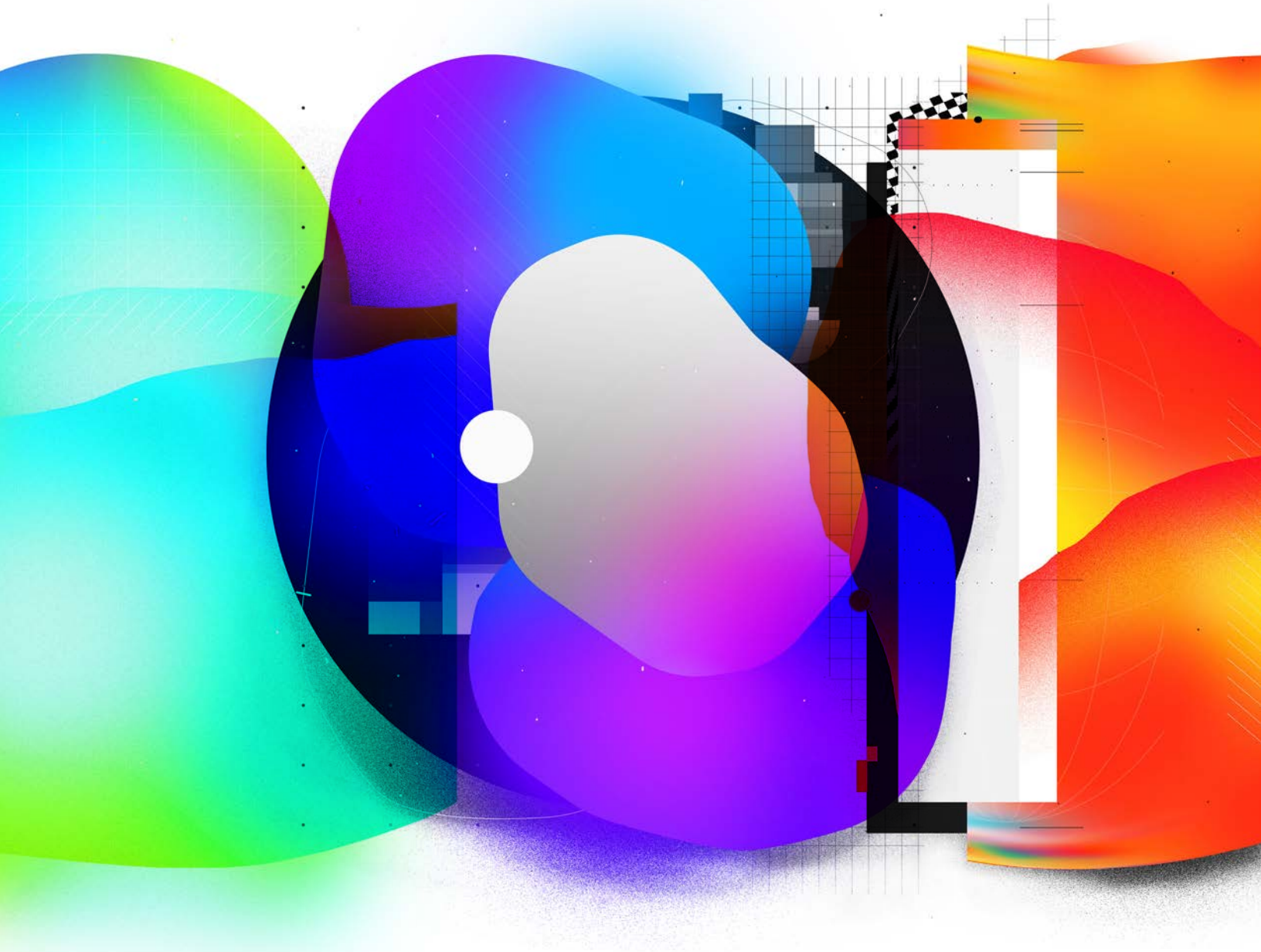




**THE  
ENGINE**

Built by MIT



**2021**

# Tough Tech Landscape

Data provided by  PitchBook.

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# Foreword

**S**olutions to our greatest challenges often emerge from those operating on the edge of what’s possible. In academia and research institutions across the globe, innovators are harnessing their talent, developing technologies that can help mitigate and even reverse Climate Change, empower Human Health, and create the next generation of Advanced Systems & Infrastructure. Just a decade ago, these teams struggled to find venture investors willing to support the necessary technological development before their breakthroughs could reach commercial viability—but something’s changed.

As we showcase in this report, venture investment in Tough Tech has never been stronger. Since our last report, only two years ago, both the size and number of checks and VCs backing Tough Tech companies has increased across all sectors. 2020 alone saw nearly \$76.8 billion invested into Tough Tech. Capital commitments from corporate VCs, later-stage institutional investors, and acquisitions through vehicles like SPACs have all increased as well, with no signs of a slowdown. If we hope to leave the planet a healthier, more resilient place for future generations, this is absolutely necessary.

The positive trends quantified in the following pages are also supported by qualitative observations. At The Engine, we are seeing exceptional individuals make the jump to Tough Tech entrepreneurship and, simultaneously, growing interest from a broader array of stakeholders, including corporate partners, government officials, and other partners across the capital stack. We are not alone in witnessing this positive momentum; friends throughout the Boston

investment community—and beyond—are all experiencing similar levels of enthusiasm from founders and partners.

So, where to next?

We must continue to nurture those at the cutting edge of scientific and technical research by giving them the opportunity to explore entrepreneurship and the potential of their breakthroughs. Our Blueprint program is one such effort. It’s designed to give the next generation of Tough Tech leaders the tools to navigate the commercialization process through hands-on tailored programming. We just completed our third cohort and will launch the program again in spring 2022 for those who aspire to be Tough Tech entrepreneurs.

