix Edtech community counts with Arizona State University (ASU), the most innovative school in the country.¹ ASU plays some key roles in the ecosystem. One, it provides major talent inflow, being one of the largest universities in the world with 82,000 students. Two, it has entrepreneurship support as one of its key priorities, with programs like ASU SkySong. Three, ASU has specifically focused on Edtech, partnering with prominent venture capitalist Tim Draper to create the ASU-Draper-GSV EdTech Accelerator, dedicated to developing and testing new tech in higher ed. Notable funding rounds in Phoenix include CampusLogic, the cloud-based student engagement platform for financial aid which raised \$10 million in 2017.

 **Health and Life Sciences.** Healthcare is a major industry in Phoenix, providing 60,000 jobs and contributing \$8 billion to the Greater Phoenix economy. Success stories include companies like Symphony Health Solutions, the pharma data company acquired in 2017 for \$530 million by PRA Health Sciences, and sizable funding rounds like the \$18 million raised by Solera, the digital health company serving employers and health insurance plans. In addition, on the funder side, AZBio, the Arizona Bioindustry Association, launched an effort to raise \$200 million in 2018 to support life science innovations of researchers and entrepreneurs in the state.

“Phoenix has a real opportunity to become one of the most generous communities for entrepreneurs, where founders can quickly access the people they need to grow and give back.”

Brandon Clarke

Co-Founder of StartupAZ Foundation

Startup Genome Members

StartupAZ inspires connectivity and generosity among Arizona’s most innovative young companies.

The Arizona Commerce Authority (ACA) is the state’s leading economic development organization.

The Arizona Technology Council works to make AZ the fastest growing tech hub in the nation.

Entrepreneurship + Innovation at Arizona State University helps students turn ideas into reality.

Invest Southwest is the connective tissue between investors and startups in the region.

The Partnership for Economic Innovation is dedicated to fulfilling the economic opportunities of Greater Phoenix.

Ecosystem Partners

AZ Founders Fund, Canal Partners, Center for Entrepreneurial Innovation, Coplex, Co+Hoots, Flinn Foundation, Galvanize Phoenix, Greg Head/Scaling Point, Moonshot, MRTNZ Ventures, Seed Spot Phoenix, Tallwave Capital

“Often for sectors to develop, you need some early successes that build up, scale, and attract talent and entrepreneurs, and then those people go off and start other companies. We’re seeing that today with Edtech in Arizona.”

Matthew Pittinsky
CEO of Parchment

“The startup and software economy in Phoenix has grown significantly in the last few years, but it is yet not overheated like other tech centers. Talent, support and funding are readily available for savvy early stage ventures.”

Greg Head
Founder/CEO - Scaling Point

“Phoenix is the only metropolitan in America without natural disasters, making it perfect for data centers that are fighting cybercrime. This region is rapidly growing and the perfect location for cybersecurity companies to prosper.”

Ori Eisen
Founder & CEO, Trusona

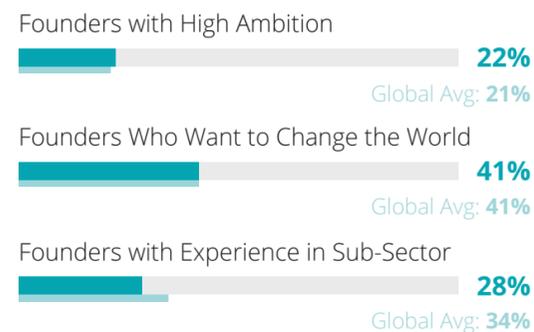
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Quebec City Canada

Quebec City is the capital city of the Canadian province of Quebec and the oldest city in Canada. Companies operating in the city have access to large-scale pool of specialized workers, including some 60,000 graduates in the fields of IT, mathematics and engineering. Along with a large and highly skilled technical workforce, Quebec City counts more than 300 companies operating in the broader ICT sector including IBM and General Dynamics. The city hosts several renowned ICT research centers, including Defense Research and Development Canada (DRDC Valcartier), the most important national Defense R&D Center in Canada. Leading startups include LeddarTech, a developer of LED detection and solutions for object recognition and distance measurement applications. The company raised \$101 million in a Series C round last year from corporate investors like Delphi and Osram, among others. Another interesting example is Coveo, an enterprise software company, that raised \$35 million in Series C in 2015.

Sub-Sector Strengths

 **Gaming.** Over the past 6 years, 13% of local VC investment went into local Gaming startups. Quebec City's gaming industry is globally renowned due to presence of major companies

like Beenox, Ubisoft Quebec, and Frima Studio. With almost 40 companies, the local digital arts and interactive entertainment industry employs nearly 1,300 people. The city also has a thriving indie game scene which includes developers and publishers like Parabole (developer of Kona), Chainsawesome Games (developer of Knight Squad), and Bishop Games (developer of Light Fall), among others. The regional government has been supporting industry startups in the region with a cluster manager hosted at Le Camp—the province also offers a tax credit for gaming and multimedia companies.

 **Health and Life Sciences.** Quebec City's strength in Life Sciences & Health draws primarily from its high-class education infrastructure with both Université Laval and INRS conducting leading-edge research. Legacy industry in the city counts more than 120 companies, some 6400 employees, 85 research centers, chairs, groups and institutes, and more than \$1.3 billion in estimated sales. The city also offers lower operating costs for companies in clinical trials and biomedical research. Local success stories include Medicago, a Biotech company that uses proprietary plant-based technologies to develop and produce novel vaccines and antibodies.

“Quebec City is largely renowned for its tech ecosystem. It benefits from a great talent pool and all levels of governments are working together to support the tech sector. Furthermore, as its success keeps growing, the ecosystem integrates more with key industries of Quebec city, such as life sciences, optic-photonics, numeric arts and interactive entertainment.”

Sébastien Tanguay

Managing Director, Le CAMP

Startup Genome Member

Quebec International contributes to the economic development in the Quebec City metropolitan region, fostering business growth, supporting key clusters and attracting talent and investment to the region.

Ecosystem Partners

BDC, PwC Quebec, ROBIC, VETIQ, Ville de Quebec, Association Québécoise des Technologies (AQT)

"We're based in Québec City because there's a skilled workforce here. The expertise is just two steps away, so why look any further?"

Patrice Allibert
President and CEO, GenePOC

"We chose the city of Quebec because it is francophone and has a friendly environment for entrepreneurs. The location is close to our partners and our American customers. The strength of the video game ecosystem and local talent pool was essential in allowing us to sign publishing contracts and successfully scale our team."

Mario Rizzo
President and cofounder of Artisan Studios

Founder Mindset



Founder Know-How



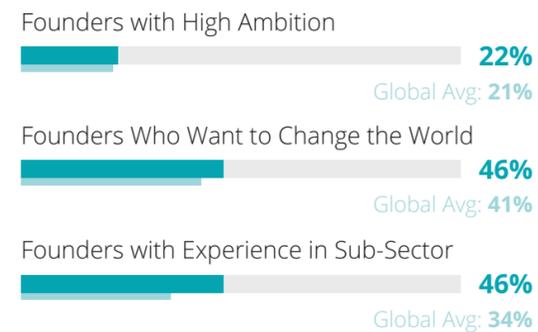
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Seattle USA

Seattle is home to tech giants like Amazon and Microsoft and has one of the highest concentrations of tech workers in the United States. In 2017, Seattle startups raised a total of \$1.7 billion in venture capital with more than half of the investments coming from outside of the city¹. Seattle has two unicorn companies: Craigslist competitor OfferUp, valued at \$1.2 billion; and the Biotech company Adaptive Biotechnologies, which has raised some \$411 million in funding at a \$1 billion valuation.

Sub-Sector Strengths

 **AI, Big Data & Analytics.** Thanks to Amazon Web Services, Microsoft Azure and a wide range of startups, Seattle is a well-known hub for Big Data and cloud computing technology. Between 2012 and 2017 almost 25% of all VC investment locally went into the sub-sector. A pillar of the local ecosystem is the Allen Institute for Artificial Intelligence (AI2), a research institute and AI incubator funded by Microsoft co-founder Paul Allen. Local success stories include Qumulo, developing enterprise data storage systems (\$30 million Series C in 2017); Textio, an AI-powered augmented writing platform (\$20 million Series B in 2017); and VoloMetrix, a people analytics technology company that uses

¹ <https://venturebeat.com/2018/03/16/more-than-half-of-seattle-startup-investments-in-2017-came-from-outside-the-city/>

big data to optimize organizational performance (acquired by Microsoft for \$250 million in 2015).

 **Cleantech.** Seattle is home to some of the country's leading Cleantech companies such as Imperium Renewables and Powerit Solutions. The local University of Washington ranks #8 globally for Earth Science. CleanTech Alliance, a trade association with 300 members is based in Seattle and drives clean technology innovation in the city. To attract further investment and innovation in the sector, the state of Washington offers clean technology companies a range of incentives, including B&O tax reductions for manufacturers of solar energy systems, components and semiconductor materials and sales and tax credits for equipment that generates electricity using renewable energy.

 **Advanced Manufacturing & Robotics.** The Seattle region's Advanced Manufacturing industry reaches into different sectors -- from aircraft assembly and logistics to agriculture. The University of Washington has excellent Robotics research groups such as the UW Robotics and State Estimation Lab. Washington State University has its Modeling, Motion and Medical Robotics Laboratory, while Pacific Northwest National Laboratory (PNNL) has multiple research projects on robotic systems. Local startup success stories in the sub-sector include Glowforge, creating 3D laser printer and raised \$22 million in Series B.

"Seattle offers a unique blend of a thriving economy, low-cost clean electricity and incredibly talented and driven entrepreneurs that share an ethos to solve today and tomorrow's climate challenges. It has positioned Seattle to stand out in the energy efficiency, transportation electrification, and the green building space."

Stephanie Gowing

Green Business Advocate at City of Seattle Office of Economic Development

Ecosystem Partners

Startup Seattle, ARI, Lighter Capital, New Tech Northwest, Techstars, Fledge, Microsoft Ventures, Seattle Angel Conference, Alliance of Angels, Startup Grind, Seven Peaks Ventures, Angel Resource Institute, Microsoft for Startups, SURF Incubator

"80% of Alliance of Angels investors expect to make more investments in 2018 than in 2017, with a high level of interest in artificial intelligence, autonomous vehicles and blockchain-based technologies."

Yi-Jian Ngo
Managing Director at Alliance of Angels

Founder Mindset



Founder Know-How



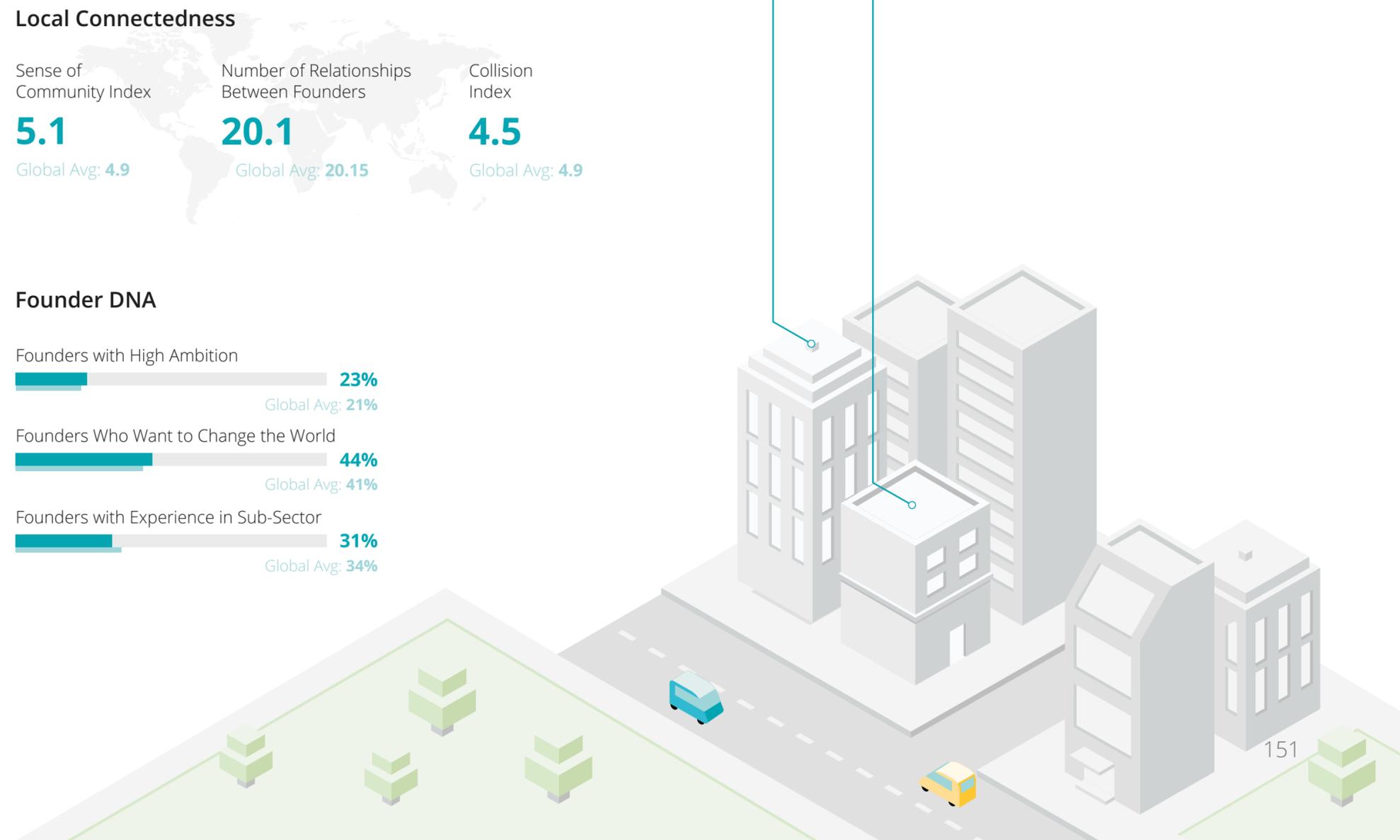
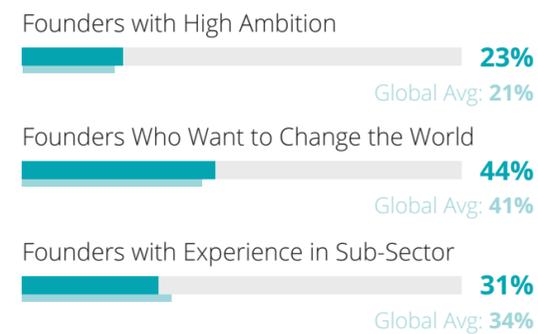
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Silicon Valley - Bay Area USA

Silicon Valley not only boasts the largest local pool of quality resources (capital, talent, investors, mentors, scaling experience—you name it) but it also combines them with a Global Resource Attraction that is five times higher than the second most attractive ecosystem in the world, New York City, explaining its continued growth and unmatched performance. In 2017 a staggering \$25 billion was invested into local startups.

Sub-Sector Strengths

 **AI, Big Data & Analytics.** AI has been one of the hottest trends in the Valley over the past years with tech companies like Facebook, Google and Uber having amassed some of the best AI teams in the world. In 2017, 20% of all local VC investment went into the AI, Big Data & Analytics sub-sector. The race of local startups for the pole position in AI has been translating into numerous funding and exit deals. Over the last five years, 90% of AI startups in SV were acquired by leading tech companies¹. One recent example is that of MindMeld, an advanced AI platform powering a new generation of intelligent conversational interfaces, acquired by Cisco for \$125 million.

¹ Kottenstette, Ryan. "Silicon Valley Companies Are Undermining the Impact of Artificial Intelligence." TechCrunch, TechCrunch, 14 Mar. 2018

 **Fintech.** Silicon Valley may not have an established financial services industry, but when it comes to Fintech the Bay Area is outperforming financial epicenters like New York or London with over 4x the amount of VC investment into the sub-sector over the last 6 years. Between 2012 and 2017, the local Fintech sub-sector accounted for 13% of all local VC Investment and boasts game-changers such as Paypal, Square and Lending Club as well as the next generation of leading Fintechs like wealth management company SoFi, which has raised over \$2 billion in funding to date.

 **Biotech.** With more than \$10 billion invested into Biotech startups over the last 6 years, the Bay Area accounts for more than 25% of global Biotech VC investments. The local workforce consists of top researchers from all over the world, fueled largely by a highly educated talent pool with strong ties to Stanford University, UCSF and UC Berkeley. The two-square-mile patch of South San Francisco is the center of gravity for Biotech companies, boasting established heavyweights like Genentech or Exelixis as well as early-stage startups such as Freenome. The company, founded in 2016, is developing disease-screening products to proactively treat cancer and closed a \$65 million Series A round led by Andreessen Horowitz in August 2017.

"Silicon Valley offers tremendous opportunities for AI and Big Data companies. Its unique culture of collaboration, created and maintained by Valley entrepreneurs over decades, has evolved a powerful support network between startups. Apart from the interchange of personal connections (such as investors and partners) among founders – a norm in this space – startups amicably exchange data and research, building a shared knowledge base, and brainstorm complementary products and ideas that add value. Particularly in AI, where Data is the key asset, there is a lot of collaborative research on merged data sources not available to a single company. The resultant synergies not only generate beneficial outcomes for individual startups, but also create new opportunities."

Aidin Tavakkol
CEO and Founder at LimeSpot

Ecosystem Partners

Startup Genome & Partners, Crunchbase, Engine, StartOut, Stanford Latino Entrepreneurship Initiative, Computer History Museum, LaunchPad, GSV, RocketSpace, Parisoma, Manos Accelerator, SVCIP.com, Stanford

“In the Bay Area the close relationship between top universities and tech giants continues. Our students benefit from unparalleled internship and employment opportunities. Our faculty regularly work with tech giants and these organizations make the flourishing of our labs possible (see the Berkeley Artificial Intelligence Research (BAIR) lab for instance). The existence of the symbiotic ecosystem comprising of universities, startups, large tech companies and venture capitalists, means that the Bay Area retains the highest mass of entrepreneurship in the world.”

Alberto Todeschini
Lecturer in Artificial Intelligence at UC Berkeley

“Oakland, a city that has always prided itself on social innovation and diversity, has been growing a robust startup ecosystem. While Pandora is well known, lesser known but equally important homegrown scaleups include tech companies such as Comfy, Mosaic, Marqueta, Turnitin and Captricity. The city’s diversity (#1 most diverse in the U.S.), climate, affordability and culture makes it increasingly attractive compared to San Francisco.”

Karen Wertman
COO at The Port Workspaces

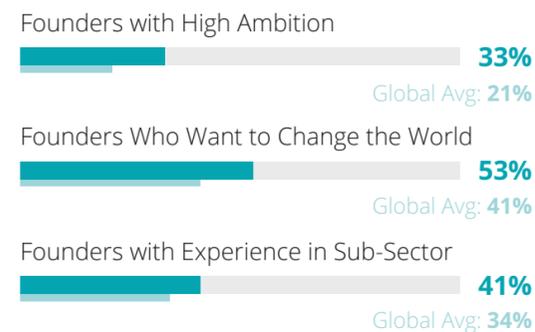
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Tampa Bay USA

New Member

As one of the 20 fastest growing metros in the U.S., the sun-bathed region of Tampa Bay is an emerging entrepreneurial hub. The metropolitan area was named the sixth most cost-friendly business location among large U.S. metros by KPMG, and has the third lowest labor cost in the country.¹

The ecosystem received \$150 million in VC investments in 2017. Notable startups include major include Tribridge, a cloud computing firm, acquired for \$152 million in 2017, and vXchange, the data center which secured \$200 million in the same year.

Sub-Sector Strengths

 **Health and Life Sciences.** This sub-sector has the highest share of VC investments from 2012 to 2017 (23%) in Tampa Bay. Notable startups include CareSync, provider of software and services for chronic disease management, raising \$26.5 million in 2017; Peerfit, a digital fitness platform, raising \$10.3 million in a series B in 2018; and myMatrixx, a pharmacy benefits solution provider, acquired for an estimated \$250 million in 2017.

¹ KPMG, Competitive Alternatives.

The broader Healthcare sector in Tampa Bay includes over 3,000 companies employing 62,100 workers -- among those a Forbes 2000 company, WellCare, with a market cap of \$6.3 billion.

 **Adtech.** The ecosystem has strong assets for this sub-sector, with sizeable ad and marketing tech companies like Catalina Marketing (\$748 million in revenue), and the Global Technology and Innovation Center for Nielsen, the market research giant with \$6.3 billion in revenue, which employs 1,500 people in Tampa Bay.

Notable startups in Tampa Bay include SiteWit (which has raised over \$7 million), Priatek (raised over \$11 million), SavvyCard (\$6 million), M-ize (\$10 million). A recent large exit was the acquisition of the e-commerce Adtech business Triad Retail Media for \$300 million by Xaxis at the end of 2016.

 **Edtech.** VC investments in Edtech in Tampa Bay make up about 2% of total VC investments, consistent with global benchmarks. Promising early stage startups include PikMyKid, which raised \$1.8 million, and seed stage Script, which was partially founded with a grant from the Thiel Foundation and was accelerated at the Tampa Bay Wave accelerator.

"Tampa Bay is evolving every day and momentum is building rapidly. I'd stay tuned; what is next is going to be pretty remarkable"

Linda Olson
CEO and President, Tampa Bay Wave

Startup Genome Member

Tampa Bay Wave is an accelerator and community that offers coworking, mentoring, and capital opportunities.

Hillsborough County Economic Development supports tech startups through the Economic Development Innovation Initiative (EDI2).

University of South Florida (USF) is research university serving with a major focus on entrepreneurship and innovation.

Ecosystem Partners

1 Million Cups St. Petersburg & Tampa, Entrepreneurial Collaborative Center, Greater Tampa Chamber of Commerce / Minority Business Accelerator, Hillsborough Community College, Innovation Place, Lakeland Catapult, Pasco County SmartStart, SparkGrowth/Station2Innovation, St. Petersburg Chamber of Commerce / Greenhouse, Tampa Bay Startup Week/Weekend, Tampa BaTech, TEC Garage, USF (Entrepreneurship Center, Muma College of Business, CONNECT), University of Tampa

"Tampa Bay continues to grow in its recognition as a place for startups to thrive. The pipeline of talent from strong university partners, the increasing angel and venture capital available, and the collaborative nature of the startup ecosystem supporters in the area all help Tampa Bay startups accelerate their rate of success."

Jeff Vinik

Billionaire investor, owner of Tampa Bay Lightning (NHL)

"As an investor we have been extremely impressed with types of deals and strength of startups in Tampa Bay. Not only have we seen the growth of seed and idea stage companies, we have truly seen some breakout companies especially in Edtech and Healthtech."

Tom Wallace

CEO of VC firm Florida Funders

"As a main source of talent to the region, with over 50% of USF's entrepreneurship graduates remaining in the Tampa Bay after graduation, we are proud supporters of the ecosystem."

Moez Limayem

Dean, USF Muma College of Business

Ecosystem Demographics

Metropolitan GDP
\$126 bn
 Global Avg: \$267 bn

Metropolitan Population
3 m

Ecosystem Performance

Ecosystem Value
\$2.3 bn
 Global Median: \$4.1 bn

Startup Output
550 - 850
 Global Avg: 1,700

Growth Index
4.1

Funding

Early-stage Funding per Startup
\$100 k
 Global Avg: \$252 k

Market Reach

Foreign Customers



Talent

Experienced Software Engineers



Experienced Growth Employees



Visa Success Rate



Startup Experience Index

4.8



Founders Demographics

Women Founders



Immigrant Founders



Resource Attraction

Entrepreneurs

NA
Global Avg: 300

Startups

NA
Global Avg: 83

Ecosystem Deep Dive

Toronto-Waterloo Canada

The Toronto-Waterloo Corridor links Canada's largest and most diverse city with one of the country's leading centres for tech innovation. It ranks among the 20 strongest startup ecosystems in the world, and benefits from leading research taking place at its 16 universities and colleges, notably the University of Toronto and University of Waterloo, which both have internationally recognized programs in computing sciences and engineering.

Sub-Sector Strengths

 **Fintech.** Toronto is North America's second-largest financial services hub, with 12,000 firms and 360,000 workers, making the Corridor fertile ground for startups. It is home to more than 500 Fintech ventures, which raised almost \$400 million last year. Recent funding rounds include eSentire (\$100 million), Kik (\$98 million ICO), Wealthsimple (\$39 million) and Nuco (\$21 million). In addition, RDM Corp. was acquired for \$102 million.

 **AI, Big Data & Analytics.** In 2017, the Corridor attracted international attention for its AI ecosystem, with Uber and Samsung establishing research labs in Toronto. In addition, the Vector Institute for Artificial Intelligence was created with a \$131-million investment. Vector's chief science advisor Geoffrey Hinton,

dubbed the "godfather of AI," leads Google's AI research. Notable funding rounds in the sub-sector include Element.AI (\$102 million) and Deep Genomics (\$10 million). Exits include Layer6 (acquired by TD Bank for \$77 million) and Maluuba (acquired by Microsoft).

 **Life Sciences & Health.** Toronto's Discovery District contains more than 30 medical and related sciences research facilities, with strengths in medical imaging and regenerative medicine. Across the Corridor, 450 ventures have raised more than \$300 million in 2017. Notable raises include BlueRock Therapeutics (\$173 million), PointClickCare (\$85.5 million) and Fusion Pharmaceuticals (\$19 million).

 **Advanced Manufacturing & Robotics.** Southern Ontario has a rich history in manufacturing, which employs over 10% of the province's workforce. A number of the next generation of advanced manufacturing firms, following in BlackBerry's footsteps, have emerged from the University of Waterloo's Mechatronics program. These companies include Aeryon Labs, Clearpath Robotics and Thalmics Labs, which have raised a combined \$270 million since 2015. Opened in 2017, Catalyst137 is the world's largest IoT campus that will accelerate development of hardware startups.

"The Toronto-Waterloo Corridor is home to an extended community of innovators, entrepreneurs, venture capitalists, corporates and customers. Together, this innovation supply chain attracts the talent, deep sources of capital and strategic market adoption opportunities that help made-in-Canada companies scale and win on the world stage."

Yung Wu

CEO at MaRS Discovery District

Startup Genome Members

With 1.5 million square feet of space in downtown Toronto, **MaRS** is the world's largest urban innovation hub. It supports scaling ventures that are tackling key challenges and helps open global markets to drive adoption of new solutions.

Communitech, founded by entrepreneurs in 1997, now supports an ecosystem of more than 1,000 tech companies—from startups to rapidly growing mid-size companies and large global players.

Ecosystem Partners

Centre for Social Innovation, Invest Toronto, Next 36, OneEleven, DMZ, City of Toronto, World Canada, Brookfield Institute, The Founder City Project, Venture Lab, RIC Centre, Innovation Factory, Haltech, Creative Destruction Lab

“The Toronto-Waterloo corridor is a strong, vibrant ecosystem resulting from world-class tech talent, ambitious and talented entrepreneurs, strong venture capital networks, and a supportive community. It’s an environment where scaling companies are supported and celebrated; where entrepreneurs share ideas and help each other succeed; where programs like Communitech, MaRS, Velocity, CDL, Next Canada, and DMZ provide expert advice and connections; and where entrepreneurs of all backgrounds can build a fast-growing company.”

Janet Bannister
Partner at Real Ventures

“Manufacturing is instilled in our region’s history - BlackBerry, the Uniroyal Tire Plant, Kaufman Footwear - just to name a few. We believe the bright future of this region lies in a combination of its manufacturing roots, reimagined through the lens of emerging technology. That’s one of the reasons we chose to build out our own 65,000+ square foot advanced manufacturing facility here last year, and why we continue to invest in the region.”

Stephen Lake
Co-founder and CEO at Thalmic Labs

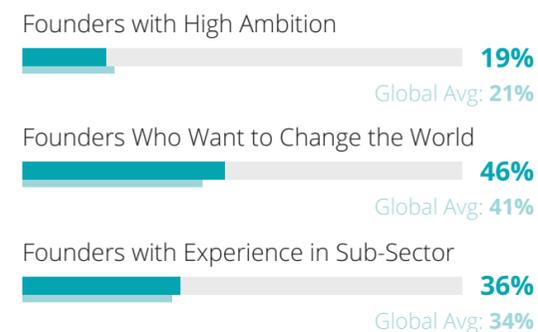
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Vancouver Canada

The list of accolades for Vancouver is long: #15 top ecosystem in Startup Genome's 2017 Global Rankings; North America's most livable and sustainable city according to two rankings; Canada's fastest-growing economy according to another; and one of the best Asia-Pacific cities to do business in according to a third. It is clear that Vancouver has created a leading innovation hub, able to produce success stories such as Slack, Hootsuite, and D-Wave.

Sub-Sector Strengths

 **Cleantech.** There are over 250 Cleantech companies in Vancouver, employing 7,700 employees. A strong interplay between startups and incumbents is underlined by Evok Innovations, a \$100 million fund by leading local Cleantech entrepreneurs and energy companies Cenovus Energy and Suncor Energy. Two notable startup success stories are Terramera, which raised \$22 million, and Saltworks Technologies, considered a world leader in advanced wastewater technology with +40 patents. .

 **Gaming.** One-third of Canada's gaming studios are based in Vancouver. A strong ecosystem includes EA's largest studio (home to FIFA), footprints by Microsoft, Capcom and Nintendo, as well as homegrown successes like Eastside Games and A Thinking Ape.

Vancouver is Canada's leading digital entertainment cluster and a top global AR/VR hub. Microsoft's strategic focus on AR/VR here and growth stage startups like Finger Food Studios and Archiact Entertainment, are proving that there is a reason why Vancouver is home to SIGGRAPH, this year's AR/VR Global Summit and now, Valve's International 8 tournaments.

 **Health and Life Sciences.** British Columbia's Life Sciences sector contributes around \$14.4 billion in GDP, with Vancouver's right at the heart of it. With a workforce of around 14,000 people, the University of British Columbia (UBC)-Broadway Corridor represents a significant knowledge network. Notable startups are 3D bioprinting company Aspect Biosystems, biotherapeutic platforms company Zymeworks (\$125.9 million in total VC funding), and cell research & tools-focused StemCell Technologies.

 **Blockchain.** Since its launch in 2017, CryptoKitties accounted for nearly 30% of all transactions on Ethereum. Vancouver recently became infamous after the homegrown company raised a \$12 million Series A round led by Andreessen Horowitz and Union Square Ventures. The city is best known by elite members in the blockchain community for being home to Ethereum leader and advocate Bob Summerwill, investors Boris Wertz and Marc van der Chijs and leading companies such as Hive Blockchain or BLT Group.

"Globally ranked universities, multinational companies, and local tech talent spin out disruptive and innovative startups at a breakneck pace. What retains them is the opportunity to work, invest and thrive in a city renowned for smart infrastructure, diversity, collegial culture and sheer liveability. This in turn draws in even more of the smart capital, companies and talent that enables Vancouver to compete with increasing success on the global stage."

James Raymond

Manager, Research & Analysis at
Vancouver Economic Commission

Startup Genome Members

The Vancouver Economic Commission is the economic development agency for the City of Vancouver. The VEC works to position Vancouver as a globally recognized city for innovative, creative, and sustainable business.

BC Tech Association's mission is to make British Columbia the best place to grow a tech company. BC Tech is committed to building a strong tech ecosystem and community, helping companies grow and advocating to keep the sector thriving.

Supported by the **Ministry of Jobs, Trade and Technology, Province of British Columbia**

Ecosystem Partners

Launch Academy, Sauder S3i, entrepreneurship@UBC, Creative Destruction Lab West, Highline BETA, RADIUS SFU, SFU Venture Labs, SFU Innovates, Wavefront, Spring, New Ventures BC, Small Business BC, Foresight, LifeScience BC, Bio Enterprise BC/Can

“At Clir our success has been based on having access to the best and brightest minds the world has to offer. In Vancouver we’ve found a group of talented people who also happen to share our company’s mission to help reduce emissions through increasing renewable power production.”

Jake Gray
COO at Clir

“Few cities can rival the 25-year history, adaptability and moxie of Vancouver’s games sector. These diverse startups flourish in an ecosystem rich in both the seasoned talent and venture funds necessary to start and scale companies. As demonstrated by its surging VR/AR cluster, this industry serves existing platforms even as it leads the charge in exploring future ones.”

Sam Chandola
Founder & CEO at V2 Games

“Vancouver’s academic institutions have cutting-edge innovation, and UBC is a premier example, able to spin out both the companies and technical talent necessary to grow a robust biotech cluster.”

Tamer Mohamed
President & CEO at Aspect Biosystems

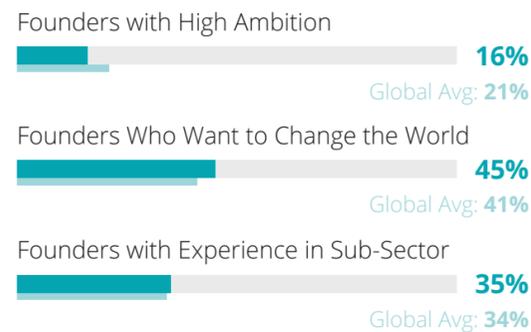
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



An aerial photograph of a city, likely Amsterdam, showing a dense grid of buildings with red-tiled roofs. The image is overlaid with a semi-transparent blue filter. The text is centered in the upper half of the image.

Ecosystem Deep Dives Europe & Middle East

Amsterdam-StartupDelta

Bahrain

Barcelona

Berlin

Frankfurt

Greater Helsinki

Istanbul

Jerusalem

London

Malta

Munich

Paris

Stockholm

Tel Aviv

Ecosystem Deep Dive

Amsterdam-StartupDelta

The Netherlands

The heart of Dutch entrepreneurship is Amsterdam-StartupDelta, a region with over 10 tech clusters that covers nearly the entire country. One of the top 20 ecosystems in the world, Dutch successes include Takeaway, the on-demand food delivery company that went public in 2016 at a \$1.1 billion valuation; Fintech unicorn Adyen; and Booking.com, which was acquired by Priceline in 2005 and has become one of the biggest names in global travel.

Sub-Sector Strengths

 **Fintech.** Home to one of the world's first modern stock markets, Fintech startups have much to like about Amsterdam. The Dutch financial industry presents an opportunity of at least \$112 billion, the combined market cap of the seven massive finance corporations in the Netherlands part of the Forbes 2000 list. Startups in the Netherlands are taking advantage of this opportunity, excelling especially in payments, digital identity and security. The ecosystem is home to multichannel payment provider Adyen, and some 8% of the VC investment from 2012-2017 went to Fintech startups. Both Ohpen, the cloud-based banking engine startup, and EclecticIQ, cyberthreat analysis company, made it to the top 10 largest rounds in the Netherlands.



Health and Life Sciences. Two of the three billion-dollar exits in the Netherlands in the past 3 years are Healthcare companies: Acerta Pharma was acquired for \$4.9 billion by AstraZeneca, DezimaPharma was acquired by Amgen for \$1.7 billion. About 10% of the VC funding from 2012-2017 years going to Healthcare companies. The underlying assets of the ecosystem are many: the Netherlands is home to 12 research universities, 85 hospitals, many research organizations and 2,500 Life Sciences & Healthcare companies -- including a great number of startups contributing to major innovations in the biomedical and healthcare fields.



Agtech and New Food. With \$1.2 billion in value-added by the agriculture sector in the Netherlands, Agtech is a major area of opportunity for Dutch startups. The ecosystem is fed by organizations like Wageningen University & Research Centre -- widely regarded as the top agricultural research institution in the world -- and StartLife, a dedicated Agtech and Food incubator and accelerator. Between 2012-2017, the sub-sector made up 7.6% of the VC funding in the region. Success stories in 2017 include food delivery startup Picnic raising a \$120 million series B round and insect farming startup Protix raising a \$50 million series B round.

"The boom in tech is inspiring many new entrepreneurs to do great things. We are heading fast towards achieving the Netherlands' ambition to be the most supportive ecosystem for hyper growth companies. We have been attracting many tech firms and investors from all over the world, which are contributing to the vibrancy of the Dutch tech scene."

HRH Prince Constantijn of the Netherlands
Special Envoy StartupDelta

Startup Genome Members

StartupDelta aims to merge all layers of the Dutch startup ecosystem into one single connected hub to improve access to talent, capital, networks, knowledge, and markets for startups.

Ministry of Economic Affairs and Climate Policy works to build for an entrepreneurial, innovative and sustainable economy.

Ecosystem Partners

Holland Fintech, StartLife, Health Holland

“As we’ve grown our company, we’ve found Amsterdam to be a great headquarters. People just love living and working in the city. Simply put, Amsterdam helps us attract talent.”

Pieter van der Does
Cofounder and CEO, Adyen

“There is a large number of world scale banks in Amsterdam but because the city is smaller, the level of engagement with the startup ecosystem is very high.”

Sara Koslinska
CEO, Limitless

“Tech talent is highly interested to work for startups and the medical community is very approachable due to our flat hierarchical culture. Combined with available early stage funding I would say we have fertile grounds for MedTech companies.”

Eline Vrijland-van Beest
Founder and CEO, NightBalance

“Nowhere in the world do we find so much knowledge, technology, and passion for food and agriculture, in such a dense area as in the Netherlands.”

Jan Meiling
Director, Startlife

Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Bahrain

New Member

Bahrain may be the smallest country in the Gulf region, yet it indicates strong entrepreneurial potential. As much as 70% of young Bahrainis are interested in the idea of starting their own business, according to EY. Ranking #2 in the MENA region in the Ease of Doing Business Index 2017, the island offers several regulatory advantages: The possibility of 100% foreign ownership in various sectors, unrestricted return of capital, and no corporate tax on profits and dividends. Bahrain's geographical location is attractive as the two biggest markets in the region, Saudi Arabia and UAE, can be reached within an hour. The emerging ecosystem is driven by Tamkeen and its key partners.

Sub-Sector Strengths

 **Fintech.** Bahrain has been the Gulf's Banking and the Islamic Finance center for over 40 years. Just recently, its neighboring countries like UAE and Kuwait have been entering the space, driving competition in the region. As Fintech transforms the industry, Bahrain strives for regional leadership again. With Bahrain FinTechBay, the largest dedicated Fintech hub in the Middle East and Africa recently opened in Manama. One of the Fintech success stories to pay attention to is PayTabs, an innovative mobile payments company that raised VC investment in excess of \$20 million.

 **Cloud Computing.** The GCC region has a cloud market value of roughly \$670 million. 83% of all traffic in the MENA region is projected to be consumed by cloud services. This potential has led the Kingdom to introduce its Cloud-First Policy last year, focusing on three core pillars: The adoption of public clouds, a preference for cloud IAAS & SAAS across government IT, and grant credit support for businesses transitioning into the cloud. A notable startup success story is Cloud Queue Management System Skiplino, considered one of the leading queue management systems.

 **Gaming.** Bahrain's regional route network and central location allows for easy access to the region's \$1 billion gaming market. The region's market for online gaming is growing at around 13% annually, and mobile gaming at 18%, respectively. Beyond its own, mostly bilingual population, local startups can tap into the localized market reaching 400 million Arabic speakers in the Middle East and North Africa. Bahrain itself has a strong gaming scene, for example in VR, confirmed by various gaming events that attract more than 15,000 attendees combined. The IGN convention, Bahrain Gaming Experience, Animania Bahrain and COMICON are four notable examples. Despite less media buzz and exposure in comparison with Fintech and Cloud Computing, the potential of Bahrain's Gaming sub-sector is beyond debate.

"Bahrain's keenness in enhancing its startup ecosystem comes in line with Bahrain's Economic Vision 2030. Bahrain today offers an attractive hub for leading international and local startups, to build a robust ecosystem, and pave the way for the emergence of new sub-sectors, such as Fintech, Cloud Computing and Gaming. "Labour Fund" Tamkeen aims to support a broader range of startups in Bahrain, working towards an ideal destination for startups."

Dr. Ebrahim Mohammed Janahi
CEO at Tamkeen

"Bahrain's entrepreneurial ecosystem is undertaking a remarkable transformation to lay the seeds of a new dynamic technology and innovation based economy. This transformation is driven by a rich and thriving ecosystem of startups, investors, accelerators, incubators, business networks, advisory and mentorship platforms."

Dr. Nasser Ali Qaedi
Chief Investment & Marketing Officer at Labour Fund "Tamkeen"

Startup Genome Member

Tamkeen is tasked with supporting Bahrain's private sector and positioning it as the key driver of economic growth and development. Established in August 2006, Tamkeen is one of the cornerstones of Bahrain's national reform initiatives and Bahrain's Economic Vision.

Ecosystem Partners

Economic Development Board, Bahrain Development Bank, along with other partners

Ecosystem Deep Dive

Barcelona Spain

Barcelona is a growing ecosystem, home to over 1,000 tech start-ups. Venture exits—IPOs and acquisitions—have grown 4x in the past four years, from five to 21 exits per year from 2012 to 2016. In addition, since 2013, Barcelona has produced an average of one \$100M+ exit per year -- and 2018 continues that trend, with patient testing solutions company STAT-DX acquired by German QIAGEN for \$191 million. The biggest tech exit in the ecosystem in the past 5 years is Privalia, the online-fashion outlet acquired for \$560 million in 2016.

Sub-Sector Strengths

 **Gaming.** 5.8% of the VC investments in the ecosystem from 2012 to 2017 went to Gaming startups, and Catalonia hosts more than 125 gaming companies employing about 2,500 people. Local success stories include Social Point, the gaming company acquired for \$270 million dollars; and major global gaming companies with presence in Barcelona include Ubisoft, Sony and Activision King. Seven Catalan universities offer courses and training in video game creation, 3D games, and visual effects, so the pipeline of talent for Gaming companies is strong.



Health and Life Sciences. Between 2012 and 2017 approximately 15% of the VC investment in the ecosystem went to Health and Life Sciences companies, with the number of Biotech companies in Catalonia growing by 15-30% each year. Today, over a quarter of Spanish biotech companies are located in the region.

Catalonia has a long tradition of work and innovation in this sector, and there are nearly 100 research centers, universities, science and technology parks, and industry organizations that engage in activity related to Biotech and Pharma. From a corporate perspective, Catalonia is home to the five largest pharmaceutical companies in Spain.



Smart City. Catalonia is home to a growing cluster of smart city startups, and the city of Barcelona is a pioneer in the adoption of smart solutions for urban management. There are an estimated 270 smart city companies in Catalonia, employing over 116,000 and with industry-related total annual revenue of \$8.2 billion. Barcelona is the 2nd smart city in the world after Singapore according to Juniper Research in 2016. Home to the annual Smart City Expo World Congress, one of the leading events on technological solutions to urban issues.

“A record high in exports in 2017, above the EU average, clearly shows Catalonia’s dynamic business ecosystem, where its growth is fueled by an open economy, a global, entrepreneurial spirit and its pro-business government. Barcelona, its capital, has recently been named most attractive Southern European investment location by the Financial Times, and is a vigorous powerhouse for creating and expanding startups.”

Joan Romero

CEO at Catalonia Trade & Investment

Startup Genome Member

Catalonia Trade & Investment promotes innovation, internationalisation and investment in Catalonia. For Catalan companies and startups, it organizes trade missions in other countries and connects them through its external network. For international investors and corporations, it offers specialised one-stop-shop services to bring foreign direct investment to Barcelona and Catalonia.

Ecosystem Partners

Antai Venture Builder, BCN Tech City, Conector, Inveready, Nekko Capital, Rousaud Costas Duran, Sabadell Ventures, SeedRocket, Ysios Capital, Caixa Capital Risc, Nauta Capital, Alta Life Sciences, ESADE BAN, Capital Cell, Delvy Law & Finance

“Our universities are very competitive and powerful now in research, and this is helping startups.”

Mariona Sanz

Director of Innovation at Catalonia Trade & Investment

“The environment in Catalonia has improved substantially in the last few years, with more money available and more talented people willing to start their own company rather than work for large companies.”

Luis Gutierrez Roy

Managing Partner at Telegraph Hill Capital

“The culture in Catalonia has always favoured entrepreneurship. Now, very different from 10 to 15 years ago, the motivation and desire to base it on cutting-edge science is there - entrepreneurs will be heroes.”