There is always more to be done—more programming support, greater investment, and more education about the possibilities of emerging technologies. As I wrote in the foreword to our impact report published this past spring, the past two years have been defined by a pandemic that has only sharpened our collective sense of urgency to discover and commercialize Tough Tech companies. These years serve as a reminder of why we must continue to create the frameworks to support those who are solving massive problems through the convergence of science, engineering and leadership.



**Katie Rae**  
CEO & Managing Partner  
The Engine

# Deals

Over the past decade, venture financing into Tough Tech has surged. In 2020, \$76.7 billion was invested across nearly 5,000 transactions. In the first 8 months of 2021 alone, nearly \$78 billion has already been invested across close to 4,000 completed financings worldwide. To increase granularity across the diverse set of fields in Tough Tech, we are grouping deals into three categories: Climate Change, Human Health, and Advanced Systems & Infrastructure. Each of these segments reached record highs for investment.

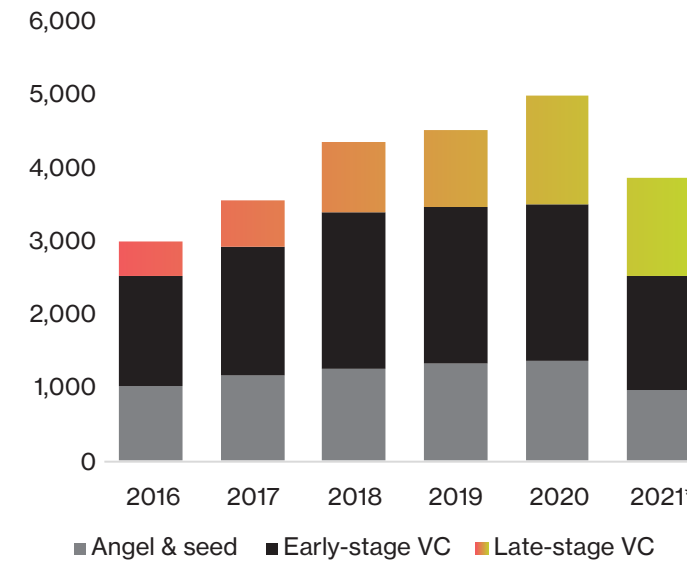
Recent events representative of long-term and urgent challenges have driven this recent flood of funding. The 2021 assessment report,

released by the United Nations' Intergovernmental Panel on Climate Change (IPCC), stressed the urgent need to develop and deploy low-emissions technologies—particularly in the power, transportation, and industrial sectors. The COVID pandemic highlighted the importance of resilience in product development through the commercial supply chains of vaccines, diagnostics, and therapeutics. This same resilience is in our our food systems. Simultaneously, the pandemic-driven lockdowns resulted in more people working from home, which led many to realize the importance of communication technologies and computing systems as critical infrastructure. Further, the semiconductor shortage and COVID-19-related supply chain delays caused governments around

the globe to prioritize domestic manufacturing initiatives.

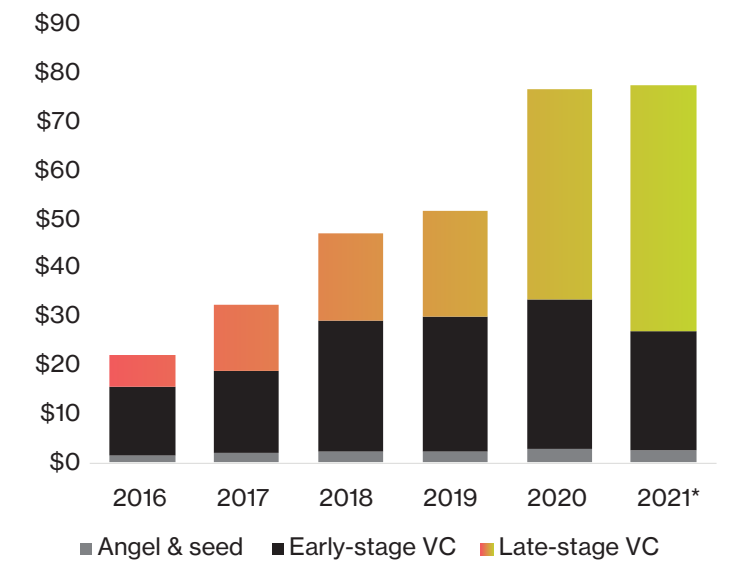
Venture firms, corporate investors, sovereign wealth funds, and family offices were even more active in Tough Tech. Such a profusion of capital into Tough Tech has required strict due diligence and greater investor understanding regarding the complexity and timeline of the products and services faced by Tough Tech companies. Nonetheless, the venture capital investment remains unabated. Looking ahead, venture capital investment into Tough Tech is expected to proceed at a record pace, as investors seek to support the next generation of technologies addressing global challenges.