Lluís Torner

Universitat Politècnica de Catalunya (UPC) and Institut of Photonic Sciences (ICFO)

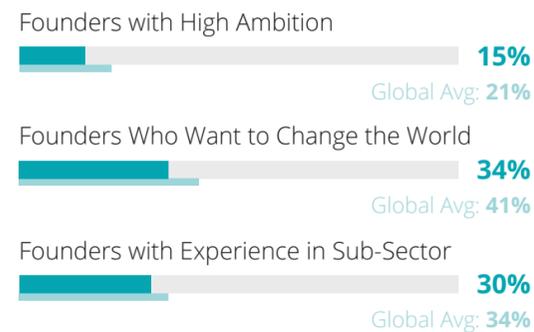
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Berlin Germany

Berlin attracts around 50,000 new inhabitants per year. Roughly one-fifth of local startups have relocated from out of town, the highest rate in the world. With growing international recognition as a major startup hub, leading support organizations are growing their footprint, too. Techstars set up shop in 2015 and already invested in 60 companies, more than anywhere else. While Berlin is undeniably buzzing with early-stage activity, the city needs more large-scale success stories to play in the league of London or NYC. Online car dealer Auto1, which recently received a \$566 million invest from Softbank, shows that it's not impossible.

Sub-Sector Strengths

 **Fintech.** While most value in Germany's financial services industry is created in Frankfurt, Berlin remains at the top as far as Fintech is concerned. The sub-sector is leading locally, too, with roughly 10% of all VC investment between 2012 and 2017 poured into Fintechs--4% ahead of AI, Big Data & Analytics. Local sources project around 40,000 new jobs in Fintech during the next ten years. Many of them will be created by scaleups. Consumer banking startup N26 raised \$212 million to date and counts half a million customers, while up-and-coming B2B Banking platform SolarisBank already secured \$95 million in just two years.

 **IoT.** Around half of Berlin's IoT-focused organizations were founded in 2012 or later. That said, renowned research centers and corporates are among them, too. German Industry giant Bosch recently opened a large IoT campus, staffing 250 employees with the objective to connect with Berlin's thriving innovation ecosystem. Interesting startup activity is found at the intersection of IoT and Blockchain technology, which is the focus of company builder Next Big Thing. IOTA is a Berlin-based startup that currently receives a lot of attention for having built an innovative decentral transaction layer for machine-to-machine interactions.

 **Health and Life Sciences.** Berlin's relevance as a Health and Life Sciences hub is not a secret. Three Universities rank in the top 50 globally in several Medical and Life Science disciplines, while Healthcare giants such as Bayer or Pfizer operate vertically focused labs and accelerator programs. Successful startups benefit from Berlin's industry expertise as much as the depth of talent mastering disciplines such as data science and software engineering. Ada Health is an emerging Health startup worth mentioning, leveraging AI to build an innovative medical app with almost \$70 million in funding.

„Being a core part of the European ecosystem, the Berlin startup industry grew up. It's great to see how we're getting used to larger funding rounds, but also to a new generation of second-time founders. Successful entrepreneurs committing themselves as business angels by reinvesting capital into the ecosystem and international VCs tackling the European market show that we're on the right way. Despite positive signals, we're not catching up with US and China.”

Florian Heinemann
Partner at Project A Ventures

Ecosystem Partners

Senate Department for Economics, Energy and Public Enterprises, Hasso Plattner Ventures, HIIG, The Factory, NKF Media, Project A Ventures, Rocket Internet, St. Oberholz, Microsoft Ventures, Berliner Startup Stipendium, Get Started by Bitkom, RCKT, RWK

“Berlin boasts a skilled and international workforce and is home to a lively and innovative tech industry. The city’s startup-friendly environment, growing fintech community and abundant global tech talent make it an attractive place for fintech founders. Moreover, Berlin’s fintech industry attracts ever increasing interest from investors and from major banks launching dedicated innovation hubs - all this helps startups thrive.”

Jens Woloszczak
CEO at Spotcap

“The city of Berlin has a long tradition to welcome talented people from all over the world. In Berlin you can feel the enthusiasm, in Berlin you can work on the chances and perspectives of a sustainable and progressive future. The Berlin tech- and startup ecosystem is working hard, and we as a city support these unique and outstanding people.”

Ramona Pop
Mayor and Senator for Economy, Energy and Enterprises

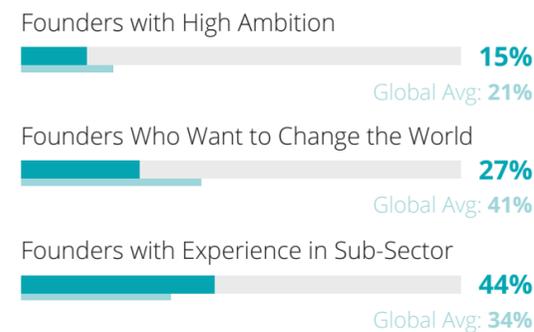
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Frankfurt Germany

Frankfurt is the European Union's financial center with the European Central Bank headquarters and over 70,000 people employed in financial services institutions. The looming Brexit as well as Frankfurt's central location in Europe, coupled with its still moderate real estate prices and living costs is further increasing the region's attractiveness as an excellent spot for Entrepreneurs and Startups looking to eventually expand to other European countries.

Sub-Sector Strengths

 **Fintech.** Unsurprisingly, Frankfurt's strongest startup Sub-Sector is Fintech. More than 50% of local VC investment went into Fintech startups between 2012 and 2017. Almost all major banks and financial institutions in the world have their German or global headquarters in the city and most of them launched programs specifically tailored towards the needs of Fintechs and Insurtechs. Examples are Deutsche Bank's Digitalfabrik, a program that supports the development of digital banking projects or Commerzbank's main incubator.

The largest German Fintech exit of all time took place in Frankfurt almost three years ago. The Forex trading company 360T was ac-

quired for almost \$800 million by Deutsche Börse, which runs the Frankfurt Stock Exchange, and serves as a role model for Fintechs in Frankfurt demonstrating that big exits are possible in Frankfurt.

 **AI, Big Data & Analytics.** The region boasts many top-notch universities, such as the Technical University Darmstadt or Goethe University Frankfurt with many of them running specific programs tied to Big Data & Analytics. One of them is the Frankfurt Big Data Lab Start-up Program by Goethe University, which offers general training courses for data computation and analytics by startups. Prominent startup examples in the AI space include Arago, a company that helps businesses automate their IT processes through intelligent automation and that raised \$55 million in funding and Savedroid, a company developing an AI-app for saving & spending of their users.

 **Cybersecurity.** While not nearly as large as the local Fintech sector, Cybersecurity is just taking off. Acellere, a startup developing analytics software to help minimizing code errors and task prioritization announced their Series A funding round of \$2.5 million this January. Another successful example is the digital authentication company Authada, coming out of the Technical University Darmstadt.

"The Frankfurt region combines a solid (digital) infrastructure, the right kind of talent, globally acknowledged research & teaching and a decade-long experience of established companies. The Masterplan for the FinTech and Startup region Frankfurt Rhein-Main, developed by TechQuartier, defines specific measures to foster the creation of tomorrow's ideas, businesses and innovation. Together with partners from industry, science and politics, the State Government of Hessen fully supports the implementation of the Masterplan."

Tarek Al-Wazir

Hessian Minister of Economics, Energy, Transport and Regional Development

Startup Genome Member

TechQuartier is an international community, incubator and co-working space located in Frankfurt. With their unique network of corporate and technology partners, service providers, investors, academic institutions and government officials, they offer an ideal environment for ambitious entrepreneurs to trade ideas and scale their businesses.

Ecosystem Partners

Accelerator Frankfurt, blackprint Booster, candylabs, Commerzbank, Deutsche Bank, Deutsche Börse Group, DZ Bank Gruppe, EY, Frankfurt Economic Development, FrankfurtRheinMain, Get started by Bitkom, Goethe University Frankfurt, Gründerküche, Hessen Trade & Invest, Hessian Ministry of Economics, IHK Frankfurt, ING-DiBa, KPMG, Merck, Provdavis Hochschule, Rhein-Main Startups, RKW, start zero, TU Darmstadt, WIBank

“The Frankfurt Ecosystem is developing in a remarkably fast pace. During the last two years, universities, corporates and policy leaders have joined forces to collaborate closely towards one common goal: Making Frankfurt a startup hotspot. The magic formula of Frankfurt is its huge talent base paired with a solid infrastructure, lots of multinationals and a local market of 5.5M inhabitants. In particular, with regard to the sub-sectors of Fintech, Cybersecurity and Big Data, Frankfurt has developed a leading position with various promising scale-ups and startups.”

Thomas Funke and Sebastian Schäfer
Co-Directors at TechQuartier

“Frankfurt has a relatively high number of startups in the B2B sector. For the Fintech sector, this results in the proximity to regulators and banks for partnerships. The Frankfurt ecosystem offers the best conditions for starting and growing a Fintech business with access to experienced workforce and investors. We see Fintechs as partners to innovate our business and not as competitors.”

Swen Moellmann
Head of Digital Strategy & Innovation, ING-DiBa

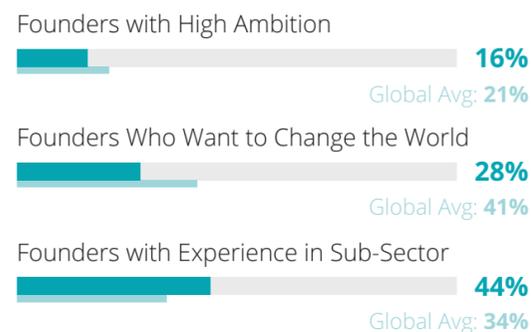
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Greater Helsinki Finland

The Greater Helsinki region has been at the forefront of digital technology for several generations, thanks to world-class universities, a supportive government, and the one-time dominance of Espoo-based Nokia. Every winter, the area attracts founders and investors from across the world not least due to its popular startup conference Slush. The national government is closely involved in the ecosystem through the innovation and internationalization agency Business Finland, which provides support to accelerate Finnish startups. Through a close-knit startup community, founders help each other and spread information and know-how.

Sub-Sector Strengths

 **Gaming.** Gaming startups in Greater Helsinki have attracted worldwide acclaim and attention, led by Rovio and Supercell, and scores of new companies have been founded in just the past few years. A notable feature is collaboration among gaming developers and founders, and the multigenerational evolution: many game developers today, for example, gained experience at Remedy, founded in the 1990s. Now, Rovio and Supercell have exerted a wider effect on the Greater Helsinki region as their executives and employees start and invest in a new generation of gaming startups, including Seriously, a new gaming leader.

 **AI.** The Finnish government declared it to be a “common national vision” to develop and implement AI in effective ways for social improvement. Research at the new Finnish Center for AI, created by Aalto University and the University of Helsinki, is already generating innovations. The Deep Learning Research Group at Aalto University produced the Curious AI Company, which is competing directly in general AI with tech heavyweights like Facebook and Google. A Curious AI founder previously started ZenRobotics, which uses AI-powered robots to sort through different forms of trash and raised \$17 million in funding.

 **Health and Life Sciences.** An intriguing local development in the area of Life Sciences & Health is the recent launch of FinnGen, one of the most ambitious genetic research efforts in the world, aiming to analyze hundreds of thousands of Finnish blood samples to develop new therapeutics and diagnostics. A leading treatment for opioid overdoses in the U.S. was developed in Helsinki, and regional health care institutions are applying AI to identify and treat diseases. Local success stories include Blueprint Genetics, a genetic testing company that raised \$17 million in funding last year and already counts customers in 40 countries.

“Helsinki has one of the leading startup ecosystems in the fields of in the information and communications technology, gaming and cleantech. Recently we have witnessed rising stars also in health. We have excellent co-operation between startups, cities, corporations and research institutes, which makes Helsinki very strong in order to solve great global challenges.”

Marja-Liisa Niinikoski
CEO at Helsinki Business Hub

Startup Genome Member

Helsinki Business Hub, the regional development agency for the Finnish capital region, seeks to make Greater Helsinki the most attractive business environment for foreign companies in Europe. They empower foreign companies to create value in Greater Helsinki by providing the right information and contacts and by designing growth opportunities for our customers, free of charge and based on full confidentiality.

Ecosystem Partners

Nestholma, Arctic Startup, Espoo Innovation Garden, NewCo Helsinki, FVCA, Tekes

"We have an excellent track record with Gaming industry in Helsinki and Finland. It comes from decades of sharing information openly among the game developers."

Jan Ameri

Chief Innovation Officer at ArcticStartup

"I started my first tech startup more than a decade ago and today it is impossible to understand how much Helsinki has developed as a startup hub since those days. Something happened and today we have a great, informal and very active community of entrepreneurs, investors and advisors and it is extremely easy to connect to European, US and Asian peers. Helsinki has always had very good talent available for with a very reasonable salary level, but I think we are only now starting to see the benefits and power of our talent pool."

Tommi Lehtonen

CEO at Blueprint Genetics

Founder Mindset



Founder Know-How



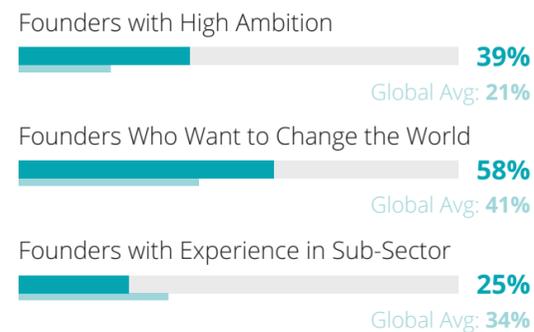
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Istanbul Turkey

New Member

Since the beginning of its history, Istanbul has been an essential bridge for commerce and enterprise between East and West — and it continues living this tradition. In 2018, Istanbul is hosting the Global Entrepreneurship Congress (GEC), a gathering of thousands of entrepreneurs, investors, researchers, and policymakers from over 170 countries that come to work together on new ways of growing startup ecosystems everywhere.

In addition to major events like GEC, Istanbul is home to Startup Istanbul — an event bringing investors from all corners of the world to connect them to top startups, especially from the Middle East. The attendees from over 65 countries include high-profile investors like Steve Blank, Chris Schroeder, and Tim Draper; as well as accelerators like Y Combinator, 500 Startups, and TechStars.

Sub-Sector Strengths

 **Fintech.** Turkey has five Forbes 2000 financial companies and banks — including Garanti Bank and Akbank — with a combined revenue of \$42.8 billion per year. These corporates have are part of an advanced banking infrastructure that is an asset for Fintech startups.

Fintech's importance in the sub-sector is essential; it brings the most amount of VC investments in the Istanbul ecosystem, with 24% of the total investment from 2012-2017. Despite the growth in VC investment (with iyzico raising a \$15 million Series C round, for example) and notable exits like Ininal, the debit card platform, and Pozitron, acquired by Monitise for \$100 million in 2014, a major activity in Fintech exits has yet to materialize.

 **Adtech.** With \$12.4 billion spent in advertising in Central and Eastern Europe, and \$18.2 billion spent in the Middle East and Africa, Istanbul's Adtech startups are in a strong place to become regional leaders in the space. Recent exits include Ad-phours, the Adtech company focused on travel. A total of 6.6% of the VC investment in Istanbul from 2012-2017 has gone to Adtech.

 **AI, Big Data & Analytics.** AI, Big Data & Analytics is the startup sub-sector attracting the third highest level of VC funding (4.1%) in Istanbul from 2012-2017. The VC funding going to this sub-sector has gone up consistently in the past three years, and recent rounds include Insider, the analytics for marketing platform, for \$2.2 million.

“All the players in the Istanbul startup ecosystem have one shared goal: to make Istanbul the centre of entrepreneurship of the region and to help promising Turkish startups go global. Entrepreneurs, Investors, established companies, NGOs and government agencies are working together to achieve this goal”

Emre Kurttepli

Chairman, Endeavor Turkey

Startup Genome Members

The **Union of Chambers and Commodity Exchanges of Turkey (TOBB)** is the largest entity representing the Turkish private sector with more than 1.3 million members and operations in 81 cities.

Endeavor is leading the global movement to catalyze long-term economic growth by accelerating the high-impact entrepreneurs in 30 growth markets. Endeavor Turkey was founded in 2006 and to date accepted 58 entrepreneurs to its network.

Turkish Exporters Assembly (TIM) is an umbrella organization for the 70,000 exporting firms in Turkey, coordinating both private and public sector.

Habitat Association is a Turkish NGO developing and implementing projects in sustainable urban development, ICTs and digitalization, financial education, technology innovation, and entrepreneurship.

“Istanbul’s startup ecosystem is growing rapidly with its young population, sophisticated infrastructure and investment rounds. Entrepreneurs are the greatest strength in Turkey’s development but they cannot do it alone – all stakeholders should join forces to help create a successful ecosystem. There is a saying, ‘If you want to go fast go alone, if you want to go far, go together.’”

Ali Sabancı

GEC Istanbul Platform Chair and TOBB GGK President

“Turkey has been a global leader in retail banking innovation in 1990-2000s, and we believe the professionals who delivered this change, combined with the well educated high-tech workforce at a fraction of Western Europe / U.S. costs, will bring along regional leaders in Fintech.”

Cenk Bayrakdar

Managing Partner, Revo VC

“The Fintech world is on the rise globally as well as is in Turkey. For us, in this scenario, one of the most anticipated developments will be solutions cultivated for the unbanked people who amount to 40% of the population.”

Barbaros Özbugutu

Cofounder, İyzico

Ecosystem Demographics

Metropolitan GDP
\$349 bn
 Global Avg: \$267 bn

Metropolitan Population
15 m

Ecosystem Performance

Ecosystem Value
\$1.4 bn
 Global Median: \$4.1 bn

Startup Output
600 - 900
 Global Avg: 1,700

Growth Index
3.7

Funding

Early-stage Funding per Startup
\$113 k
 Global Avg: \$252 k

Market Reach

Foreign Customers
22%
 Global Avg: 23%



Talent

Experienced Software Engineers
71%
 Global Avg: 72%

Experienced Growth Employees
63%
 Global Avg: 60%

Visa Success Rate
90%
 Global Avg: 41%



Startup Experience Index
5.0

Founders Demographics

Women Founders
<10%
 Global Avg: 16%

Immigrant Founders
11%
 Global Avg: 19%

Resource Attraction

Entrepreneurs
17
 Global Avg: 300

Startups
30
 Global Avg: 83

Ecosystem Deep Dive

Jerusalem Israel

With its unique geopolitical and social position as the nexus of the three world religions Judaism, Islam and Christianity, Jerusalem is one of the most inherently challenging communities in the world. Yet, Jerusalem is well-known for its diverse startup community that is attracting high-potentials from all over the world (34% of local founders are immigrants). The ecosystem thrives on close collaboration between leading academic institutions and the innovation community, providing startups with top talent and breakthrough research, building the basis for Jerusalem's excellence in specific startup Sub-Sectors.

Sub-Sector Strengths

 **Health and Life Sciences.** Tel Aviv may be Israel's high-tech capital, but the heart of Life Sciences and Biotech innovation lies in Jerusalem. The city is home to some 150 Life Sciences companies that employ more than 3000 people and accounted for 27-29% of local VC investment over the past 6 years. Nearly half of the Biotech and Medical research in Israel is conducted in Jerusalem at the Hebrew University of Jerusalem and its affiliate Hadassah Medical Center. This research often translates into successful startups like Oramed Pharmaceuticals, a company devel-

oping proprietary oral drug delivery technology which is based on over 30 years of medical research at Hadassah. Next to academic institutions there is a number of growing platforms for Life Science entrepreneurs in the city such as BioGiv, BioHouse, Alynnovation or BioJerusalem, which serves as a one stop center for all Life Science companies in Jerusalem facilitating connections between companies, hospitals, academia and the government. Other startup success stories in the Sub-Sector include Gamida Cell, a leader in the development of stem cell therapy technologies and products (Total Funding \$98 million).

 **AI, Big Data & Analytics.** Between 2012 and 2017 around 20% of local VC investment went into AI, Big Data & Analytics startups. Over the last years the ecosystem developed specific expertise in the fields of Computer Vision and Image Processing. Primary examples are autonomous-driving company Mobileye which has been acquired in 2017 by Intel for \$15.3 billion, making it the largest-ever exit of an Israeli company and OrCam, a startup developing wearable aid for people with impaired vision which is valued over \$1 billion. Both startups were co-founded by Amnon Shashua, who is a computer science professor at the Hebrew University in Jerusalem.

"The phenomenal mix of a highly-engaged startup community together with the establishment of more and more supportive platforms for entrepreneurship has turned Jerusalem to be one of the most entrepreneurs-friendly cities around the world. Looking ahead, we believe the next growth phase lies in strengthening the bridges between the top-notch academic environment in the city and the innovation community. The government investment in the developing the ecosystem is planned to grow immensely in order to leverage the momentum the city has gained in the past few years."

Itzik Ozer

Head of Business Development at The Jerusalem Development Authority

Startup Genome Member

Jnext supports technology innovation development and works to transform Jerusalem into a magnet for hi-tech ventures and early-stage companies.

Ecosystem Partners

BioJerusalem, Startup Nation Central, Jumpspeed, Siftech, Masschallenge Jerusalem, Made in JLM, Bizmax, Ourcrowd, HUstart, AtoBe, JVP, VLX

“The Jerusalem startup scene has recently developed real momentum. OurCrowd is proud to be part of this rapid growth, funding almost 150 companies from our Jerusalem headquarters. We are convinced that Jerusalem will be a magnet not only for global tech companies such as Intel-Mobileye, but for 100’s of new startups who will benefit from this world leading tech hub with phenomenal technology, beautiful weather, unequalled history and atmosphere, and the world’s greatest humus.”

Jonathan Medved
CEO and Founder, OurCrowd

“There is no question that health-related research and development currently being conducted in Jerusalem is among the world’s best. The strength of Hebrew University and its close relationship with the network of research centers and hospitals in the city have led to the development of a vibrant healthcare-innovation ecosystem, even before the full potential of the increasing numbers of initiatives in this area as well as increase in capital pool have been fully realized.”

Dr. Yaron Danieli
CEO of Yissum at The Hebrew University of Jerusalem

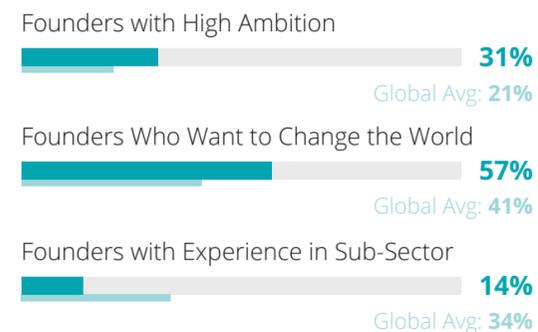
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

London United Kingdom

London is the highest performing European startup ecosystem. Lately, Londoners are increasingly wary that Brexit would limit access to talent and shift venture capital to countries that remain in the EU. For the moment, at least, VC investment is not slowing down. London's tech sector continues to fuel the growth of the UK's digital economy, with the capital's tech firms raising a record \$6.6 billion 2017. The city has developed an infrastructure in which startups can become scaleups, and in eleven cases, even unicorns.

Sub-Sector Strengths

 **Fintech:** London competes only with New York City for the status of the world's major financial centre, with an estimated 315,000 people employed in the financial services sector within the famous "Square Mile" or "City". Unsurprisingly, Fintech was the most prominent Sub-Sector for investors in 2017, attracting a record \$1.3 billion in venture capital (20% of all VC investment in London in 2017), led by major scaleup rounds for TransferWise (\$280 million Series E), Funding Circle (\$100 million Series F) and Monzo (\$100 million Series D). Level39 in Canary Wharf is the biggest hub of fintech talent in London, hosting more than 170 Fintech startups and enabling thousands of invaluable collisions.



Blockchain: Building on its financial services and Fintech legacy, London is one of the largest emerging Blockchain hubs in the world. The city comes in second, after Silicon Valley, for talent in Blockchain development, measured by the number of Blockchain projects on GitHub. Local success stories include Blockchain.com, a company founded in 2011 that builds software for Bitcoin users (Bitcoin wallet, Bitcoin APIs etc.). It recently raised \$40 million in Series B funding. Another example is Cashaa, a blockchain-based banking platform that aims to become a one-stop-shop for financial needs and raised some \$18 million in their ICO in November 2017.



Adtech: London's advertising sector employs nearly 80,000 people. The city boasts advertising giants like AMV BBDO or adam&eveDDB with massive ad spending budgets and some of the world's most creative talent. The city's success as a global advertising hub is strongly related to the local Advertising Technology scene. Several local startups are driving breakthrough technological innovation in the space such as LoopMe, a digital advertising firm that uses AI to optimize mobile video advertising and has raised \$10 million in funding.

"London is the financial and advertising hub of the world, among other things. So it's no surprise that it has been identified as a hub for Fintech and Adtech. More importantly, these industries are very much aware of Blockchain as a potential system to streamline many services in the future. So the fact that this has also been recognised as a strength in this credible Startup Genome report is testament to London's ability to foresee change and embrace it, enabling it to maintain its global competitive status as a dynamic Tech City, at the forefront of global digital innovation."

Gerard Grech

Chief Executive at Tech Nation (formerly Tech City UK)

Startup Genome Member

Tech Nation (formerly Tech City UK) aims to make the U.K. the best place to start and grow a digital business. It does this through free business lifecycle programs, policy thought leadership, and digital skills support.

Ecosystem Partners

MassChallenge, Techstars London, Balderton Capital, Wayra London, Accelerator Network, City of London, KPMG, TechUK, GSMA, Level39, Tech London Advocates, GEN, Microsoft Ventures, Northzone, Microsoft for Startups

“Some companies are pure technology for technology’s sake. Others apply technology into existing markets. While London has both types, it really thrives on the second. Because London is a true global leader for industries such as finance, fashion, advertising and more, some of best startups in London meld these different spheres, making it a particularly strong place to build, for example, Fintech, Fashiontech or Adtech companies. This is all about the talent at the end of the day and, in London, unlike in the Bay Area, there’s a lot of finance, fashion and advertising talent.”

Suranga Chandratillake
Partner at Balderton Capital

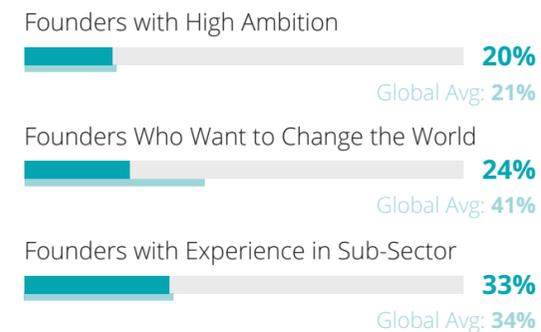
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Malta

Malta is the most densely populated country in Europe and its central position in the Mediterranean makes it a highly strategic dynamic hub. With the United Kingdom leaving the EU, Malta becomes the only officially anglophone nation in the EU and a possible relocation destination for those UK start-ups and companies searching for stability and a better point of entry into the European market.

Sub-Sector Strengths

 **Fintech.** Malta's well-established financial services sector counts more than 25 credit institutions and helped the country to build a thriving local Fintech industry that accounted for 15-17% of local VC investment between 2012 and 2017. The local scene thrives on tax benefits and a favorable regulatory environment that successive governments have implemented and promoted. A local success story is Truevo: Formerly known as Swish Payments, Truevo enables users to accept payments anywhere by transforming their mobile phone into a point-of-sale (PoS) terminal. The company possesses a European banking license and has partnered with both Visa and MasterCard.



Blockchain. Targeting the domain of Blockchain and related activity, the Maltese Government recently launched a consultation process on the establishment of a Malta Digital Innovation Authority (MDIA) and the development of a regulatory framework to oversee the uses of distributed ledger technologies (DLT) and related service providers. The framework is intended to facilitate the certification of DLT platforms in Malta, to oversee the principal service providers to DLT Platforms, and to provide regulatory oversight on issuers of ICOs. Binance, the world's largest cryptocurrency exchange by traded value is planning to open a "fiat-to-crypto" exchange in Malta and partner with local banks that can provide access to deposits and withdrawals.



Gaming. As the first EU country to license online gaming, Malta has seen two decades of uninterrupted growth in this sector. Today, the gaming industry makes up for 12% of the Maltese economy and employs around 9,000 people. Over 280 gaming companies are based in the country, including Betsson, Tipico and Betfair. Gaming startups make up for around 46% of local VC investment over the last 6 years. A prominent example is the fantasy soccer esports company Oulala whose founder, Valery Bollier, is also the founder of Silicon Valletta, one of the most important local startup associations.

"The Maltese ecosystem stands out as an attractive alternative to the traditional hubs in Europe. Our regulatory nimbleness, low burn-rate and the characteristic lifestyle make Malta a desirable destination for startups and scaleups. Malta's growing founder community is testament to this reality."

Dr. Edward Woods

Chairman at Malta Communications Authority

Startup Genome Member

The Malta Communications Authority (MCA) is responsible for maximizing the benefit derived from developments in ICTs by stimulating innovation, increased awareness, and opportunities in business and society.

“Sherpa is an innovative new insurtech business. As such, we chose Malta as a base because of the availability and quality of tech resource, the willingness of the regulator to embrace new ideas and their approachability, and the access Malta provides to the whole EU. Add in to that the robust English-based legal and financial systems, rapidly developing local start-up funding options, and the lower operating costs, and it was an easy choice to make. We are also encouraging other Fintechs to consider Malta through our involvement in Silicon Valletta.”

Chris Kaye
CEO & Co-Founder at Sherpa

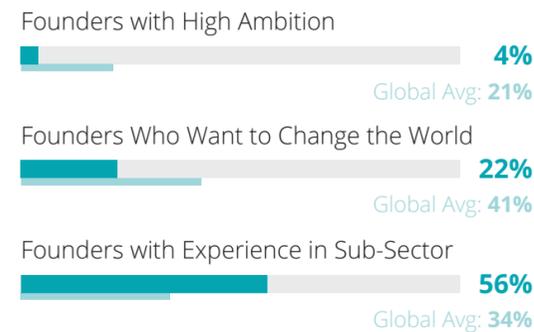
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Munich Germany

New Member

Munich is home to Germany's most powerful economy, with a third of the country's 30 major public companies headquartered here. Startups thrive due to the immediate access to leading research institutes and industry giants, especially in B2B. The headquarter of IBM Watson IoT is located here, as well as respective labs of Microsoft, Intel, Huawei and Accenture. Munich has an Ecosystem Value of around \$4.5 billion, supported by three top-tier Universities and roughly 45 VC investors ranging from Target Partners to Vitruvian Partners, a leading PE firm with a current fund of almost \$3 billion.

Sub-Sector Strengths

 **Fintech.** Around 11% of local VC investment between 2012 and 2017 went into Fintech, making it one of Munich's top three sub-sectors. A notable success story is digital investment service Scalable Capital, which has gathered €500 million in assets in less than four years. BlackRock, the world's biggest asset manager, took a stake in the company last year in exchange for \$30 million. That said, Munich's strongest suit in Fintech is Insurance. Munich-based Allianz and Munich Re are two industry heavyweights of global renown, offering two of the various local, vertically-focused support programs alongside Werk1 and others.

 **Healthcare.** Munich's Healthcare sector consists of some 350 companies that generate more than \$5 billion in combined revenues. Fraunhofer Society, Europe's largest institution for applied research, is just one of many key institutions headquartered in Munich. In the Medical Technology discipline, LMU Munich ranks fifth globally, while TUM ranks 22nd, respectively. Two startup success stories are Sapiens and Definiens. The former is a medical device company delivering solutions for deep brain stimulation therapy, which sold for \$200 million in 2014. Definiens provides solutions for digital pathology and sold in the same year for \$150 million.

 **Mobility:** Automotive is Munich's leading sector by means of employees and turnover. In addition to brands like ADAC, BMW, MAN, and Audi headquarters in close proximity, the cluster concentrates organizations along entire Mobility value chains. This drives startup activity, for example in Advanced Manufacturing & Robotics. Between 2012 and 2017, 10% of all local VC investment went into this sub-sector, ranking it among the top 3. Local universities rank among the top 15 globally in related engineering disciplines, a sustainable source of new talent and latest knowledge. The biggest success story is Flixbus, which became Europe's largest long-distance mobility provider in less than five years, funded post Series-D.

"The Munich startup ecosystem consists of leading universities within Germany and Europe, world-renowned corporate partners, and an extensive network of the financial industry; excellent infrastructure and quality of life top it off."

Gabriele Böhmer

CEO at Munich Startup

Startup Genome Members

City of Munich, IHK for Munich and Bavaria, Invest in Bavaria, LMU Entrepreneurship Center, Munich Startup, Unternehmer-tum, Strascheg Center for Entrepreneurship (SCE)

Ecosystem Partners

48forward, ammersee Denkerhaus, AZO Anwendungszentrum, Bavarian State Ministry of Economic Affairs, Energy and Technology, BayStartUp, Bayern Kapital, BioM, Bits & Pretzels, brigk, Burda Bootcamp, CDTM, CM Equity, DLD, Early Bird, Extorel, Fraunhofer Venture, Gate, German Entrepreneurship GmbH, HV Holtzbrinck Ventures, HWK, Impact Hub, IZB, Ludwig Bölkow Campus, Make Munich, Max Planck Institute for Innovation and Competition, MCBW, Media Lab, MTZ, Munich Network, MUST, next47, Social Entrepreneurship Akademie, Startup Alm, Stellwerk 18, Target Partners, UN World Food Programme Accelerator, W1, Wayra, Werk1

“Munich’s startup ecosystem is boosted by over one hundred support organizations like startup incubators, accelerators, entrepreneurship programs, co-working spaces, coding schools and maker spaces. What makes it very special is the open innovation culture connecting startups, universities and established companies.”

Helmut Schönenberger

CEO at UnternehmerTUM

“Companies in and around Munich offer a wide range of cooperation opportunities. Multinationals as well as the successful German “Mittelstand” (SMEs) provide innovation projects. They collaborate with startups to develop new products and services. That helps startups to finance themselves, since earnings are the best way of funding.”

Claudia Schleich

Head of Division for Startups at Chamber of Commerce and Industry for Munich and Upper Bavaria

Ecosystem Demographics

Metropolitan GDP
\$133 bn
 Global Avg: \$267 bn

Metropolitan Population
5.2 m

Ecosystem Performance

Ecosystem Value
\$4.4 bn
 Global Median: \$4.1 bn

Startup Output
500 - 900
 Global Avg: 1,700

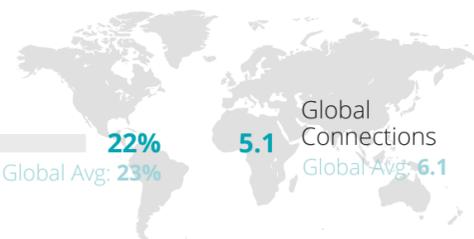
Growth Index
5.5

Funding

Early-stage Funding per Startup
\$416 k
 Global Avg: \$252 k

Market Reach

Foreign Customers
22%
 Global Avg: 23%



Talent

Experienced Software Engineers
64%
 Global Avg: 72%

Experienced Growth Employees
51%
 Global Avg: 60%

Visa Success Rate
NA
 Global Avg: 41%



Startup Experience Index
5.5

Founders Demographics

Women Founders
<10%
 Global Avg: 16%

Immigrant Founders
20%
 Global Avg: 19%

Resource Attraction

Entrepreneurs
16
 Global Avg: 300

Startups
NA
 Global Avg: 83

Ecosystem Deep Dive

Paris France

The Parisian startup ecosystem saw a successful 2017, including a number of announcements that drove global exposure and international resource attraction. The President of France, Emmanuel Macron—a former investment banker—has pledged over \$11 billion to make France a “country of Unicorns”. According to his plan to improve foreign startup attractiveness by 2020, 30% of startups in Parisian incubators must be foreign. Mechanisms in place to achieve this include a four-year startup visa program, called the French Tech Ticket, for entrepreneurs, engineers and investors. Early 2017, Station F opened its doors as the world’s largest coworking and incubation space.

Sub-Sector Strengths

 **Education Tech.** The French Edtech Observatory lists 322 innovating companies, most of them startups, that are reshaping education with new technologies. The local market is accelerating, with two thirds of the listed companies having existed for less than three years, and 75% of them having less than 10 employees. Primary examples include OpenClassrooms: a platform for online courses that counts over 1 million members today and has raised \$10 million in funding. Another example is that of Ornikar: a startup that recently raised about \$12 million in Series A funding and is set to become the first national online driving school.

 **Fintech.** Paris is home to some of the European Union’s leading banks, the pan-European Euronext stock exchange, and a thriving Fintech scene. Between 2012 and 2017, 11% of local VC investment went into the sub-sector, with more than \$200 million invested in 2017 alone. The largest deal in 2017 went to consumer lending platform Younited Credit, which raised \$47.8 million in a Series F round. Top-tier events like the Paris Fintech Forum confirm that Paris is an international pole of attraction for Fintech expertise, bringing together more than 180 related innovators and companies from all over the world.

 **Healthtech.** In 2011, France spent 11.6% of GDP on healthcare, a figure much higher than the average spent by countries in Europe, making it a good environment for Healthtech startups to thrive. The most successful one is Doctolib, an online and mobile booking platform that helps to find and book consults with specialist doctors nearby. The platform is used by over 40,000 physicians in Europe and the company raised \$42 million in Series D funding in November 2017. Another highlight is CardioLogs, which recently raised \$6.5 million in Series A funding. Founded in 2014, the company leverages cutting-edge machine learning technology and medical expertise to deliver interpretation services for healthcare professionals to screen patients for cardiovascular diseases.

“Paris is now considered to be the biggest biotech hub in Europe. There is a huge pool of IP and talents with high-level PhDs willing to turn their research into impactful solutions through entrepreneurship, a very innovation-friendly environment, both in terms of culture and fiscal incentives, and several big pharmaceutical companies and VCs.”

Arnaud de la Tour

Vice President and Co-Founder at Hello Tomorrow

Ecosystem Partners

Balderton Capital, Hello Tomorrow, La French Tech, Mairie Paris, Paris & Co, Le CENTQUATRE-PARIS, France Digitale, The Family, Cap Digital, beelev

“Paris has emerged in the last couple years as one of the most (if not the most) dynamic place to start and develop a tech business. The extraordinary technical talent that has always existed in the top schools and universities is now combining with the brightest of the business school minds to start extraordinarily exciting companies with world-leading tech. New initiatives like Station F, Ecole 42 as well as new sources of funding from BPI, and the growing number of venture capital funds at all stage participate in making France a startup nation. We see this in AI, crypto assets, cloud-based software, fintech and many other sectors.”

Bernard Liautaud
 Managing Partner at Balderton Capital

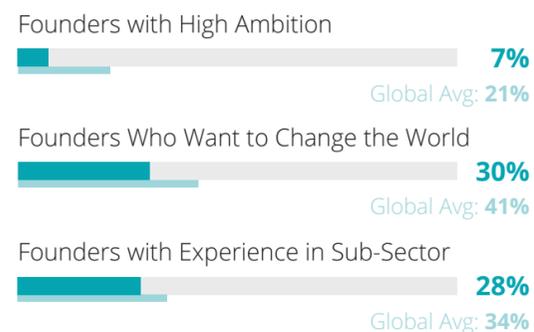
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Stockholm Sweden

The Swedish capital city Stockholm may be a small city with under 1 million inhabitants, but it has produced more Unicorns per capita than any other ecosystem in the world (excluding Silicon Valley). 18% of Stockholm's local workforce work in high-tech related jobs—the EU average is at 10%—and 5 out of the 10 fastest growing companies in Europe are Stockholm-based¹. In 2016, the city attracted 54% of the total capital invested in the Nordic countries, while accounting for only 4% of the population of the region.

Sub-Sector Strengths

 **Gaming:** Over the last 6 years, 8% of local VC investment went into Gaming startups. Stockholm is home to international Gaming success stories like Candy Crush, Minecraft and the Battlefield series. With one of the most competitive gaming industries in the world, Sweden boasts the second-highest concentration of video game studios per capita worldwide. According to 2017's Game Developer Index, there are some 2,500 game developers employed by 123 companies in the Greater Stockholm region. These companies range from Gaming giants like King, Mojang and Paradox Interactive, to smaller independent studios like Lionbite Games and Fatshark.

 **Fintech:** Some 21% of all local VC investment between 2012 and 2017 went into Fintech startups. The ecosystem contains large successful Fintechs such as Klarna—a provider of e-commerce payment solutions for merchants and shoppers that already raised roughly \$630 million in total funding; and iZettle, a mobile payments company which raised around \$330 million. The subsector's annual inflow of funding remains relatively steady at around \$120 million annually since 2015. Two emerging players each received \$10 million+ in investments in 2017: Tink, an app that allows users to connect all their cards and bank accounts and Qapital, a personal banking app that helps customers save money.

 **Cleantech:** Stockholm City Government's official target is to make the Stockholm region CO2-free by 2040, a goal that is driving a dynamic market for alternative fuels and renewable energy. Consequently, some of the largest funding rounds in Stockholm in 2017 were by Cleantech startups like Northvolt, the battery startup founded by former Tesla executive Peter Carlsson, which raised a round of roughly \$64 million.

"Stockholm punches above its weight. With a long list of success stories that have reached the global stage over the past decade, Stockholm is now delivering a second and third generation of tech entrepreneurs. From King, Spotify, Klarna, and beyond we are now seeing businesses like Soundtrack Your Brand, founded by an ex-Spotify executive and the co-founder of Beats Music, emerge as the new global winners. In a similar wave, Stockholm now also has an active pool of angels that have been along for the ride once or twice before, fuelling the growth and taking the sting off the risky business of starting up."

Lars Fjeldsoe-Nielsen
General Partner at Balderton Capital

Ecosystem Partners

Balderton Capital, Business Sweden, Impact Hub, Northzone, SISP, SUP46, Stockholm Business Region, Stockholm Chamber of Commerce, Stockholm School of Entrepreneurship

¹ <https://startupsventurecapital.com/10-most-impressive-facts-about-stockholms-tech-scene-6531de033c27>

“Following the success of gaming companies like Minecraft, DICE, King and Paradox, next generation startups are now revolutionizing the VR space and the E-sport arena. Seasoned developers, creatives and entrepreneurs are joining and investing in these new companies which is significantly increasing their potential. My personal favorite is Neat Corporation—VR studio releasing their first title “Budget Cuts” in May 2018.”

Jonas Almeling

Head of Innovation and Ecosystem at Business Sweden

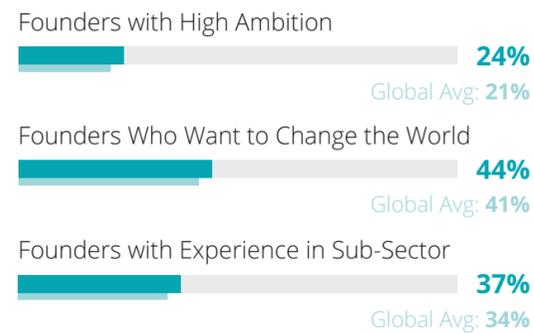
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Tel Aviv Israel

Tel Aviv is known as the startup capital of Israel, the country known as “Startup Nation” with the highest number of startups per capita in the world. Startup success in this young ecosystem - 29% of the population is between the age of 18 and 35 - is driven by the government’s innovation policy, technology innovation coming from the national military forces, and the city’s culture of diversity and collaboration.

Sub-Sector Strengths

 **Cybersecurity.** Israel is a dominant force in the global Cybersecurity industry, accounting for around 16% of global Cybersecurity investments, second only to the US, and raising \$814.5 million in VC and private equity investment in 2017. There were 14 exits by Israeli Cybersecurity companies with a total exit value of \$1.4 billion in 2017 one of them Fireglass, a browser isolation technology developer who got acquired for \$250 million in July 2017 by Symantec.¹ Unit 8200, an Intelligence Corps of the Israel Defense Forces plays a key role in the ecosystem and has evolved into a prolific technology incubator for Cybersecurity startups.

¹ According to Start-Up Nation Central Data

 **Automotive.** With the increasing reliance of cars on software and intelligent technology, Tel Aviv is becoming a world center for Autotech and related technologies with investment in the space increasing some 200% over the past 3 years. Many international carmakers like Daimler, Porsche or Renault have launched research and development centers in Tel Aviv looking to partner up with local startups focusing on automation, smart mobility and collision avoidance. The biggest local success story is Waze, a navigation app that got acquired by Google for \$1.3 billion.