**Tough Tech VC deals (#) by stage**



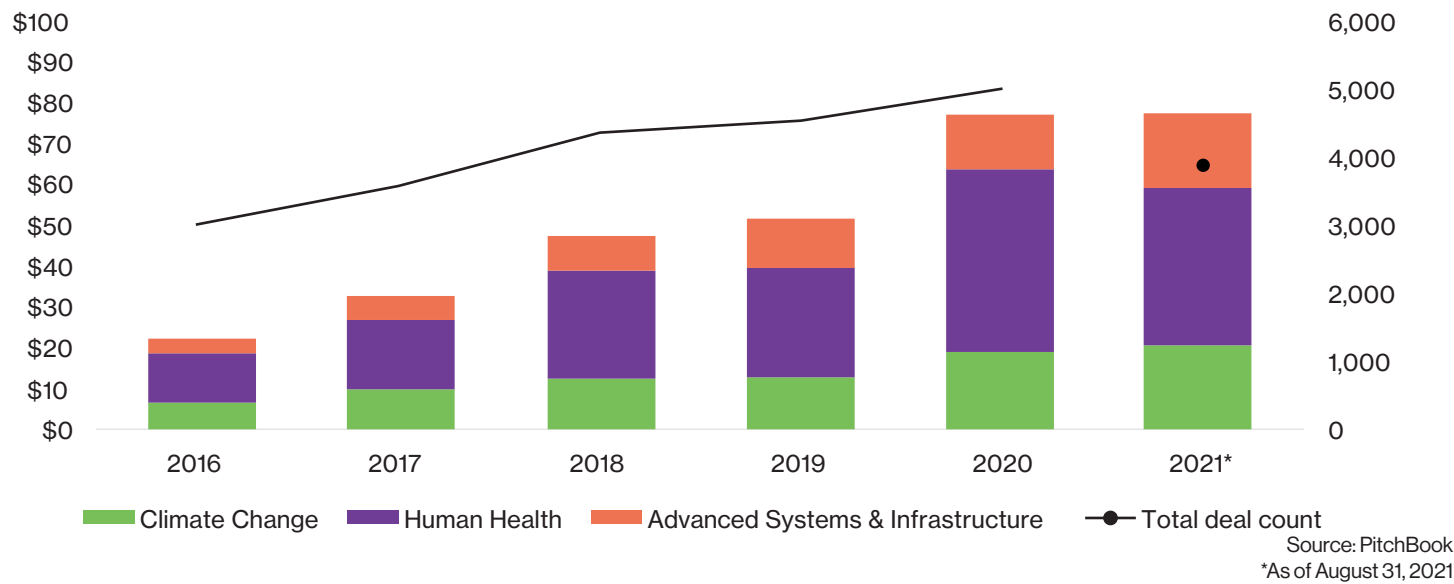
Source: PitchBook  
\*As of August 31, 2021

**Tough Tech VC deals (\$M) by stage**



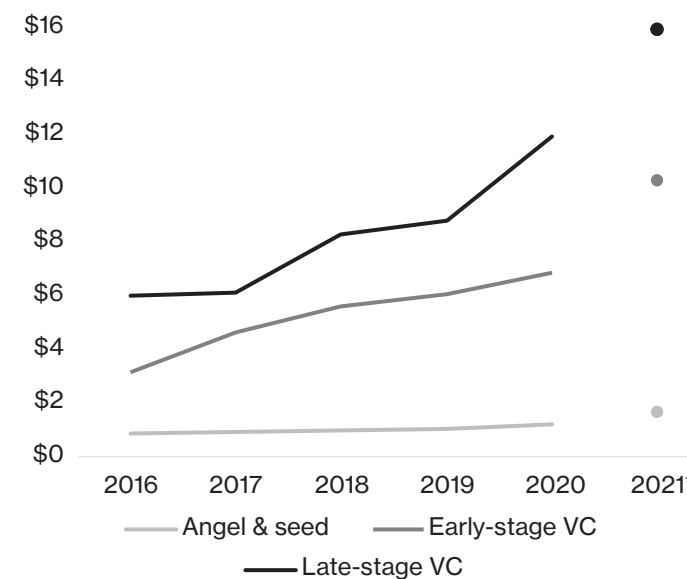
Source: PitchBook  
\*As of August 31, 2021

**Tough Tech VC activity by segment**



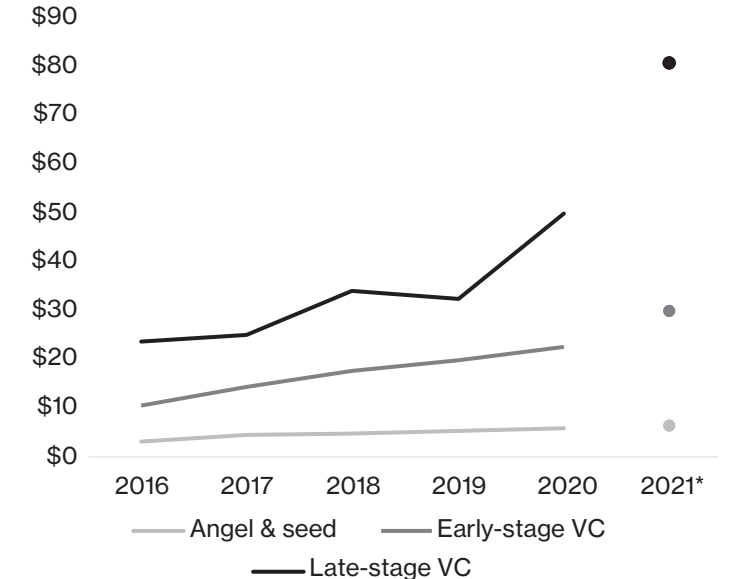
Source: PitchBook  
\*As of August 31, 2021

**Tough Tech median VC deal size (\$M) by stage**



Source: PitchBook  
\*As of August 31, 2021

**Tough Tech median VC pre-money valuation (\$M) by stage**



Source: PitchBook  
\*As of August 31, 2021



# Exits



Over the past four years, Tough Tech has experienced two dramatic surges in growth, with both the number of exits and exit valuations.

The first occurred in 2018, when exit activity increased by more than 200% and exit count increased by 39%, compared to the year prior. The bulk of this growth was for IPOs in the Human Health segment, which jumped from 32 exits totalling \$5.4 billion in 2017 to 58 exits totalling \$28.0 billion in 2018. In fact, that year, biotech startups made up half of all VC-backed IPOs. This wave was driven by companies developing therapeutics and gene-editing technologies, including *Moderna*, *Rubius Therapeutics*, and *Homology Medicines*.

The second surge occurred in 2020. Tough Tech exit activity increased by more than 130% with the Climate Change segment experiencing the largest jump (+991%). Most of this activity was concentrated in IPOs as well as in reverse mergers with special purpose acquisition companies (SPACs).

A SPAC is a publicly listed shell company designed specifically to acquire a private company and convert it into a public one. An alternative to the traditional IPO process, more Tough Tech companies have chosen to go public via reverse mergers with SPACs for several reasons. The first is available capital. Between January 2020 and August 2021, the 34 Tough Tech startups choosing to go public via SPAC received an average valuation above \$1 billion, even though a significant per-

centage of this cohort do not yet offer any commercial products.

This scale of funding is not unique to SPAC targets—as venture capital funds have grown over the years, so too have the number of venture-funded unicorns, or startups with billion-dollar valuations. Therefore, the second key benefit of SPAC mergers is the accelerated access to this capital, as the entire timeline of a SPAC merger, from first touch to public listing, can take as little as six months.

Lastly, the third key benefit to Tough Tech startups is the actual process of going public via SPAC. In an IPO, companies must announce the IPO before knowing either valuation or share price. The company's true market capitalization is thus unknown until it actually starts trading. In a SPAC transaction, the target company's valuation is part of the negotiation process, and strong returns for existing shareholders are essentially guaranteed. Additionally, since the SPAC continues to be publicly traded in the period between the announcement and the completion of the transaction, there is reduced risk of an unexpectedly disappointing IPO.

Between January 2020 and August 2021, 19 Climate Change startups have gone public via reverse mergers with SPACs. The bulk of these companies are specifically focused on batteries, energy storage, electric vehicles (EVs), and EV charging. Many of these companies are still pre-revenue, and chose to venture into the public markets in order to secure fresh capital for scaling

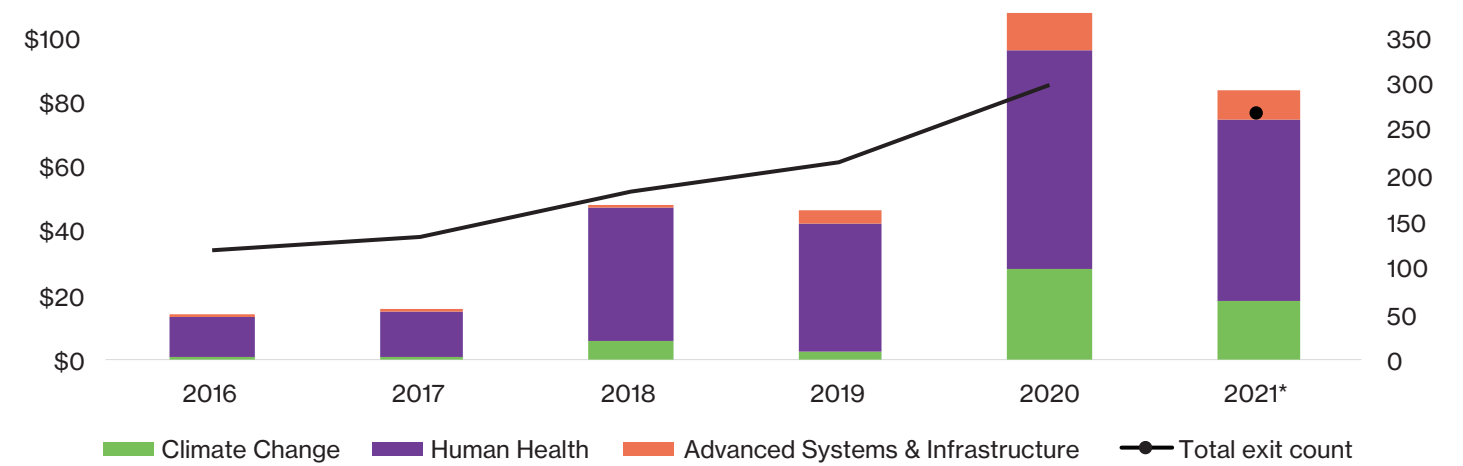
production, since transitioning from a startup to an automotive original equipment manufacturer (OEM) or a Tier 1 Li-ion battery cell manufacturer, requires billions of dollars in investment.

The surge of capital into the cleantech and electric mobility exits demonstrates two emerging views within the institutional investor community. First, these investors are now convinced the energy transition is a huge market opportunity that will transform the power and automotive industries, and they are looking to capitalize on this opportunity. Second, the technologies powering this transition are not necessarily coming from incumbents, but from Tough Tech startups looking to disrupt today's status quo.

Meanwhile, the Advanced Systems & Infrastructure segment has also experienced an uptick in exit counts and valuations. One of the most notable exits in this space is *IonQ*, which became the first publicly traded, pure-play quantum computing company after completing a SPAC merger on October 1, 2021. The company received gross proceeds of \$636 million from the transaction. *IonQ* plans to use this capital to continue its path towards building a multi-million qubit, fault-tolerant quantum computer.

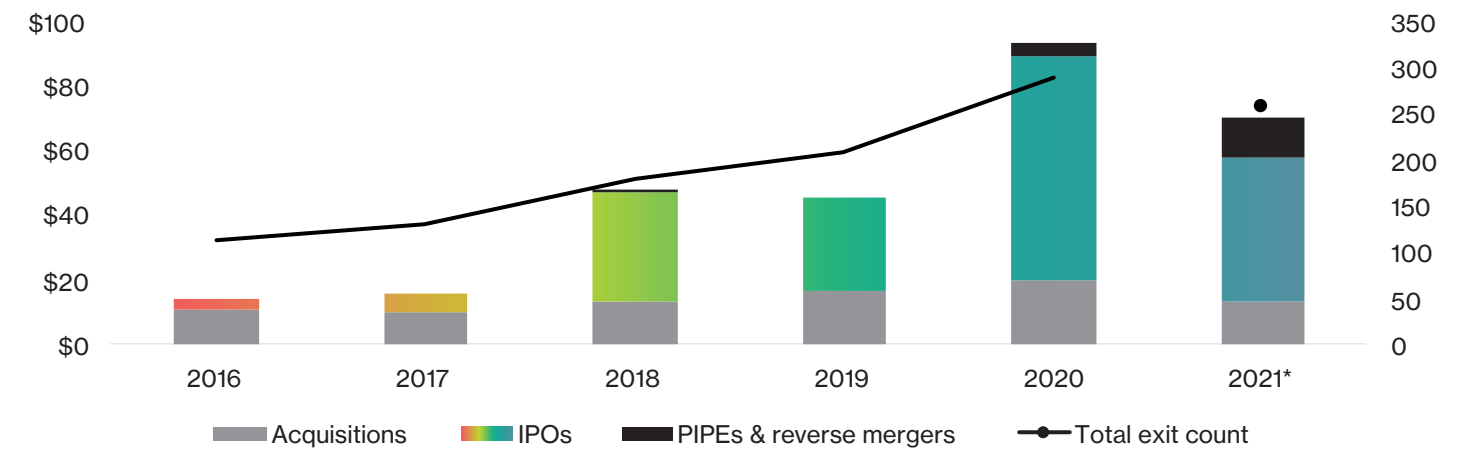
Looking ahead, Tough Tech IPOs, SPAC mergers, and exit valuations are likely to only continue to skyrocket, as the emerging markets in Climate, Human Health, and Advanced Systems & Infrastructure begin to come to fruition.