 **Adtech.** The local Adtech sub-sector accounts for around 7% of the total VC investment in Tel Aviv over the last 6 years. There is a number of Israeli Adtech startups that have become global powerhouses over the last years, one of them being ironSource which offers monetization and distribution solutions for developers and is currently valued at more than \$1 billion. Two other of the world’s most relevant content marketing platforms, Taboola and Outbrain were both founded in Tel Aviv.

“We believe that our high-tech sector must open the market to foreign talent in order to keep growing. For that, Tel Aviv Global together with our governmental partners, is working on continuing the process of: attracting Int’l R&D centers; opening Int’l accelerators; encouraging foreign entrepreneurs to work in the city; and promoting the activity of global corporations.”

Eytan Schwartz
CEO at Tel Aviv Global

Startup Genome Member

Tel Aviv Global is an initiative started by the Mayor’s Office of Tel Aviv-Yafo designed to position Tel Aviv as a global city and a leading international business center that specializes in innovation.

Ecosystem Partners

Startup Nation Central, Geektime, SOSA, Microsoft Ventures, Microsoft for Startups

“For a country that has no car manufacturing to speak of, Israel, and Tel Aviv in particular, has become a world center for autotech, with investment in the space jumping 200% over the past 3 years. We might not make the cars here, but we make the brains for the cars.”

Eugene Kandel
CEO at Start-up Nation Central

Founder Mindset



Founder Know-How



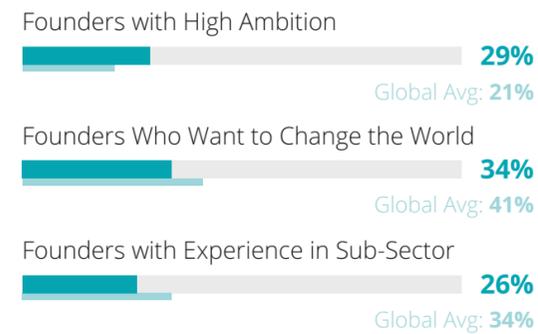
Ecosystem Demographics



Local Connectedness



Founder DNA





Ecosystem Deep Dives Asia-Pacific

Bengaluru

Beijing

Hong Kong

Kuala Lumpur

Melbourne

New Zealand

Shanghai

Shenzhen

Singapore

Sydney

Taipei City

Ecosystem Deep Dive

Bengaluru India

Bengaluru is traditionally home to the Indian headquarters of many global technology companies. Driven by its large talent pool, Bengaluru is also the number one hotspot for Indian entrepreneurs to start and scale their company. Bengaluru thrives on a high cost efficiency for engineers. For instance, salaries are about 13 times cheaper than in the Bay Area and 4 times cheaper than the average salary across Asia-Pacific. However, it's not cost benefits that capture Bengaluru's key competitive advantage, it's its engineering prowess. 94% of Bengaluru-based founders have a technical background, the highest rate in the world. The ecosystem has been maturing, led by Unicorns like Flipkart, Inmobi and Ola.

Sub-Sector Strengths

 **Advanced Manufacturing (IoT).** Advanced Manufacturing and IoT in particular are on a growth path in India. With close to 1000 companies operating in the wider IoT space, the sub-sector has seen an impressive growth rate of over 100% from 2016 to 2017. At a total of around 540 registered IoT companies, Bengaluru is home to an estimated 50% of all IoT startups in India. They can count on extensive support from initiatives like the Intel India Maker Lab, an incubation program for hardware and systems

startups. Since its inception in January 2016, the Maker Lab has supported over 50 startups by offering infrastructure, technology and mentorship.

 **Fintech.** Between 2012 and 2017 almost 20% of all VC investment in Bengaluru went into Fintech startups, making it the largest local sub-sector by means of venture investment. Success stories include that of Capital Float, an online platform that provides working capital finance to SMEs in India that raised \$45 million in August 2017. Then there's Razorpay Modern, a startup that provides payment gateway solutions for India and recently raised \$20 million in series B funding.

 **Edtech.** India has more than 1.5 million schools with over 260 million students. One of the country's most pressing challenges is the need to transform its education system to serve its fast-growing population. Over the past years a growing contingent of local entrepreneurs has shifted its attention to Edtech. A primary example is BYJU, India's largest Edtech company. It is reinventing how students learn through a learning app that offers learning programs for students in class 6-12. The company has already raised a whopping \$244 million from well-known investors like Sequoia Capital, Tencent Holdings and the Chan Zuckerberg Initiative.

"In keeping with global trends Fintech is the largest investment sector in India as well. However, the explosive growth rate of Advanced Manufacturing (IoT) sector, especially in Bengaluru is a pleasant surprise. Indian entrepreneurs are addressing a massive India-focused opportunity of education for the rapidly growing population. BYJU, an Edtech startup, has recently entered the unicorn league through investments from global investors."

Ravi Narayan

Global Director at Microsoft for Startups

Ecosystem Partners

91springboard, Kyron Global, Microsoft Ventures, Global Incubation Services, Microsoft, Tlabs, Nasscom, The India Network

“Bangaluru, being an academic city with a large number of technical institutions and R&D laboratories is an ideal place for technical collaboration in developing and upgrading new products and processes. This presents a unique opportunity for the founders to succeed in the Advanced Manufacturing and Robotics space”

Vinod Shankar

Chief Operating Officer at Global Incubation Services

Founder Mindset



Founder Know-How



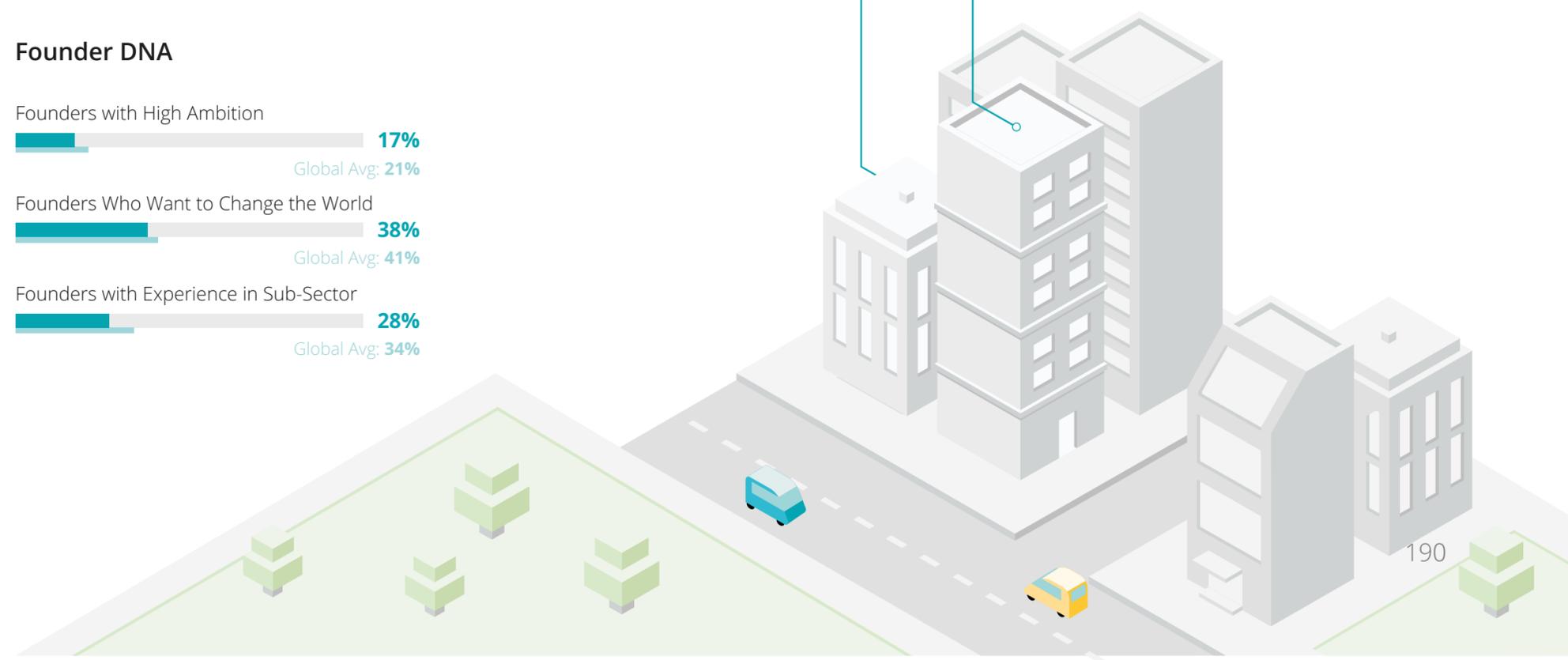
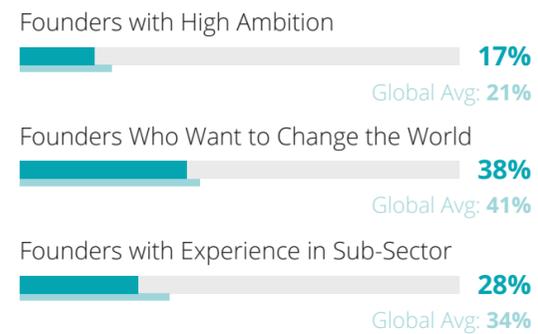
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Beijing China

Beijing is the center of the massive Chinese market, which is—at 1.3 billion people—30% larger than the U.S. and Europe combined. The startup ecosystem is best described in superlatives, too. VC investment in China reached a record high of over \$40 billion in 2017—a 15% increase from 2016—with the largest share captured by Beijing startups¹. To date, the city boasts more than 40 unicorn companies. This is a higher number than any other ecosystem in the world, second only to Silicon Valley.

Sub-Sector Strengths

 **AI, Big Data & Analytics.** The Chinese government positioned AI as a strategic priority and laid out a development plan in July 2017, aiming to become the world leader in the field. Accordingly, the City of Beijing plans to build a \$2.1 billion AI development park in the city's western region that will house up to 400 AI enterprises. Just last year, local investment has been soaring with 7.3% of all local VC investment going into AI, Big Data & Analytics startups. One of the most popular Beijing AI startup is ByteDance, famous for its personalized news aggregator app Toutiao. Founded in 2012, the company is now valued at over \$20 billion.

¹ <https://home.kpmg.com/cn/en/home/news-media/press-releases/2018/01/china-vc-investment-hits-new-heights-in-2017.html>

 **Edtech.** Almost 90 million Chinese citizens educated themselves online in 2016. The Chinese online education market is expected to grow to some 240 million users and a total value of \$64 billion by 2021². China's leading internet giants—Baidu, Alibaba Group Holding, and Tencent—have all invested heavily in online education. A beneficiary of this trend is Yuanfudao, which became the first Chinese Edtech unicorn in 2017. There's also VIPKID, an online English learning platform for children aged between 4-12, that raised \$200 million in its Series D round in August 2017.

 **Blockchain.** China has seen impressive growth in the Blockchain sub-sector, claiming more than half of the world's Blockchain-related patents in 2017. Beijing has the most blockchain startups in China, according to the Wuzhen think-tank. Among them are the popular cryptocurrency exchanges Huobi and OKCoin. Although the Chinese government implemented bans around ICOs earlier in 2017, it recently took measures to boost the development of blockchain technology. In March 2018 the Ministry of Industry and Information Technology announced plans to set up a national committee for the standardization of blockchain and distributed-ledger technologies.

² <https://www.researchandmarkets.com/reports/4318804/china-online-education-industry-report-2016-2021>

“Beijing’s Blockchain ecosystem is developing rapidly as the government and industrial juggernauts continue to acknowledge the importance of this emerging technologies and spearheaded into incubating and investing in this sector. I have seen startups with innovative technology and applications that is set to disturb the incumbents.”

Alex Banh

Partner at IPV Capital

Ecosystem Partners

91Maker, Creativyoungcommunity, Cyzone Innoway BJ, Makes-global, Noodle&Meetup, Startup Grind, Suhehui, Technode

Ecosystem Deep Dive

Hong Kong China

New Member

Funding activity in Hong Kong has drastically increased over the last few years, growing 11 times from 2012 to 2016, and crossed \$1 billion in 2016. Recent funding rounds demonstrate that HK is able to produce scaleups, i.e. SenseTime raising \$637 million in series B & C, or LalaMove raising \$100 million Series C. Local startup support organizations include Hong Kong Cyberport, HKSTP, StartmeupHK, FAHK, StartupsHK and WHub, a startup community that has been helping startups source talent and build connections, leveraging its vast network in Hong Kong.

Sub-Sector Strengths

 **Fintech.** Hong Kong has a strong legacy industry presence with more than 70 out of world's largest 100 banks operating in the city. There are more than 200 Fintech companies in Hong Kong according to Hong Kong Cyberport. Several Fintech focused accelerators like SuperCharger, DBS Accelerator and Fintech Innovation Lab by Accenture maintain a presence in city. During the last three years Fintech has contributed to 27% of the overall funding in the Hong Kong tech startup ecosystem. Major recent funding

rounds include WeLab (\$220 million in series B+), Futu5 (\$145 million in series C), and CompareAsia Group (\$50 million in Series B). TNG, a current Hong Kong Cyberport incubatee completed its Series A round at \$115 million, the largest Series A ever in Hong Kong and on of the largest Series A rounds in the world.

 **HealthTech.** Hong Kong's healthcare system is more digitized than many of its counterparts while Biotech in the city has seen a steady growth over the last few years. Major fundings in 2017 include IDS Medical Systems Group (idsMED), a Hong Kong-based medical supply-chain solutions company which raised \$60 million in a private equity round and Prenetics, a leading genetic testing company, raised \$40 million in series B funding.

 **Consumer Electronics (including IoT).** With its local strengths and proximity to Pearl River Delta (Shenzhen in particular), Hong Kong has access to great product development, manufacturing talent and resources. Asia's largest hardware trade show Startup Launchpad (SULP) takes place in Hong Kong, bolstering relationship between startups and other industry players like retailers. Hong Kong also boasts of specialised accelerators like Brinc Global IoT Accelerator which focuses solely on IoT cluster, Readwrite Labs Hong Kong or The Mills business incubator.

"Hong Kong's startup ecosystem has been growing at tremendous pace over the past few years, and the components required for healthy growth - market, talent and funding - are beginning to fall in place. With developments driven by the market and support by the Government's priority on innovation & technology, we hope to see more positive socio-economic impact derived from the growth of startup ecosystem in years to come."

Jayne Chan

Head of StartmeupHK

Startup Genome Members

InvestHK's vision is to strengthen Hong Kong's status as the leading international business location in Asia. The mission is to attract and retain FDI which is of strategic importance to the economic development of Hong Kong.

Hong Kong Science and Technology Parks Corporation (HKSTP) is a statutory body dedicated to building a vibrant innovation and technology ecosystem to connect stakeholders, nurture technology talents, and catalyse innovations.

Cyberport is committed to develop the digital tech industry as a key economic driver by connecting startups and entrepreneurs to strategic partners and investors, driving collaboration with business partners, and accelerating digital adoption.

Ecosystem Partners

StartupsHK, Hong Kong Fintech, brinc, WHub, Mettā, The Hong Kong Polytechnic University

“Hong Kong’s Fintech growth has been largely organic and B2B focused. Now with the current administration’s focus on innovation and technology, Fintech is getting a boost and the ecosystem is getting even stronger. With Hong Kong being the major Financial Center for APAC, it is an ideal place for Fintechs focussed on B2B solutions to scale their business.”

Musheer Ahmed

General Manager at Fintech Association of Hong Kong

“Hong Kong as Asia’s leading international Financial Centre provides the optimal mix for launching a successful Fintech startup and scaling it in Asia: Access to top talent, strategic geographical position in the Greater Bay Area with access to China and the rest of Asia, quality business services and legal infrastructure, a young and vibrant ecosystem and regulators in dialogue to support Fintech innovation.”

Karena Belin

Co-Funder at WHub

Ecosystem Demographics

Metropolitan GDP

\$430 bn

Global Avg: \$267 bn

Metropolitan Population

7.4 m

Ecosystem Performance

Ecosystem Value

\$2.2 bn

Global Median: \$4.1 bn

Startup Output

450 - 850

Global Avg: 1,700

Growth Index

4.3

Funding

Early-stage Funding per Startup

\$202 k

Global Avg: \$252 k

Market Reach

Foreign Customers



Talent

Experienced Software Engineers



Experienced Growth Employees



Visa Success Rate



Startup Experience Index

5.1

Founders Demographics

Women Founders



Immigrant Founders



Resource Attraction

Entrepreneurs **73**
Global Avg: 300

Startups **75**
Global Avg: 83

Ecosystem Deep Dive

Kuala Lumpur Malaysia

Kuala Lumpur is an Activation Phase ecosystem with a supportive local government in prime location in Southeast Asia. In 2016 the ecosystem saw a record number of exits, with more than \$600 million in exit value generated. Its best funded startups include iflix (a video streaming platform) with close to \$300 million in funding, and iProperty (online real estate marketplace) with \$100 million in funding. While not one of the sub-sector strengths we cover in this report, Kuala Lumpur has a strong level of activity in E-commerce. Malaysia's E-commerce sector has grown 47% since 2015 and is now worth \$2.4 billion. Local startups in E-commerce include Fashion Valet, a fashion retailer with \$6.4 million in funding.

Sub-Sector Strengths

 **Big Data & Analytics.** Local startups in Big Data & Analytics include Ebizu, the ad targeting platform which has raised \$3 million; iMoney, the finance analytics provider, with over \$10 million in funding; and Pipeline Network, the IoT and analytics company with about \$1 million in funding. In terms of local assets, Kuala Lumpur has two ranked universities for computer science: University of Science, Malaysia, and University of Malaya -- the latter also ranked for information science.



Healthtech. Kuala Lumpur's Healthtech startups are primarily focused on connecting patients to medical providers. They include Getdoc, Door2Door Doctor, Teleme, HomeGP, Healthmetrics, and BookDoc -- which recently raised \$2 million. As a potential asset to build upon, Malaysia is one of the world's top destinations for medical tourism, according to CNBC, receiving nearly 1 million foreign patients seeking treatment locally per year.



Smart Cities. With a sandbox regulatory environment set by the government, recent collaborations with Alibaba for smart traffic systems, and accelerators like Cyberview Living Lab, Sunway Innovation Labs, and IFCA MSC Prop-Tech accelerator, Kuala Lumpur is making investments to spur Smart Cities developments forward.

The country recruited Chinese billionaire and tech pioneer Jack Ma as its digital economy adviser, and is working closely with the tech giant Alibaba to bring Smart Cities tech to Kuala Lumpur. The region is the first outside of China to implement Alibaba Cloud's City Brain -- which has the first function of optimize vehicle flow in the city.

"Ranked 24th by the World Bank for ease in doing business, Malaysia provides easy connectivity to a regional market of over 641 million people. The supporting mechanisms that exist such as the Malaysia Tech Entrepreneur Programme, Digital Free Trade Zone, Malaysia Digital Hub initiative, National Regulatory Sandbox initiative and the Asean Centre of Entrepreneurship startup service platform makes Kuala Lumpur a thriving entrepreneurial hub."

Ashran Dato' Ghazi

CEO at MaGIC

Startup Genome Member

MaGIC (Malaysian Global Innovation & Creativity Centre) creates an enabling entrepreneurship ecosystem to propel the nation's economic transformation through the generation of future-ready, creative and innovative entrepreneurs. MaGIC supports these entrepreneurs with the necessary tools, skills and capabilities to succeed in local, regional and global markets.

Ecosystem Partners

1337 Ventures, Codearmy, MAD Incubator, Malaysia Digital Economy Corporation, Maybank, 500 Startups

“The startup ecosystem in Malaysia has shown great potential and validation - from my experience investing in local startups - with the exit of Hermo, the success of Carsome in raising what could be one of the largest funding round in Malaysia. More investors and large companies should look at the opportunity in Malaysia and extend that to the whole Southeast Asia.”

Victor Chua

Managing Partner, Vynn Capital

“One may not realize that KL actually has a rich startup ecosystem. And it built over the years, at least since 2001 when MAVCAP came into the picture. The tech sector is further enriched by private and corporate accelerators like 1337, university and state institutions like MaGIC and Sunway’s iLabs, NGOs like GEM, NEF, Women In Tech and along that, various entrepreneurship initiatives for grassroots and students promoted by GLCs and the Government. Entrepreneurs will find that starting up a company in KL is much easier and rewarding.”

Jamaludin Bujang

CEO, MAVCAP

Founder Mindset



Founder Know-How



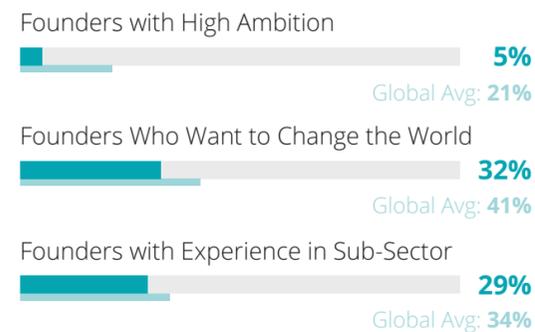
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Manila Philippines

New Member

The economy of the Philippines is currently growing at above 6%, one of the highest growth rates in the world. Micro, small, and medium enterprises (MSMEs) account for 70% of total employment, with millennials venturing into entrepreneurship at an increased rate. Manila is home to an estimated number of 400-450 currently active tech startups. A landmark success for the emerging technology scene is Revolution Precrafted, a real-estate startup focused on developing prefabricated designer homes. The company has raised a Series B round, co-led by famed Singapore-based investor K2, qualifying it as the first unicorn of the Philippines.

Sub-Sector Strengths

 **Fintech.** There are a little less than 100 Fintech startups in the Manila region, mostly focused on mobile payments and alternative finances. The total transaction value for Philippine Fintech startups in 2017 is estimated at around US\$5.5 million, indicating significant potential for growth. Only around 30% of the Filipino population have a bank account today, underlining that local venture opportunities begin with basic financial services such as credit and investment offerings. Initial success stories include 500 Startups-backed Pawnhero, the first online pawnshop in South-east Asia, and the peer-to-peer lending platform MoneyMatch.



Enterprise Solutions. Most promising startups in the Philippines to date are focused on Enterprise Solutions, as confirmed by international competitions and VC investors. In the last five years, Seedstars World (SSW), the global startup competition for emerging markets, has hailed two Philippine champions, one of them Salarium, an innovative end-to-end payroll system. This year, social-media-focused recruiting solution Serve Happy Jobs will represent the Philippines. Earlier this year, Qwikwire Billing Systems, a cross-border billing and invoicing startup for enterprises, has secured an undisclosed sum for overseas expansion. Prior to that, the firm had already raised close to half a million from 500 Startups and JFDI.Asia.



AI & Machine Learning. The Philippine Government has committed to engage in more collaborative research and development (R&D) initiatives to keep up with technological trends, as laid out in the Philippine Development Plan (PDP) 2017-2022. The plan's emerging technologies' component covers a wide array of areas including manufacturing, agriculture and health. For AI, the initial focus is going to be in manufacturing industries to optimize mass production of goods in the country. In the private sector, particularly banks and brokerage firms have started to employ AI and machine learning.

"We are keen on supporting the growing startup ecosystem in the Philippines. Government has programs for startups that assist them in creating value at significant scale. We need to develop a new breed of startups that will contribute to sustainable economic growth and generate value by introducing innovative and technological ways to solve social and environmental issues to better the quality of life of our people."

Nora K. Terrado

Undersecretary at Department of Trade and Industry
(Trade and Investments Promotion Group)

Startup Genome Member

As the national agency responsible for making a globally competitive and innovative industry and services sector that supports inclusive growth and employment through entrepreneurial spirit, the **Department of Trade and Industry (DTI)** promotes the development and scaling up of local startups through its Startup Ecosystem Development Program (SEDP). This aims to foster inter-enterprise linkages among micro, small, and medium enterprises (MSMEs) and reinforce collaborative networks.

Ecosystem Partners

1000 Angels, Brainsparks, QBO

“The Philippines has the opportunity to develop the best FinTech services in the world because they have so many mobile phones. They have 7,000 islands and it’s impossible for banks to have branches everywhere, but mobile phone coverage is everywhere.”

Jack Ma
Co-Founder and Executive Chairman at Alibaba

“The advent of AI and machine learning is an opportunity rather than a threat. AI can open “sweet spots” for job-seekers. Creative services will grow 14 percent, health care services by 13 percent, and software development by 11 percent, which translates to 700,000 more jobs in the next 6 years.”

Cathy Iletto
Vice Chairman at IBPAP

“While Artificial Intelligence technology is new to some of the industries here in the country, there have been a lot of efforts in educating the market. This includes a lot of meet-ups, workshops and AI education at universities. These efforts will drive more opportunities for startups and developers working in this industry.”

Ralph Regalado
Founder and CEO at Senti

Ecosystem Demographics

Metropolitan GDP
\$108 bn
Global Avg: \$267 bn

Metropolitan Population
13.5 m

Ecosystem Performance

Ecosystem Value
\$120 m
Global Median: \$4.1 bn

Startup Output
300 - 600
Global Avg: 1,700

Growth Index
5.9

Funding

Early-stage Funding per Startup
\$60 k
Global Avg: \$252 k

Market Reach

Foreign Customers
11%
Global Avg: 23%



Talent

Experienced Software Engineers
50%
Global Avg: 72%

Experienced Growth Employees
23%
Global Avg: 60%

Visa Success Rate
NA
Global Avg: 41%

Startup Experience Index
4.3



Founders Demographics

Women Founders
18%
Global Avg: 16%

Immigrant Founders
14%
Global Avg: 19%

Resource Attraction

Entrepreneurs
64
Global Avg: 300

Startups
52
Global Avg: 83

Ecosystem Deep Dive

Melbourne Australia

Over the last several years, the number of coworking spaces in Melbourne has risen by over 900%, to 170, in addition to a sixfold increase in the number of accelerators. Since 2014, the city has seen eight life sciences companies go public, and four software companies exiting for over \$100 million. Most recently, construction software company Aconex was acquired by Oracle for \$1.2 billion. Since the beginning of 2016, nearly \$300 million of VC has been invested locally, suggesting a sustainable pipeline of competitive startups.

Sub-Sector Strengths

 **Biotech & Life Sciences.** Over half of Australia's publicly-listed life sciences companies are based in Melbourne, where approximately 180 biotech companies cluster in the innovation precinct surrounding the University of Melbourne, which ranks 9th in the world for medicine and health. A string of recent acquisitions and public listings have reinforced local biotech growth: In 2015, Spinifex Pharma was acquired by Novartis for \$200 million, Hatchtech signed a commercialization deal with Dr. Reddy's for up to \$280 million, and Starpharma entered into licensing deals with Astrazeneca worth up to \$450 million.

 **Health.** Since 2014, \$149 million has been invested into Melbourne's health startups, which make up 11% of startups in the city but employ one-quarter of startup employees. As befits Melbourne's title as the world's Ultimate Sports City of the past decade, 6% of Melbourne startups are in sports tech, with many of those working on health issues. Health startups in Melbourne benefit from the presence of Monash University, which is highly ranked globally for its clinical medicine and pharmacy programs.

 **Adtech.** As early as 2011, Melbourne hosted Australia's inaugural ad:tech conference, establishing itself as a forerunner in the Adtech space. Six years later, Melbourne was home to nearly four dozen Adtech startups raising millions of dollars in funding. Today's Adtech startups benefit from the presence of massive successes REA Group and Carsales.com, multi-billion dollar publicly-listed companies that have generated jobs and economic value for the region. They provided Adtech experience to hundreds of employees, and the their founders contribute to the ecosystem through sizeable investment funds.

"Melbourne has been ranked by the Economist Intelligence Unit as the world's most liveable city since 2011. This has undoubtedly helped us to attract and retain startups particularly in the areas of health and life sciences of which Victoria has a global reputation."

Dr. Kate Cornick
CEO at LaunchVic

Startup Genome Member

LaunchVic is Victoria's startup agency. It's mission is to lead the development of a globally-connected startup ecosystem by supporting startups and investors to sustainably grow and boost the economic and cultural benefits for both Victoria and Australia.

Ecosystem Partners

BioMelbourne Network, Inspire9, York Butter Factory, Runway Geelong, Startup Bootcamp, ACMIX, Rome2Rio, Startup Victoria

“Victoria has a global reputation for cutting edge innovation in medical technology including customised 3D-printed surgical implants and the mind-controlled robotic prosthetic arm. Our medical technology and pharmaceuticals industry employs around 23,000 people and generates over \$12.7 billion in revenue.”

Andrew Wear

Director, MedTech and Pharmaceuticals, DEDJTR

“Victoria is one of the world’s leading biotechnology hubs and the centre of Australia’s biotech investment with over 650 companies, 12 major medical research institutes, 10 major teaching hospitals and nine universities.”

Dr Krystal Evans

CEO, BioMelbourne Network

“More than 190 digital marketplaces are founded in the State of Victoria, with the sector growing at ~11% per annum - well above the State’s current GSP growth of 3%. They also contribute \$1.6bn in value add to the state, employ ~13,000 people and create almost 100,000 employment opportunities”

Sin Yin Long

Director, Corporate Finance Strategy, Ernst & Young

Founder Mindset



Founder Know-How



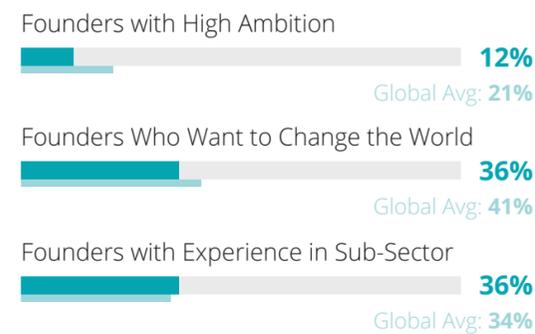
Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

New Zealand

With a population of fewer than 5 million people, the New Zealand startup ecosystem punches above its weight. There are about 500 startups across several verticals, VC investment has ranged between \$90 million and \$140 million in the past three years, and New Zealand has been named the #1 country in the world for ease of doing business.¹ While 2017 has been weaker than previous years in terms of IPOs (the country only had one) and VC investment, the ecosystem has shown long-term improvement. An important part of the ecosystem long-term development has come from the growing angel investor community—there are 3x times as many angel networks as ten years ago, and the capital deployed by them has grown 310% from \$21 million in 2006.

Sub-Sector Strengths

 **Agtech and New Food.** New Zealand has long been a world leader in agricultural production, with \$1.2 billion in value added agricultural activity. It is the largest dairy and sheep meat exporter in the world, and is a major global supplier of beef, wool, apples and seafood. VC-backed startups in the sub-sector include Engender Technologies, the company using laser technology to improve artificial insemination for cattle, which raised \$4.5 million.



Health and Life Sciences. New Zealand is ranked #4 in world for Biotech potential, driven especially by the local talent pipeline. Matter of fact—fueled by local academic institutions like University of Auckland, University of Otago, and Massey University—the country has the highest density of post secondary science graduates and Ph.D. graduates in Life Sciences in the world. Most of the activity in this sector has been in contract manufacturing and in wellness. The government is looking to build on these assets to transform the country into a center for biotech innovation, allocating \$40 million in an investment fund dedicated to Biotech opportunities. An interesting startup in this sector is UpsideBio, a regenerative medicine company which recently closed a Series A funding round of \$2.3 million.



Govtech. NZ's government has an international reputation as friendly, transparent and stable, being ranked #1 by Transparency International as the least corrupt country in the world. Building on these assets, programs like Lightning Lab GovTech program are kickstarting the Govtech sub-sector sector in New Zealand.

“We like to think of New Zealand as the ‘Upstart Nation.’ In the last decade, angel numbers have grown from barely 100 to over 700. From a nation of 5M, angel investment last year exceeded \$86m and returns are being generated. PowerbyProxi’s acquisition by Apple last year was a highlight and we have more in the pipeline.”

John O’Hara

Chair of NZ Angel Association

Startup Genome Member

The NZ Angel Association (AANZ) connects early stage investors nationally and internationally. It actively supports deal-making, collaboration and professional development, promoting angel investment as an asset class.

Ecosystem Partners

Angel HQ, Lightning Lab, VentureCenter, Enterprise Angels, Callaghan Innovation, Sprout Accelerator, StartupWeekend, NZX, New Zealand Trade and Enterprise, CreativeHQ, IceHouse, Astrolab, WNT Ventures, NZ Venture Investment Fund, Equitise, Snowball Effect, BizDojo, Tin Network, GD1, Flying Kiwi Angels

"We are seeing significant growth in the number and quality of investment opportunities in Health and Life Sciences. As NZ has a small domestic healthcare market, even our very early stage businesses have immediate focus on international growth"

Maxine Simmons

Executive Director of seed fund Cure Kids Ventures

"We see enormous potential in Govtech opportunities, not only in New Zealand, but also around the world. We are pleased to see the forward thinking and willingness of the NZ Government to encourage these technologies to be successfully deployed for the benefit and equality of its consumers, and the willingness to partner with us to create a truly global opportunity."

Steve Meller & Larry Howell

Founders of Global GovTech Fund

"Over the past 25 years NZ's food exports have more than quadrupled from \$1 billion to \$5 billion. As a nation of 5 million we produce enough food to feed 40 million."

Michael Ahie

Chairman of Plant & Food Research

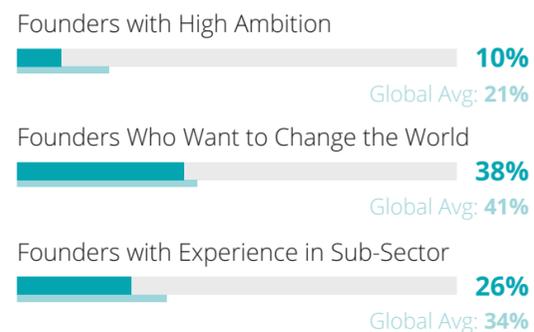
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Shanghai

With a population exceeding 24 million, Shanghai is one of the most populous cities in the world. A global financial centre and transportation hub, Shanghai indicates a more internationally oriented startup ecosystem in comparison with Beijing. Shanghai startups have, on average, 32% of their customer-base outside of China as compared to Beijing's 7%. The city is currently home to 21 unicorn companies and counting. In 2014, only 14% of global unicorns were from China. In 2017 and 2018 so far, that number has grown to 35%. Shanghai's municipal government is taking steps to support the ecosystem through various subsidy programs, such as a risk-compensation policy that covers as much as 60% of any actual losses of VC investors of seed and early-stage investments.

Sub-Sector Strengths

 **Fintech.** Fintech is by far the largest sub-sector in Shanghai in funding terms. Between 2012 and 2017 26.5% of all local VC investment went into Fintech startups. Shanghai also represented 30% of KPMG's 2016 China Leading Fintech 50¹, a prestigious listing that recognizes the country's top 50 fintech leaders. Among them are heavyweights such as ThongAn, an online

¹ <https://home.kpmg.com/cn/en/home/insights/2016/09/2016-china-leading-fintech-50.html>

insurance company that IPO'd in September 2017 at a \$11 billion valuation. Another example is Lujiazui (Lufax), a Fintech startup offering peer-to-peer personal loan services to its users. It will be seeking a valuation of \$60 billion with its IPO in April 2018. Then there's OneConnect Financial Technology, a company providing financial technology solutions for small and medium-sized banks, that recently raised \$650 million in Series A funding.

 **Gaming.** China is home to the world's largest market of gamers, with over 600 million². According to the classification of the CNG Games Research Center, there are three dominant categories of video games in the Chinese market: mobile games (49%), PC client games (35%), and PC browser games (11%). Shanghai is the center of the Chinese Gaming industry, with a total of \$7.3 billion in revenue in 2017. In 2017, around 5.4% of all local VC investment went into Gaming startups. Local Shanghai Gaming companies include heavyweights such as Shanda Interactive Games and Giant Interactive alongside younger startups like Zhuohua Entertainment - a startup using real-time rendering to connect the dots between video games and motion-capture animation.

² <https://www.bloomberg.com/news/articles/2017-06-01/china-just-became-the-games-industry-capital-of-the-world>

"As China's financial center, Shanghai provides great startup ecosystem for Fintech startups. In addition, Shanghai is probably the best landing pad for foreign entrepreneurs to enter China market."

James Chou

Managing Director & CEO at Microsoft for Startups Shanghai

"The Shanghai Government has rolled out very targeted policies to encourage innovation and entrepreneurship. Such policies ranges from funding to government support, right down to talent pool. Unlike many other cities, these policies tend to come with stringent KPIs imposed on the recipients; resulting in a much more sustained growth of related service providers such as incubators, accelerators and co-working spaces in the city. Many players including INNOSPACE+ are forging its own entrepreneur ecosystems, giving the city a very vibrant and diversified yet inter-twined startup culture."

Richard Tan

Director at INNOSPACE+

Ecosystem Partners

ChinaAccelerator, Ether Capital, Innoclub, Innospace+, NakedHub, People Square, Startup Grind, technode, Xnode

Ecosystem Deep Dive

Shenzhen China

Commonly referred to as the “Silicon Valley of Hardware”, Shenzhen transformed itself from a small fishing village 30 years ago to a metropolis with a booming economy. Tech is a driving force here, and has attracted millions of workers in its development process. Once criticized for its industry of imitations of Western brands, Shenzhen has become a powerful and innovative ecosystem of collaborative entrepreneurs and talent as well as fast-learning suppliers and factories. Therefore, it arguably is the world capital for hardware entrepreneurs, alongside Silicon Valley.

Sub-Sector Strengths



Advanced Manufacturing & Robotics. China is transforming into a world-leader in advanced manufacturing technologies. The country employs the highest number of industrial robots in the world and is home to two of the four unicorns in the Advanced Manufacturing sub-sector: UBTECH Robotics and DJI (Dà-Jiāng Innovations). Shenzhen is the electronics manufacturing hub of the world, making 90% of the world's electronics according to Inc¹. Shenzhen's geographic location plays an important role in advancing its positioning as a hardware hub. It's proximity to Hong Kong has helped the city to source international VC money and talent.

Shenzhen also ranks highest in China in terms of its R&D investment at almost 4% of GDP, driven largely by private companies. According to Shenzhen's 13th five-year plan, the city will spend more than 4.25% of its annual GDP (\$17 billion) on R&D by 2020. Shenzhen is home to some of the world's biggest high tech companies like Huawei, Tencent, BYD, Gionee, Konka, TP-Link, TCL, and OnePlus. These companies are major contributors to R&D in China and have substantially upped their budgets in recent years. Huawei has already surpassed Apple, Oracle and Facebook in its R&D investments.

Shenzhen-based companies have seen a substantial increase in the number of patents over the years. In 2015, Shenzhen submitted 13,300 PCT patents representing 47% of all China's patents. Along with accelerators like HAX—the world's first and largest hardware accelerator—a friendly business environment, strong supply chain, cheaper costs and easy prototyping infrastructure, the city has been able to attract numerous foreign startups. These include Wazer, developer of a desktop waterjet digital cutting device, and Voltera—developer of circuit-board printer.

“For hardware, Shenzhen is unique as its broad and fast supply chain is a superpower for startups, from consumer electronics to medical devices or service robots. It epitomizes the distributed nature of many startups today, where the functions of research, prototyping, production, financing and sales can happen in different locations. HAX has funded over 250 hardware startups - most do not have a Shenzhen office but fly in regularly for development sprints or to manage production. They say that they get months of work done in weeks. Shenzhen works at startup speed.”

Cyril Ebersweiler

Founder & Managing Director at HAX

1 <https://www.inc.com/will-yakowicz/shenzhen-city-of-electronics.html>

Ecosystem Deep Dive

Singapore

Best known for its Fintech landscape, Singapore is by no means a one-dimensional startup ecosystem. The government's continuous commitment of keeping the R&D spendings at 1% of GDP as well as its recent pledge to fuel \$19 billion into different research, innovation and enterprise projects confirm Singapore's determination to maintain its position as one of the strongest and most diverse startup ecosystems globally.¹

Sub-Sector Strengths

 **Fintech.** Singapore has been the frontrunner of the Fintech space in Asia for the last decade. The city is home to more than 270 Fintech Startups, and more than 20 global banks and insurance companies have set up local research centers or innovation labs in the city. Between 2012 and 2017 6.7% of all local VC investments went into Fintech startups.

The government seeks to further bolster Singapore's status as a global Fintech hub by promoting Fintech in an ongoing campaign: The MAS (Monetary Authority of Singapore) has set aside \$225 million for Fintech development over five years. Startup success

¹ <https://www.opengovasia.com/articles/6883-singapore-government-pledges-19-billion-towards-research-innovation-and-enterprise-plan>

stories in the sector include: Nera Payment Solutions (sold for \$67 million in 2016), WB21 (Online Bank, Series A Funding of \$62 million in 2016) and Quoine (Bitcoin Trading Platform, Series A Funding of \$16 million).

 **Digital Media.** Over the last 6 years 10% of local VC funding in Singapore went into Digital Media startups, making it one of the top Sub-Sectors of the ecosystem. The most recent of a large and continued number of success stories in the area is Sea (formerly Garena). The online and mobile entertainment provider first raised \$550 million in Series E in May 2017 and then IPO'd at the NYSE for \$884 million in October 2017.

 **Big Data & Analytics.** Singapore has not just attracted foreign Big Data player like Palantir and Spire to step up in the country but is also growing a notable local Big Data & Analytics startup scene with 5.2% of local VC investment going into the Sub-Sector over the past 6 years. One recent example is Eyeota, a company that provides marketers with the data they need to reach the right online audiences. The company raised \$12.5 million in Series B funding in January 2018.

"Over the past decade, Singapore's startup ecosystem has made significant progress. With the merger of SPRING and IE to form Enterprise Singapore in April, startups can access our global network of partners to scale up and capture opportunities in Asia and beyond. Enterprise Singapore will continue to play the important role of a catalyst to engage and empower accelerators, investors and research institutes to create a vibrant environment for startups to scale and grow, in the region and globally."

Ted Tan
Deputy Chief Executive Officer,
Industry Clusters, Enterprise Singapore

Startup Genome Member

Enterprise Singapore is a merger of International Enterprise Singapore and SPRING Singapore. Launched in April 2018, Enterprise Singapore champions enterprise and industry development, builds trust in Singapore's products and services, promotes international trade, and works with Singapore companies to go global.

Ecosystem Partner

500 Startups. ACE. Trendlines Medical Singapore

“The Singapore ecosystem has been particularly supportive of Fintech startups thanks to a forward thinking regulatory environment and growing support from financial institutions.”

Vishal Harnal

General Partner at 500 Startups

“Our startups are taught to go global from day one. Because we are forced to look abroad we often shape our business model in a way that is more universal rather than domestic. That is one of our advantages.”

Mark Hon

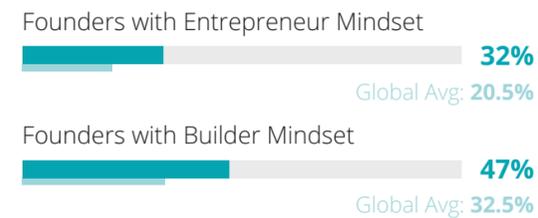
Chairman at ACE

“We believe that medical technology in Singapore has reached a fertile stage. With operators like us bringing relevant expertise to incubate and mentoring startups leading to commercial pathway, I believe we will see more success out of those technologies.”

Eric Loh

CEO at Trendlines Medical Singapore

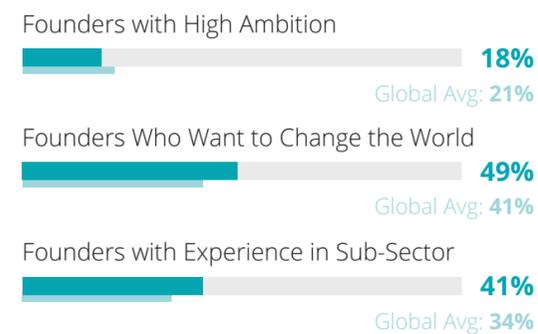
Founder Mindset



Local Connectedness



Founder DNA



Founder Know-How



Ecosystem Demographics



Ecosystem Deep Dive

Sydney Australia

Sydney hosts the nation's largest collection of tech startups, and the city and regional governments are active in supporting the ecosystem. Jobs for New South Wales, the agency charged with helping businesses, offers grants to startups at different stages and helped set up the new Sydney Startup Hub. The City of Sydney also established a Visiting Entrepreneur Program, which brings international entrepreneurs to visit and mentor local startups.