**Global VC Exit Activity by Tough Tech Bucket (\$B)**



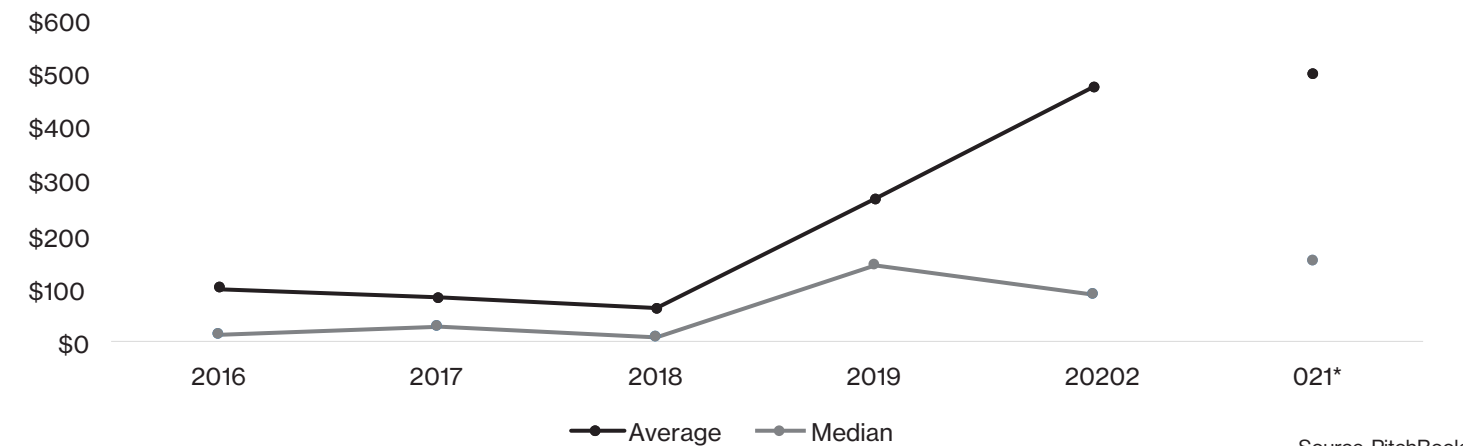
Source: PitchBook  
\*As of August 31, 2021

**Global VC Exit Activity by Exit Type (\$B)**



Source: PitchBook  
\*As of August 31, 2021

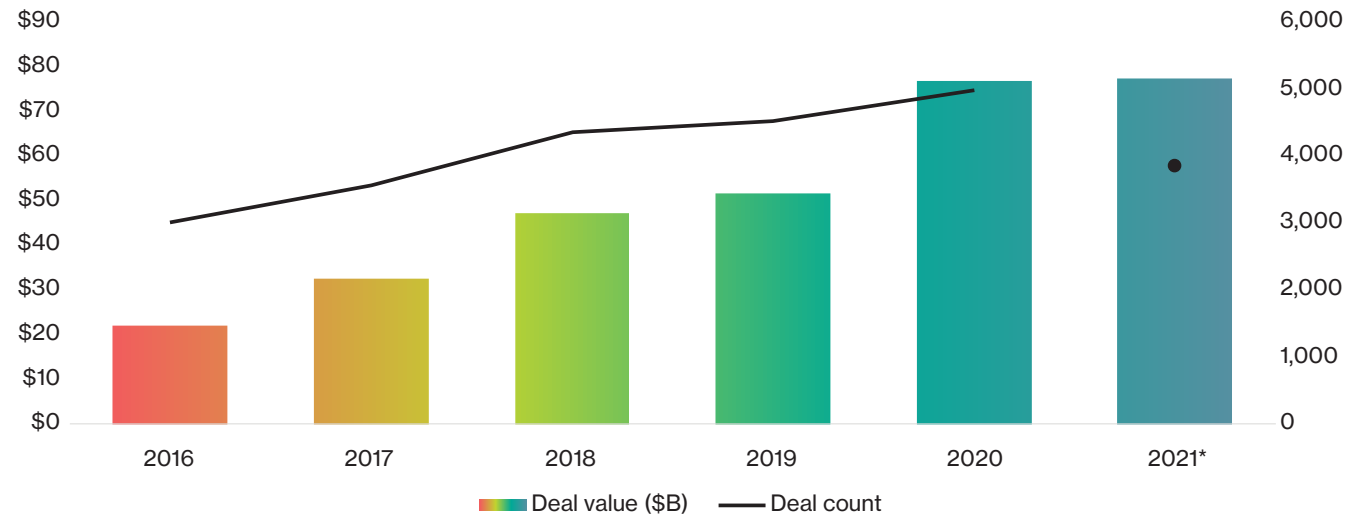
**Global VC Exit Activity by Exit Type (\$B)**



Source: PitchBook  
\*As of August 31, 2021

# Tough Tech by the numbers

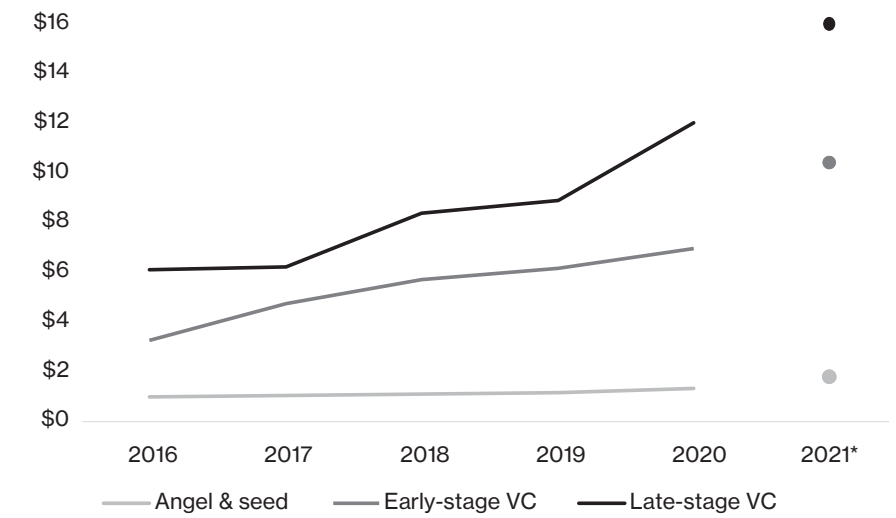
## Tough Tech VC activity



Source: PitchBook  
\*As of August 31, 2021

VC activity in Tough Tech is setting records in 2021, even after record sums invested last year. Benefiting from multiple accelerating factors, ranging from breakthrough technical advances, growing adoption and expansion of business applications, and macroeconomic factors, such as government policies and changing regulations. Multiple Tough Tech segments are seeing more investment than ever before.

## Tough Tech median VC deal size (\$M) by stage



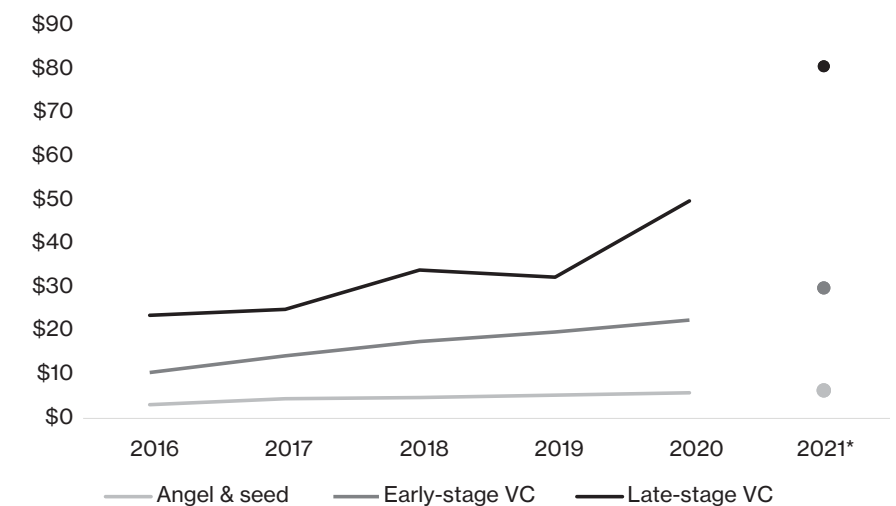
Source: PitchBook  
\*As of August 31, 2021

## Most active VC investors in Tough Tech, 2020-2021\*

Investor	Deal count
SOSV	136
Sequoia Capital China	98
OrbiMed	94
Hillhouse Capital Group	94
Keiretsu Forum	90
RA Capital Management	89
Qiming Venture Partners	71
Casdin Capital	66
Matrix Partners China	63

Source: PitchBook  
\*As of August 31, 2021

## Tough Tech median VC pre-money valuation (\$M) by stage



Source: PitchBook  
\*As of August 31, 2021

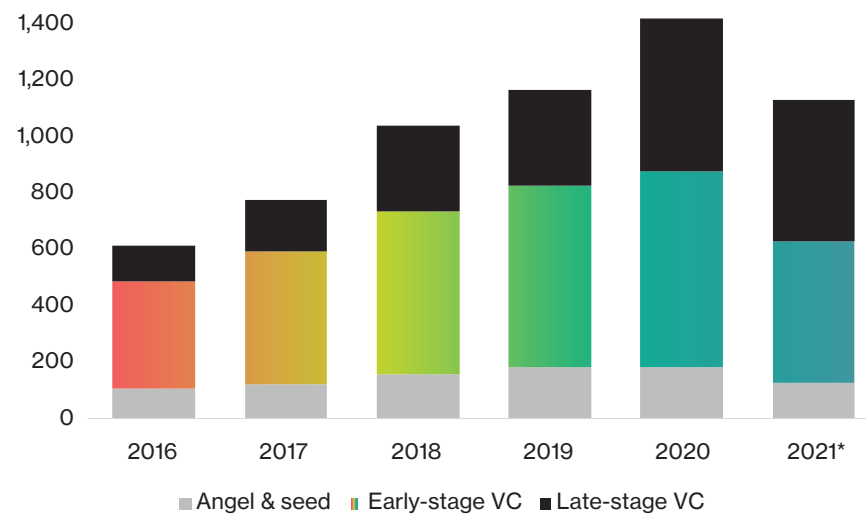
**\$307.6B**

Venture capital invested from 2016 through August 2021

**48.7%**

Year-over-year increase in Tough Tech venture investing from 2019 to 2020

## Tough Tech VC deals (#) with corporate participation by stage



Source: PitchBook  
\*As of August 31, 2021

**\$77.5B**

Venture capital invested in 2021 through August

**5,800**

2021 is currently on pace to record nearly 5,800 transactions

**\$80.7M**

The median late-stage pre-money valuation in Tough Tech hits a new high

# Q&A

## **What is The Engine?**

The Engine is an early-stage venture firm that invests in Tough Tech companies commercializing transformative technology that will lead to a healthier population, more accessible and adaptive society, and a more resilient world.