Sub-Sector Strengths

 **Fintech.** Around 60% of Australia's Fintech companies are based in Sydney which also has received the major share of Fintech venture capital in the country at \$171 million between 2014 and 2016. The city also boasts a strong financial legacy industry with 9% of national GDP created by the financial services sector, a scale bigger than in either Hong Kong or Singapore, the region's other two major Finance hubs. The Fintech accelerator Stone and Chalk helps support startups in the subsector, where the two largest verticals are payments and lending. The ecosystem has several key startups (\$50+ million market cap) that will move the sector forward, such as Stockspot, Australia's first robo-advisor.

 **Digital Media.** The Australian entertainment and media market is projected to grow to \$47.4 billion by 2020 and Sydney is the country's base for large traditional media companies and Digital Media startups. Local success stories include Executive Channel International, which provides office media solutions that facilitate connections between property owners, office executives and advertisers and was acquired in 2016 for \$68.5 million by Inlink. Another example is Genero, a video production solution platform delivering affordable, high-quality content, at scale and speed. The company raised \$4 million in venture funding in 2016.

 **Adtech.** Even though growth in Australia's traditional advertising industry is shrinking, internet and especially mobile advertising has taken off. Internet advertising reached \$7.4 billion in 2016 and is forecasted to account for over half of the total Australian advertising market by 2021. The integration of digital technology into advertising companies and practices is driven by local startups like Oneflare. The company challenges the traditional Yellow Pages model by directly connecting customers with home services providers and has raised \$20 million in funding.

"Sydney is an attractive business gateway for Australia and South East Asia and is rapidly becoming one of the best places in the world to build a high growth tech company. The city boasts a dense and fast-growing startup community, robust government and regulatory support and a diverse and stable investment ecosystem. There has been an exponential rise in companies tackling local and global Fintech challenges, with new precincts like Stone and Chalk and more broadly the Sydney Startup Hub bringing critical density of people and ideas to central Sydney. New industry wide organisations like Fintech Australia and TechSydney are helping to coordinate and support these efforts."

Dean McEvoy

Founder & CEO at TechSydney

Startup Genome Members

TechSydney is an entrepreneur-led industry group that connects, supports and promotes the tech industry in Sydney.

StartupAUS is Australia's national startup advocacy organization, with a mission to transform Australia through technology entrepreneurship.

The University of Technology Sydney got ranked as the #1 young university in Australia, and is committed to advancing entrepreneurial education and equipping graduates to take on and create the jobs of the future.

“Sydney’s continued leadership and strength as Australia’s largest startup ecosystem requires a steady, well-supported pipeline of entrepreneurial talent. Partnering with this vibrant ecosystem, UTS has a critical role to play connecting thousands of prepared graduates into that pipeline, ensuring a thriving and growing base for the startup sector.”

Professor Glenn Wightwick

Deputy Vice-Chancellor Innovation & Enterprise at University of Technology Sydney

“Startups in Australia are booming. Capital availability is at record highs, our education system is producing high quality technical talent and governments on all levels are increasing support for high growth businesses. Sydney has just opened the largest startup hub in the Southern Hemisphere after only 18 months from ideation to completion. Forward thinking reforms in recent years on both the state and federal level are having a marked effect, and Sydney is taking a global leadership role in key verticals like Fintech.”

Alex McCauley

CEO at StartupAUS

Founder Mindset



Founder Know-How



Ecosystem Demographics



Local Connectedness



Founder DNA



Ecosystem Deep Dive

Taipei City Taiwan

New Member

Taiwan has brought about some of the world's largest tech companies. Foxconn, the world's largest electronics contract manufacturing company and the two largest pure-play chipmakers are just three examples. No wonder Taiwan's citizens are tech-savvy: 88% are connected to the internet while 70% own a smartphone, one of the largest penetrations worldwide. By building on its economic DNA, Taipei City stands a good chance to develop a globally competitive startup ecosystem especially in AI, Advanced Manufacturing & Robotics and Biotech.

Sub-Sector Strengths

 **AI, Big Data & Analytics.** At 23%, AI, Big Data and Analytics is Taipei City's leading startup sub-sector by means of VC investment allocation between 2012 and 2017. A driving force is accelerator and VC fund AppWorks, whose 323 alumni are generating a combined annual revenue of \$1 billion. AI applications for Advanced Manufacturing are particularly promising for Taipei, yet the ecosystem is producing success stories in different fields. Commerce-focused Appier is one example, which raised more than \$80 million to date. The company was recently ranked as one of the 100 most promising private artificial intelligence companies in the world by CB Insights.



Advanced Manufacturing & Robotics. In the words of the Taiwanese Nvidia CEO Jensen Huang, "the robot is arguably the ultimate AI." A leading hardware hub with strong R&D capabilities and IP protection, this projection puts Taipei in a promising position. The demand for efficient computing and integrated circuits are on the rise as much as the demand for machine intelligence (the so-called AIoT). Startups like industrial AI company Thingnario are built around this demand, exploiting machine intelligence and deep learning to predict operational key insights, such as energy consumption and maintenance requirements. Naturally they thrive off of Taipei's related industries and expertise.



Biotech. Taipei's Biotech sector is expected to reach around \$120 billion in production by 2025. Roughly 18% of local VC investment between 2012 and 2017 went into Biotech, making it the second strongest sub-sector. Success stories in this space include the Taiwan Liposome Company, which filed for a NASDAQ IPO earlier this year,¹ TaiMed Biologics and JHL Biotech. TaiMed Biologics is a National Research Institute spin-off with \$20 million in funding, currently seeking FDA approval on innovative HIV treatments. JHL Biotech is a biopharmaceutical company with an \$80 million backing from premier investors such as Kleiner Perkins Caufield & Byers and Sequoia Capital.

"Compared to the past few years, the environment and infrastructure for startups have become much healthier in Taiwan. With more support from the public sector through policy making and other initiatives, startups have been accepted as imperative for the long-term development of the society; more and more global and regional investors, startups, and serial entrepreneurs seriously consider Taiwan as an attractive destination."

Katie Chen
CEO at Business Next

Startup Genome Member

Business Next is the longest-running media organization in Greater China with a dedicated focus on the worlds of tech and business. Business Next specializes in identifying the key factors that are shaping tomorrow's mainstream concepts and describing the landscape as it unfolds and evolves.

"We see more and more mature startups with a focus on artificial intelligence. WI Harper has invested more than \$20 Million in Series Seed and Series A rounds of 15 AI startups. Many of them have found customers; currently, they are at the stage of market validation through accumulating data."

Yvonne Chen
Partner at WI Harper

"Although successful Internet startups and serial entrepreneurs are comparatively rare; witnessing recent advancement in the startup ecosystem in Taiwan, it would be expected for more startups in the field of digital technology."

Ryan Kuo
President at CDIB Capital Innovation Advisors and CDIB Capital Innovation Accelerator

"With more than \$27 billion market value, Taiwan is actually a great destination for e-commerce startups from Southeast Asian countries."

Nice Cheng
Partner at AppWorks

Ecosystem Demographics

Metropolitan GDP
\$327 bn
Global Avg: \$267 bn

Metropolitan Population
7.4 m

Ecosystem Performance

Ecosystem Value
\$580 m
Global Median: \$4.1 bn

Startup Output
150 - 350
Global Avg: 1,700

Growth Index
5.7

Funding

Early-stage Funding per Startup
\$256 k
Global Avg: \$252 k

Market Reach

Foreign Customers
28%
Global Avg: 23%



Talent

Experienced Software Engineers
65%
Global Avg: 72%

Experienced Growth Employees
63%
Global Avg: 60%

Visa Success Rate
NA
Global Avg: 41%

Startup Experience Index
4.0



Founders Demographics

Women Founders
12%
Global Avg: 16%

Immigrant Founders
<10%
Global Avg: 19%

Resource Attraction

Entrepreneurs
17
Global Avg: 300

Startups
5
Global Avg: 83

Methodology, Framework, and Acknowledgments

Acknowledgments and Partners

Methodology

Data Sources and References

Acknowledgments and Partners



A project like the Global Startup Ecosystem Report can only be realized with an enormous effort from both the project team and external supporters. Several partners have invested significant resources into the project. Numerous advisors, founders, investors, and industry experts have given us access to their knowledge, networks, and time because they support our vision and wanted to move their ecosystem and the whole startup sector forward.

Startup Genome and Global Entrepreneurship Network (GEN) would like to express our deep gratitude and appreciation to everyone who contributed towards making this project possible.

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Startup Genome

JF Gauthier

Founder and CEO. Silicon Valley serial entrepreneur, JF has founded five businesses in two continents, with two successful exits, two ongoing, and one miserable failure, source of much learning. He is also an active angel investor, founded a coworking space, and advised VCs on investment decisions. He started in banking then in tech strategy and corporate innovation, advising IBM, Cisco, Agilent/HP, J&J, Abbott and others, for the firm of Kim Clark, former Dean of Harvard Business School, alongside Clayton Christensen and other thought-leaders. Harvard MBA.

Dane Stangler

Chief Policy Officer. Dane specializes in entrepreneurship development and economic growth, and provides insights and policy analysis for startup ecosystems worldwide. He is Visiting Vorzimer Professor of Entrepreneurship at LIU Post and former Vice President for Research and Policy at the Ewing Marion Kauffman Foundation. A frequent public speaker and writer, Dane's work

is published in The Wall Street Journal, Huffington Post, Forbes.com, and Washington Monthly, and he is frequently quoted by national broadcast and print outlets.

Marc Penzel

Founder and COO. Marc focuses on ecosystem strategies as they relate to sub-sector strengths and scaleup production, European policy, and growth of the global community. Prior to founding Startup Genome, Marc worked in strategy consulting and on numerous startup ecosystem development projects. He led a pro bono consulting firm that supported more than 50 social enterprises. Marc is a frequent public speaker and popular presenter at technology and economic development conferences.

Arnobio Morelix

Director of Research. Arnobio focuses on ecosystem assessment, especially within Deep Tech and Life Sciences IP production. Arnobio has worked for the Kauffman Foundation, where he created the Growth Entrepreneurship Index and the Main Street Entrepreneurship Index, hailed as the "bible of entrepreneurship trends" by The Huffington Post and used by senators, governors, city leaders, Fortune 500 companies, and the White House. His articles appear in The New York Times, The Economist, and The Wall Street Journal. He also serves data science-focused appointments at Inc. Magazine and Stanford University.

Global Entrepreneurship Network (GEN)

Jonathan Ortman

Founder and president of the Global Entrepreneurship Network, an organization that provides a platform of initiatives to help new firms start and scale within one global ecosystem. Through GEN, Jonathan has assembled a multi-disciplinary coalition in 170 countries that includes entrepreneurs, investors, policymakers, researchers, and affiliated support organizations. He chairs the Global Entrepreneurship Congress each year, gathering thousands of leaders to explore innovative approaches to advancing entrepreneurial growth. Jonathan is a longtime advisor to the Kauffman Foundation and serves on numerous boards in various countries around the world.

Survey Participants and Interviewees

Thanks to the more than 12,000 survey participants and the over hundred interviewees—startup founders, investors, leaders of accelerators, incubators and startup hubs, and policy-makers—all over the world who trusted us by sharing their confidential information and expert knowledge with us. By providing us with solid quantitative data and insights, they created the basis and the heart of our research.

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Dan Hodgson, Managing Director at Linn Grove Growth Funds

Mark Trevitt, Principal at Industrial, Clean and Energy Technology Venture Fund, BDC Venture Capital

Devashree Saha, Director of Energy & Environmental Policy at The Council of State Governments

Pat Sapinsley, Managing Director of Cleantech Initiatives, Urban Future Lab/ NYC ACRE at NYU Polytechnic School of Engineering

Dawn Lippert, CEO at Elemental Excelsior & Innovation, Emerson Collective

Cyril Ebersweiler, Founder & Managing Director at HAX and General Partner at SOSV

John Teel, Founder and Lead Engineer at Predictable Designs

Rick Nahm, COO at GTR Accelerator

Oskar Burman, CEO at Fast Travel Games and Co-founder of Stugan

Luis Wong, Co-Founder and Head of Studio at LEAP Game Studios

Sho Sato, Principal Analyst, International Division at Media Create

Yaniv Feldman, Co-Founder & CEO at Cointelligence

Lou Kerner, Co Founder & Partner at CryptoOracle

Rumi Morales, Advisory Board Member at Chamber of Digital Commerce

Susanne Chishti, CEO at Fintech Circle

Sotirios Makrygiannis, Founder of Eliademy

Terry Heick, Founder and Director at TeachThought

Manish Kothari, General Manager, Platform at Edmodo

Ketan Kothari, General Manager, Consumer at Edmodo

Patrick Brothers, Co-Founder at HolonIQ

Maria Spies, Co-Founder at HolonIQ

Nish Bhalla, Founder & CEO at Security Compass

Mark Hatfield, Founder & General Partner at Ten Eleven Ventures

Dino Boukouris, Director & Founding Member at Momentum Partners

Steve Morgan, Founder & Editor-In-Chief at Cybersecurity Ventures

Jeremiah Grossman, Founder at WhiteHat Security

Brian Krebs, Investigative Journalist at KrebsOn-Security

Dave Shackelford, Founder at Voodoo Security

Mikko Hypponen, Security & Privacy Expert at F-Secure

Asheem Chandna, Partner at Greylock Partners

Antti Korhonen, CEO at XEdu

Jan Matern, CEO at Emerge Education

Robb Kunz, Founding Partner at Boom Startup

Susan Van Gundy, CEO & Founder at Eduvate

Anant Agarwal, CEO at edX

Sherry Coutu, Founder at Founders4Schools

Ian Fordham, CEO at Edtech UK

Eric Yang, CEO at Tutor Group

Jerome Serre, CEO at Edupad

Simon Nelson, CEO at Future Learn

Mike Michalec, Co-Founder at EdTech Asia

Tom Vander Ark, CEO at Getting Smart

Douglas Levin, President at EdTech Strategies, LLC

Tak Lo, Managing Partner at Zeroth.ai

Brody Huval, Co-Founder at Drive.ai

Shin Wee CHUANG, Co-Founder & CEO at Pand.ai

Matt Ocko, Managing Partner at Data Collective (DCVC)

Jim Adler, Managing Director at Toyota AI Ventures

Van Espahbodi, Co-Founder at Starburst

Josh Wolfe, Founder at Lux Capital

Bruce Sachs, General Partner at Charles River Ventures

Elise Caffrey, Senior Vice President, Investor Relations at iRobot

Tyler Benster, Co-founder & General Partner at Asimov Ventures

Krishna Vedati, CEO and co-founder at Tynker

Sotiris Makrygiannis, Co-founder at Eliademy

Brad Gillespie, Partner at IA Ventures

Vivjan Myrto, Managing Partner at Hyperplane Venture Capital

Tim Brady, Founder at imaginek12

Steve Curtis, Managing Partner at BoomStartup

Asad Butt, Partner & Director at Learnlaunch

Bart Epstein, CEO at Jefferson Education Accelerator

Thank you for your support!

Partners and Collaborators

Global Partners

- CrunchBase: Everyday investors, journalists, founders, and the global business community turn to CrunchBase for information on startups and the people behind them.
- Dealroom.co provides data-driven intelligence on high-growth companies.
- Orb Intelligence: Business Information for B2B Marketing and Sales. Orb provides company information and smart algorithms as a service to marketing software vendors and B2B agencies.
- Angel Resource Institute provides education, training, mentoring, and information on best practices in the field of angel investing to improve connections between angel investors and entrepreneurs.
- Tech Nation (formerly Tech City UK) empowers ambitious tech entrepreneurs through growth programmes, digital entrepreneurship skills, a visa scheme for exceptional talent and by championing the UK digital sector through data, stories and media campaigns.
- QCC: The QCC Conference is a two-day annual event, alternating between Quebec City and

Toronto, that supports the development of a buoyant private market investment ecosystem, in Canada and internationally.

- Fingerprints for Success studies attitudes and motivations of entrepreneurs to learn what separates them from the rest of the population and help entrepreneurs and business owners succeed.

Startup Genome Network Members

Amsterdam, Netherlands

Startup Delta
Ministry of Economic Affairs and Climate Policy

Atlanta, United States

Metro Atlanta Chamber

Bahrain

Tamkeen

Barcelona, Spain

Catalonia Trade & Investment

Edmonton, Canada

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Houston, United States

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Istanbul, Turkey

Endeavor Turkey

The Union of Chambers and Commodity Exchanges of Turkey (TOBB)

Turkish Exporters Assembly (TIM)

Habitat Association

Jerusalem, Israel

Jnext

Kuala Lumpur, Malaysia

MaGIC

London, United Kingdom

Tech Nation (formerly Tech City UK)

Malta

Malta Communications Authority

Manila, Philippines

Department of Trade and Industry

Melbourne, Australia

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Montreal, Canada

Centech

Real Investment Management

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City of Munich

IHK for Munich and Bavaria

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LMU Entrepreneurship Center

Munich Startup

Unternehmertum

Strascheg Center for Entrepreneurship

New York City, United States

New York City Economic Development Corporation

Tech:NYC

New Zealand

NZ Angel Association

Ontario, Canada

Government of Ontario

Ottawa, Canada

Invest Ottawa

Phoenix, United States

Startup AZ Foundation

Arizona State University

Arizona Commerce Authority

Arizona Technology Council

Invest Southwest

Partnership for Economic Innovation

Quebec City, Canada

Quebec International

Singapore

Enterprise Singapore

Sydney, Australia

StartupAUS

University of Technology Sydney

TechSydney

Taipei City, Taiwan

Business Next

Tampa Bay / Hillsborough County, United States

Tampa Bay Wave

Hillsborough County Economic Development

University of South Florida (USF)

Tel Aviv, Israel

Tel Aviv Global

Toronto-Waterloo, Canada

MaRS Discovery District

Communitech Corporation

Vancouver, Canada

Vancouver Economic Commission

BC Tech Association

Ecosystem Partners

Ecosystems by alphabetical order

Amsterdam, Netherlands

Health Holland

Holland Fintech

StartLife

Atlanta, United States

Advanced Technology Development Center (ATDC)

Atlanta Tech Village

Engage

Enterprise Growth Institute

Entrepreneurs Organization (EO)

Flashpoint

FlatironCity

Hypepotamus

IgniteHQ

Invest Atlanta

LaunchPad2x

Prototype Prime

Sandbox ATL

Startup Atlanta

TechSquare Labs

Techstars Atlanta

TiE Atlanta

Austin, United States

3 Day Startup

Tech Ranch

Austin Technology Incubator

University of Texas Austin

BuiltIN

Central Texas Angel Network

St. Edward's University

WeWork

Techstars Austin

Capital Factory

Bahrain

Economic Development Board

Bahrain Development Bank

Bangalore, India

91springboard

Kyron Global

Microsoft Ventures

Global Incubation Services

Microsoft

TLabs

Nasscom

The India Network

Barcelona, Spain

Antai Venture Builder

BCN Tech City

Conector

Inveready

Nekko Capital

Rousaud Costas Duran

Sabadell Ventures

SeedRocket

Ysios Capital

Caixa Capital Risc

Nauta Capital

Alta Life Sciences

ESADE BAN

Capital Cell

Dely Law & Finance

Beijing, China

91Maker

Creativeyoungcommunity

Cyzone Innoway BJ

Makesglobal

Noodle&Meetup

Startup Grind

Suhehui

Technode

Berlin, Germany

Senate Department for Economics, Energy and
Public Enterprises,

Hasso Plattner Ventures

HIIG

The Factory

NKF Media

Project A Ventures

Rocket Internet

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Microsoft Ventures

Berliner Startup Stipendium

Get Started by Bitkom

RCKT

RKW

Boston, United States

4GenNow

Cambridge Innovation Center

Capitalnetwork

Carlton PR marketing

Health Innovators

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TechStars

Greentownlabs

Cybersecurity Factory

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Boston New Technology

LearnLaunch

StartHub.Org

DCU FinTech Innovation Center

New England VC Association

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Edmonton Research Park

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Frankfurt, Germany

ING-DiBa

EY

Frankfurt Economic Development

blackprint Booster

Provadis Hochschule

DZ-Bank Gruppe

Goethe University Frankfurt

Gründerküche

TU Darmstadt

Deutsche Bank

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Commerzbank

KPMG

RheinMain Startups

Deutsche Börse Group

IHK Frankfurt

Accelerator Frankfurt

WIBank

Startzero

Hessen Trade & Invest

Frankfurt RheinMain

Candylabs

Hessian Ministry of Economics

Get Started by Bitkom

RKW

Helsinki, Finland

Nestholma

Arctic Startup

Espoo Innovation Garden

NewCo Helsinki

FVCA

Tekes

Hong Kong

StartUps HK

Hong Kong Fintech

brinc

WHub

Metta

The Hong Kong Polytechnic University

Houston, United States

Houston Angel Network
Rice University - McNair Center for Entrepreneurship
Rice University - Rice Alliance for Entrepreneurship
Unconventional Capital
Circular Board
Redlabs
Mercury Fund
Fannin Innovation Studio
University of Houston - Hatch Pitch
Rice University - Owl Spark
Houston Technology Center
Station Houston
TMCx
JLaBS

Jerusalem, Israel

BioJerusalem
Startup Nation Central
Jumpspeed
Siftech
Masschallenge Jerusalem
Made in JLM Bizmax

Ourcrowd

HUstart

AtoBe

JVP

VLX

Kuala Lumpur, Malaysia

1337 Ventures
Codearmy
MAD Incubator
Maybank
Malaysia Digital Economy Corporation
500 Startups

London, United Kingdom

MassChallenge
Techstars London
Balderton Capital
Wayra London
Accelerator Network
City of London
KPMG
TechUK
GSMA
Level39

Tech London Advocates

GEN

Microsoft Ventures

Northzone

Microsoft for Startups

Los Angeles, United States

Bixel Exchange
Cross Campus
Mucker Capital
Bixel
WeWork

Manila, Philippines

1000 Angels
Brainsparks
QBO

Melbourne, Australia

BioMelbourne Network
Inspire9
York Butter Factory
Runway Geelong
Startup Bootcamp
ACMIX
Rome2Rio