It was conceived of and created by MIT to address the need for sustained support for startups commercializing breakthrough science and engineering, with the potential to solve intransigent global problems and make a material, positive impact on society. Launched out of MIT in 2016, The Engine was designed as an “innovation orchard”, where Tough Tech founders could have access to capital, infrastructure, and a growing network of stakeholders needed for them to be successful. Together, these three elements combine to create a model around which we can build an innovation ecosystem that successfully translates breakthrough research to impact.

## **What is Tough Tech?**

Tough Tech is transformative technology that solves the world’s most difficult challenges through the convergence of breakthrough science,

engineering, and leadership. While it is often grouped with Deep Tech or Frontier Tech, Tough Tech differentiates itself by centering on mission and purpose.

Tough Tech has the potential for big returns and global impact, through the creation of new foundational economic infrastructure and by enabling the transformation of existing industrial activities. The Engine’s Tough Tech founders have proven breakthrough science in labs and are taking the next step to bring their technologies to market and impact. These companies will improve human health and agriculture, build resilient systems, enable adaptive infrastructure, and adapt to—and even reverse—climate change.

## **How has your investment thesis around Tough Tech evolved given the past few years’ developments in the space?**

Our commitment to early-stage investment in Tough Tech companies has remained unchanged. Previously, skeptics of investment in Tough Tech would point to long technology development timelines and capital intensity as barriers to successful returns. However, the pandemic, coupled with the scientific and

technological world’s response, has highlighted the importance of supporting Tough Tech across not just health, but also other urgent societal challenges, such as climate change. The Engine continues to identify, fund, and offer the infrastructure needed to startups pursuing transformational changes.

Although our investments are broadly defined as Tough Tech, each industry in which Tough Tech can play a role has unique trends and economics that factor into the investment thesis in that space. We invest across three segments: Climate Change, Human Health, and Advanced Systems & Infrastructure.

However, a few key underlying themes exist that carry across every industry. First and foremost is finding incredible founders to build diverse and people-oriented companies—great technical founders who can traverse the difficult journey of Tough Tech and attract great people—is key to long-term success. Other essential factors are technologies that can potentially impact society on a global scale and transform industry. To take big swings and conquer Tough Tech, we dream big and understand the hurdles impeding progress in each industry.

## **How is Tough Tech investment different from other early-stage technology investing?**

The Engine’s approach focuses on shepherding work from the lab and academia to commercial reality. Discovery is just the start. Bringing new science and technology to market requires a unique skillset and an entrepreneurial drive. We’ve designed programming, such as our Blueprint Program, to foster these skills and promote the next generation of Tough Tech entrepreneurs.

While commercializing Tough Tech, a founder has to manage risk across four dimensions: technical, market, scale, and regulatory. Assessing those risks requires expertise in the specific technical fields, an understanding of intricate market structures, and engagement with the policy community—a combination of knowledge that is difficult to assemble in the time period normally allotted for company diligence. At The Engine, we have worked to build a network of technologists, investors, government representatives, corporates, and academics that provides important feedback during our diligence process, and we work closely with our portfolio companies as they move forward.

## **With increased scrutiny on venture capital diversity, what are some of the ways The Engine is addressing diversity and inclusion within the firm, as well as with investments?**

Diversity has been central to The Engine’s values from the beginning, and we are particularly proud of the makeup of our founders to date. In the past 18 months, we have seen the conversation around venture diversity change. This open dialogue means looking more closely at the representation of our portfolio, as well as our firm, and identifying how we can continue to do better. Today, 66.6% of companies have a minority CEO and/or founder (defined as Asian/Asian American, Black/African American, Latinx, American Indian, Native Pacific Islander, and/or women); 44% of our companies have a female founder; and 66.6% have a female executive or board member. While we are incredibly proud of our progress thus far, we all have more work to do.

## **How has the increased pace and volume of early-stage investment impacted The Engine’s investment strategy?**

Like the rest of venture, the last year has been an exciting time at The

Engine. We announced the close of our second fund in fall 2020, and have invested in 9 new companies—spanning dynamic and accessible routing for public transit (The Routing Company), to distributed chemical production (Emvolon), to cement decarbonization (Sublime Systems). Since its inception, The Engine has invested in 36 companies across both of our funds.

## **What do you look for in a founding team?**

We look for founders with the drive and passion to fulfill their mission. They must be working on groundbreaking science or technology that has the potential to solve a big global problem and the opportunity to transform an industry.

# Climate Change

In the past ten years, massive markets have been created in renewable power and vehicle electrification, attracting investors across the capital stack. Two of The Engine's first investments were in companies pursuing renewable energy solutions, *Form Energy* and *Commonwealth Fusion Systems*. Both companies have made dramatic strides since their inception in 2017, commercializing multi-day energy storage systems and nuclear fusion power plants, respectively.

Beyond carbon-free electricity, there is a second category of companies looking to electrify applications outside of the power sector, such as industrial materials and metals. There are several key megatrends driving innovation and investor interest in low-emission technologies for these sectors. In one regard, urbanization and the growing global population are creating increased demand for metals and materials for the built environment, such as steel and cement. The material production processes powering these industries require truly innovative Tough Tech solutions in order

to decarbonize them, such as those being developed by *Boston Metal* and *Sublime Systems*.