Startup Victoria

Montreal, Canada

Notman
Arche Innovation
District 3
Startup Fest
Capital Intelligent
PME MTL
Innocité MTL
Réseau Capital
Montréal Inc
Mtl Newtech
HEC
Mtl Lab
Quartier de l'innovation (QI)

Munich, Germany

48forward
ammersee Denkerhaus
AZO Anwendungszentrum
Bavarian State Ministry of Economic Affairs, Energy and Technology
BayStartUp
Bayern Kapital

BioM
Bits & Pretzels
brigk
Burda Bootcamp
CDTM
CM Equity
DLD
Early Bird
Extorel
Fraunhofer Venture
Gate
German Entrepreneurship GmbH
HV Holtzbrinck Ventures
HWK
Impact Hub
IZB
Ludwig Bölkow Campus
Make Munich
Max Planck Institute for Innovation and Competition
MCBW
Media Lab
MTZ
Munich Network

MUST
next47
Social Entrepreneurship Akademie
Startup Alm
Stellwerk 18
Target Partners
UN World Food Programme Accelerator
W1
Wayra
Werk1

New York City, United States

Digital.NYC
Flight VC
General Assembly
Gust
NationSwell
Quake Capital
Rubicon VC
Runway VC
Sandbox
TechHubNYC

New Zealand

Angel HQ
Lightning Lab
VentureCenter
Enterprise Angels
Callaghan Innovation
Sprout Accelerator
StartupWeekend
NZX
New Zealand Trade and Enterprise
CreativeHQ
IceHouse
Astrolab
WNT Ventures
NZ Venture Investment Fund
Equitise
Snowball Effect
BizDojo
Tin Network
GD1
Flying Kiwi Angels
Ottawa, Canada
Capital Angels
Entrepreneurship Algonquin

La Cite College
Lead To Win
Startup Garage
Kanata North BIA
L-Spark
ID Gatineau

Paris, France

Balderton Capital
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La French Tech
Mairie Paris
Paris & Co,
Le CENTQUATRE-PARIS
France Digitale
The Family
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Phoenix, United States

AZ Founders Fund
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Center for Entrepreneurial Innovation
Coplex
Co+Hoots

Flinn Foundation
Galvanize Phoenix
Greg Head/Scaling Point
Moonshot
MRTNZ Ventures
Seed Spot Phoenix
Tallwave Capital

Quebec City, Canada

BDC
PwC Quebec
ROBIC
VETIQ
Ville de Quebec
Association Québécoise des Technologies(AQT)

Seattle, United States

Startup Seattle
ARI
Lighter Capital
New Tech Northwest
Techstars
Fledge
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Seattle Angel Conference

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Stockholm Business Region
Stockholm Chamber of Commerce
Stockholm School of Entrepreneurship

Tampa Bay, United States

1Million Cups St. Petersburg & Tampa

Entrepreneurial Collaborative Center
Greater Tampa Chamber of Commerce / Minority Business Accelerator
Hillsborough Community College
Innovation Place
Lakeland Catapult
Pasco County SmartStart
SparkGrowth/Station2Innovation
St. Petersburg Chamber of Commerce / Greenhouse
Tampa Bay Startup Week/Weekend
Tampa BaTech
TEC Garage
USF (Entrepreneurship Center, Muma College of Business, CONNECT)
University of Tampa

Tel Aviv, Israel

Microsoft for Startups
Geektime
SOSA
Microsoft Ventures
Startup Nation Central

Toronto, Canada

Centre for Social Innovation

Invest Toronto
Next 36
OneEleven
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City of Toronto
World Canada
Brookfield Institute
The Founder City Project
Venture Lab
RIC Centre
Innovation Factory
Haltech
Creative Destruction Lab

Vancouver, Canada

Launch Academy
Sauder S3i
entrepreneurship@UBC
Creative Destruction Lab West
HighlineBETA
RADIUS SFU
SFU Venture Labs
SFU Innovates
Wavefront

Spring
New Ventures BC
Small Business BC
Foresight
Lifesciences BC
Bio Enterprise BC/Can

Startup Package Partners

To reward participants of our online survey, multiple great companies agreed to offer huge discounts on their product:

Mixpanel's mission is to help the world learn from its data. It tracks user interactions with web and mobile applications and provides tools for targeted communication with them.

Gusto's mission is to create a world where work empowers a better life. By making the most complicated business tasks simple and personal, Gusto is re-imagining payroll, benefits and HR for modern companies.

ChargeBee is a PCI Level 1 certified recurring billing platform for subscription based SaaS and eCommerce businesses. It handles all your crucial

workflows from lead to ledger with power packed integrations that include Salesforce, Xero, Quickbooks, Avalara, Slack, among others.

ZipRecruiter provides a platform to hire and get hired. They have helped over 1 million businesses and 100 million job seekers find their next perfect match through partnerships with the best job boards on the web, curated email alerts, award-winning mobile apps, and one of the most sophisticated job search algorithms in the space.

Methodology

The Startup Genome quantitative data infrastructure includes data on over 1 million companies, nearly 100 ecosystems, and survey data from more than 10,000 startup executives across the globe -- the Voice of Entrepreneurs.

Below is a description of the main datasets that make up this data science infrastructure:

- Startup Genome proprietary data:
 - Interview of 100+ Experts
 - 2017-2018 Startup Ecosystem Survey with more than 10,000 participants
- CrunchBase: global dataset on funding, exits, and locations of startups and investors
- Orb Intelligence: global dataset on company information
- Dealroom: global dataset on funding, exits, and locations of startups and investors
- Local partners (accelerators, incubators, startup hubs, investors):
 - list of startups
 - list of local exits and funding events

In addition to quantifying several aspects of startup sub-sectors across the world, we are undertaking a major research effort to qualitatively understand each and every of the sub-sectors and ecosystems we cover on this report.

This qualitative research effort includes:

- Reviewing hundreds of research reports, media articles, and books
- Interviewing over 100 experts on the topic, for both sub-sectors and ecosystems
- Gathering qualitative insights and free form text from an over 10,000 founders and startup executives surveyed directly by Startup Genome

We use the knowledge gathered from this qualitative research effort to inform trends described on the report, review the methodology framework, and identify nuanced and forward-looking insights that the data alone could not give.

Key Terms and Definitions

Startup

Steve Blank defines a startup as a “temporary organization in search for a repeatable and scalable business model”. We use this definition to look across sectors and sub-sectors, including software, hardware, health, energy, and others.

Ecosystem

Defined around the concept of a shared pool of resources, generally located within a 60 mile (100 km) radius around a center point in a given region, with a few exceptions based on local reality.

Startup Sub-Sector

Defined as a subset of startup ecosystems along the main innovation sectors: Tech/ICT, Life Sciences, and Cleantech. Because some are horizontal in nature, we stayed away from using the term “vertical”. These sub-sectors are areas in which startups are applying innovation and carving out new areas of economic activity often distinct from—although sometimes related to—legacy industries (e.g. AI, which doesn’t have a well-defined related industry, and FinTech, with the related Financial Industry).

Ecosystem Lifecycle Factors

Combined with some of measures from our Success Factor Model, Ecosystem Lifecycle Factors measure different dimensions of a startup ecosystem. These allows us to determine the phase of development in which the ecosystem is in -- Activation, Globalization, Expansion, or Integration.

- **Resource Attraction:** captures the extent to which entrepreneurs move to an ecosystem to start a startup and how many startups relocate to an ecosystem. Increasing Resource Attraction at the national and global levels is an important determinant of an ecosystem's growth rate.
- **Startup Leakage:** measures the percentage of startups that, in our global survey, reported leaving a certain ecosystem. A low score on Startup Leakage indicates that few startups have left that ecosystem in favor of another one.
- **Triggers:** Triggers are the externally impressive exits and high startup valuations that spark a sharp increase in Resource Attraction, driving the growth of an ecosystem and its evolution to the next phase of the Lifecycle.

Success Factor Model

Our principal analytical tool, this measures different dimensions of what supports the performance of local startups. We look at 10 Factors: one measuring actual performance with 9 Success Factors associated with performance, each comprised of sub-factors and metrics.

- **Performance:** A combination of leading, lagging, and current indicators that capture economic outcomes in a startup ecosystem.
- **Funding:** The level and growth of early-stage funding, looking at both access and quality.
- **Market Reach:** How well startups in a given ecosystem are able to reach customers outside their country and the immediate continental region.
- **Global Connectedness:** How well founders are meaningfully connected to founders in other ecosystems, with a focus on the world's top seven ecosystems.
- **Resource Attraction:** The gravitational pull of an ecosystem in drawing in entrepreneurs and startups from elsewhere.
- **Startup Experience:** The depth and diversity of the pool of prior startup experience in an ecosystem.
- **Talent:** Measures the accessibility, quality, and cost of software engineering expertise.
- **Founder:** success factors related to the startup founder, under his or her control, or internal to the startup as opposed to external (a function of the ecosystem)
 - **Founder Mindset:** Attitudes and preferences that align with success. See related ecosystem science article for more.
 - **Founders with Entrepreneur Mindset:** startup founders that closely matched the validated profile of successful early-stage entrepreneurs along five attitudes tested: Initiation, Reflection + Patience, Breadth, Depth, and Structure.
 - **Founders with Business Builder Mindset:** startup founders that closely matched the profile of successful business builders (late-stage entrepreneurs) along the five attitudes tested.
- **Founder DNA:** The background, experience, ambition, and motivation of local founders.
- **Founder Know-How:** A multi-variable assessment of founder knowledge of key startup methodologies such as Steve Blank's Customer Development and Eric Ries' Lean Startup.
 - **Theoretical Know-How:** a sub-factor of Founder Know-How capturing theoretical knowledge of key startup methodologies.
 - **Practical Know-How:** a sub-factor of Founder Know-How measuring a behavior demonstrating knowledge of key startup methodologies was put into practice.
- **Founder Go-Global Strategy:** measures whether a startup is going global from the outset or first targets its local market, and whether its customer acquisition team is located, targeted, and skilled to succeed.
- **Founder with High Ambition:** Founders who expressed all of the following attributes: Total Addressable Market of \$30 billion USD or more; developing a globally-new, or one of the globally-leading or niche products; and the mission to change the world, get rich or create a great product.
- **Founders with Experience in Sub-Sector:** founders who considered their graduate or postgraduate degree to be directly relevant to their startup.
- **Local Connectedness:** A multi-variable assessment of the local community, including sense of community, relationships, and collisions between founders, investors, and experts.
 - **Sense of Community Index:** a sub-factor of Local Connectedness capturing the degree to which founders informally receive help from investors, experts, and fellow founders.

- **Number of Relationships Between Founders:** number of quality relationships between local founders, where they know each other and can call upon the other for help “this week”.
- **Collision Index:** a sub-factor of Local Connectedness capturing the number of events founders recently participated in and the number of collisions with startup community participants.
- **Organizations:** Measurement of the quantity and quality of organizations, programs, events, and other activities is being conducted with support from the Kauffman Foundation.

Metrics Covered on this Report, by Success Factor

Performance

Startup Output measures the estimated number of startups in an ecosystem. Generally speaking, ecosystems need higher Startup Output (more startups) in order to enjoy faster ecosystem growth and higher performance.

We calculate an **Exit Value Growth Index** by capturing the value of exits over a two-year period in order to smooth fluctuations. Rapidly growing exit values capture attention from founders and investors from around the world and establish a track record of success.

Market Reach

To measure **Global Market Reach** in an ecosystem, we look at the average percentage of customers outside the country or continent.

Startups in Europe, for example, may sell to foreign customers in other European countries, but ‘Global Market Reach - Out of Continent’ captures how extensively they sell outside of Europe. Higher Global Market Reach means faster growth rates for startups.

Global Connectedness quantifies quality relationships that exist between startup leaders. We focus especially on connections with the world’s top ecosystems, the ecosystems that are at the nexus of the global fabric of knowledge, ideas, people and organizations. Global Connectedness brings Global Know-How into an ecosystem and leads to greater Global Market Reach.

Travel Connections show how many relationships of founders were formed by traveling to top ecosystems, whereas Local Meeting shows how many people from other ecosystems made connections with startups in a given ecosystem. The latter is a good indicator of the strength of conferences and events in the ecosystem attracting other people to come and visit.

Globally-Leading Product metric reports the percentage of startups in an ecosystem who say they are developing a completely new product for global markets. This is an indicator of Founder Ambition, and is influenced by the degree of Global Connectedness in an ecosystem, i.e. to what extent startups tap into the global knowledge allowing them to develop a new business model or technology—and know it actually is new.

Our metric on **Targeting Global Market** First reports the percentage of startups in an ecosystem who are going global immediately or targeting the United States or the United Kingdom, markets where, more than anywhere else, startups from all over the world

compete. This is an indication of Founder Know-How in terms of Going Global and Customer Development strategy.

Resource Attraction captures the extent to which entrepreneurs move to an ecosystem to start a startup and how many startups relocate to an ecosystem. Increasing Resource Attraction at the national and global levels is an important determinant of an ecosystem’s growth rate.

Startup Leakage measures the percentage of startups that, in our global survey, reported leaving a certain ecosystem. A low score on Startup Leakage indicates that few startups have left that ecosystem in favor of another one.

Startup Experience

Startup Experience captures the pool of experience startups can draw on in an ecosystem. We measure it by looking at several metrics indicating the experience in and around the founding team and scaling experience in the ecosystem.

Our measure of **Experienced Growth Employees** captures how many employees working in customer acquisition (growth) roles at startups have at least two years of prior experience working in startups.

Sector and Sub-Sector Definitions

Below are our definition for each startup Sub-Sector analyzed here. Note that sub-sectors are not mutually exclusive nor comprehensive — some startups are in sub-sectors we did not consider.

In addition, at least from patents, the data shows a clear tech convergence. Technology like AI software are increasingly inter-related, and we would expect a similar convergence overtime for Startup Sub-Sectors.¹

For more detail, including in our machine learning classification of sub-sectors, please see our Methodology section. For more coverage on each sub-sector, please see their respective sections in the report.

Advertising Tech (Adtech)

Advertising Tech captures different types of analytics and digital tools used in the context of advertising and marketing. Extensive and complex systems are used to direct, convey, or monitor advertising to target audiences of any size and scale.

Advanced Manufacturing & Robotics

Advanced Manufacturing involves smart technology to improve traditional manufacturing of products and/or processes. Robotics is the science and technology of robots, their design, manufacture, and application.

¹ "Patents and the Fourth Industrial Revolution. The inventions behind digital transformation," December 2017. European Patent Office.

Agriculture Tech (Agtech)

Agriculture Tech captures the use of technology in agriculture, horticulture, and aquaculture with the aim of improving yield, efficiency, and profitability through information monitoring and analysis of weather, pests, and soil and air temperature.

Artificial Intelligence, Big Data & Analytics

AI, Big Data & Analytics refers to an area of technology devoted to extracting meaning from large sets of raw data, e.g. often including simulations of intelligent behavior in computers.

Blockchain

Blockchain is a decentralized data storage method secured by cryptography. Cryptocurrencies are one of many innovations utilizing the blockchain. Companies building their product/architecture on top of this decentralized and encrypted technology are defined as blockchain companies.

Cleantech

Cleantech is comprised of sustainable solutions in the fields of Energy, Water, Transportation, Agriculture, and Manufacturing that including advanced materials, smart grids, water treatment, efficient energy storage, and distributed energy systems.

Consumer Electronics or Home Electronics (includes Wearables, Smart Devices)

Consumer Electronics or Home Electronics are electronic or digital equipment intended for everyday use, including smart devices used

for entertainment, communications, and home-office activities as well as other wearables.

Cybersecurity

Cybersecurity is the body of technologies, processes, and practices designed to protect networks, computers, programs, and data from attack, damage, or unauthorized access.

Education Tech (Edtech)

Education Technology refers to an area of technology devoted to the development and application of tools (including software, hardware, and processes) intended to redesign traditional products and services in education.

Fintech

Fintech aims to improve existing processes, products, and services in the Financial Services industry (including insurance) via software and modern technology.

Gaming

Gaming involves the development, marketing, and monetization of video games and gambling machines, as well as associated services.

Health and Life Sciences

Health and Life Sciences uses digital technology to maintain or improve health via the diagnosis, treatment, and prevention of disease, illness, and injuries.

Selected Data Timeframes

- Ecosystem Value, Exit Value, and Startup Valuation: sum of exits and funding rounds of 2015, 2016 and 1H2017
- Based on our previous analysis we assessed that it takes one year for half of the seed rounds to find their way into major data sources. Therefore, we use 2016 as the latest year for which earlier-stage metrics can be computer to create reliable benchmarks at the ecosystem level. Globally, it's reliable to use 2017 data for cross startup sub-sector comparisons.
- Early-Stage Funding: Sum of all Seed and Series A investments in 2015 and 2016, corrected for obviously missing rounds.

Startup Sub-Sector Performance Assessment

The purpose of the Startup Sub-Sector Performance Assessment is, first, to identify local Startup Sub-Sectors that already perform above average and, second, to identify locational advantages that support certain Sub-Sectors or may translate into internationally competitive Sub-Sector Performance in future. For each sub-sector, the overarching goal of the analysis is to identify patterns that make for relative success in the global comparison. Ultimately we want to inform the development of Sub-Sector strategies prioritizing one to three attractive Sub-Sectors, focusing enough resources to become globally competitive in these Sub-Sectors and drive ecosystem growth.

The Startup Sub-Sector Strengths Analysis focuses on the following aspects:

Startup Sub-Sector Analysis

Assessment of the startups that belong to one of the Startup Sub-Sectors with a special focus on their performance and overall attractiveness.

Existing Market & Legacy Industry Analysis

Identification and assessment of existing markets and potential legacy industries that are related to the startup sub-sector.

Talent & Knowledge Analysis

Assessment of university infrastructure and output that feeds talent and expertise demand of the sub-sector.

Startup Sub-Sector Analysis

We measure the Performance and the relative the different Startup Sub-Sectors (e.g. Fintech, Cybersecurity, Biotech) on a Global Level as well as on an Ecosystem Level. The Sub-Sector Performance Analysis is based on our Startup Ecosystem Assessment Model and examines the following factors, qualitatively and quantitatively. Due to data availability, some factors can only be evaluated at the global level.

Startup Output

- Estimate of the number of startups that are active in the Sub-Sector
- Startup Output Growth over the last 5 years

Exits, Unicorns & IPOs

- Number of all Startup Exits in the Sub-Sector & Exit Volume
- Sub-Sector Unicorns in Existence and their Valuations
- Analysis of Startups per Sub-Sector that went public
- Growth Rates for all of the above over the last 5 years

Funding

- Assessment of Total Funding per Sub-Sector: Number of Funding Events & Total Funding Amount
- Examination of High Growth Startup Development (Series B+)
- Growth Rates for all of the above over the last 5 years

Sub-Sector Founder Dynamics & DNA in relation to other

Sub-Sectors:

- Founder Ambition, Go-Global Strategy & Global Connectedness of Sub-Sector Founders
- Prior legacy industry expertise of founders

Local Support for the Sub-Sector

- Accelerators with formal focus on the Sub-Sector
- Events with focus on the Sub-Sector
- VCs with formal focus on the Sub-Sector

Existing Market & Legacy Industry Analysis

In order to get an idea of the potential of the different sub-sectors we analyze the Market Size of related traditional industries. Example: For Adtech we have looked at the market for traditional Advertising & Marketing.

These are evaluated quantitatively and qualitatively, as applicable. qualitatively and quantitatively. Due to data availability, some factors can only be evaluated at the global level.

Related Market Size

- Identification of the relevant market segments that are linked to the sub-sector
- Analysis of the market size, market growth and future predictions (e.g. based on Market Cap, Sum of Sales, etc.)

Furthermore we are identifying and analyzing Legacy Industries that are related to specific Startup Sub-Sectors (e.g. Financial Services Industry for Fintech).

Related Legacy Industry

- Identification of the relevant legacy industries that are linked to the Sub-Sector
- Analysis of the market size, market growth (e.g. Annual Revenue, People Employed, etc.)

The long-term goal is to identify Local Industry Strengths and to find out if and how they translate into higher Startup Sub-Sector Performance.

Talent & Knowledge Analysis

We apply our validated Talent sub-factors (Access, Cost, and Quality of Talent) to the different Startup Sub-Sectors. Additionally, we are going to put a special focus on Universities and Colleges, looking at local concentration of specific degrees or research focuses, qualitatively and quantitatively. Due to data availability, some factors can only be evaluated at the global level.

Universities & Colleges

- Specialized Degrees
- University Rankings
- University Graduates Analysis
- Research, Patents & Academic Citations
- Academic Awards & Nobel Prizes

Startup Classification Methodology

A foundation of this report is the classification of companies into the Sub-Sectors covered by our research. To build this foundation, we relied heavily on a combination of top-down and bottom-up clustering techniques and state-of-the-art machine learning algorithms.

In a nutshell, we followed a 4-step approach that led to the classification of companies as it is used throughout this report:

- 1 Clustering of tens of thousands of companies based on tags provided by our main data partners Crunchbase, Dealroom and Orb Intelligence
- 2 Identification of clusters of sufficiently large size within the innovation economy
- 3 Improved labelling of companies based on company descriptions to reduce tagging errors (e.g. tags often included misleading buzzwords)
 - a Manual labelling of a random selection of 10k+ companies
 - b Automatic labelling of companies based on frequent and useful tags within each of the clusters
- 4 Iterative sub-sector classification until our accuracy standards were met (see below for standards)
 - a Predictive machine learning algorithms based on natural language processing of company description texts provided by our data partners
 - b Manual review of false positives and false negatives to improve labels for next iteration

This semi-automated and iterative approach allowed us to move fast while still achieving high accuracy scores. More specifically, we required every predictive model to meet the following criteria:

- Recall², Precision³ and F1 Score⁴: 0.85 or higher
- ROC - AUC Score⁵: 0.9 or higher

Additionally, to ensure the high quality of our classification process, we are going to add a manual review process following the 80-20 rule to make sure the largest and most successful companies,

2 Recall: Proportion of actual positive values found by the classifier

3 Precision: Proportion of positive predictions that were indeed positive

4 F1 Score: Harmonic mean between Precision and Recall

5 ROC - AUC: Area under the ROC; score contrasting true positives vs. false positives; from 0.5 (random model) to 1 (perfect model)

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