Separately, in order to meet global CO<sub>2</sub> emissions targets, the production of critical minerals used in new energy technologies will need to increase dramatically. These minerals include battery materials, such as lithium, nickel, and cobalt, as well as rare earth metals, which are critical components for magnets used in wind turbines and electric motors. *Lilac Solutions* has developed an ion exchange material that enables vastly more efficient lithium extraction to meet the rapidly growing demand for lithium, which is required for electrification of transportation.

Lastly, there are a wide variety of chemical production processes that require new technologies to reduce emissions and bring new products to market. Hydrogen production is a key process within this category; *Syzygy Plasmonics* is pioneering a new type of chemical reactor driven by light to enable decentralized on-site hydrogen generation. Other technologies in this category include those that will

enable the establishment of a robust carbon market, such as carbon capture, storage, and utilization systems.

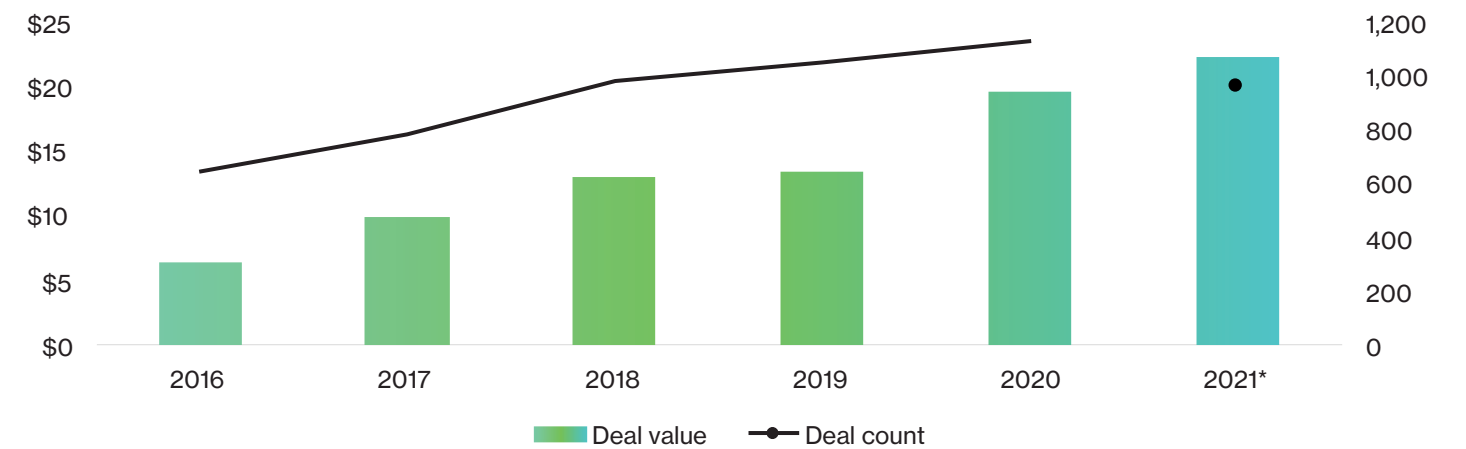
From January 2020 through August 2021, more than \$40 billion in venture capital has flowed into ClimateTech startups—a 37% increase compared to all investments made in 2018 and 2019. As low-emission technologies reach commercialization and create new markets, even more opportunities will arise for Tough Tech climate entrepreneurs seeking to build more robust, sustainable systems.

## Climate Change Deal Activity

Investor	Deal count	Investor	Deal count
SOSV	47	S2G Ventures	15
Breakthrough Energy Ventures	28	Keiretsu Forum	15
Climate Capital	20	Y Combinator	12
Lowercarbon Capital	19	The Engine	12
Prelude Ventures	18	ImpactAssets	12
Alumni Ventures Group	16		

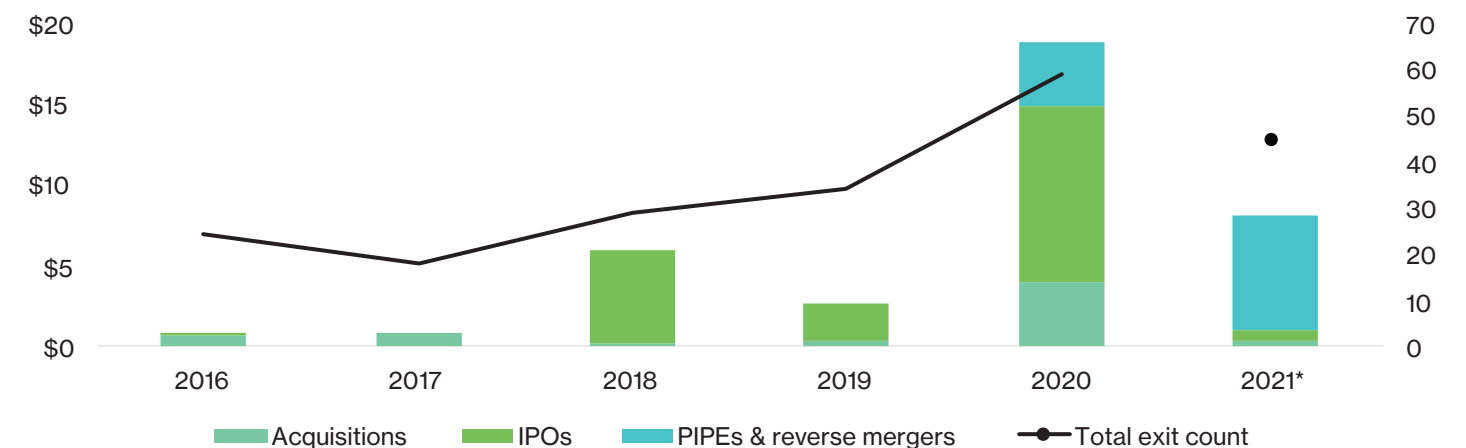
Source: PitchBook  
\*January 2020 - August 2021

## Global VC Deal Activity in Climate Change (\$B)



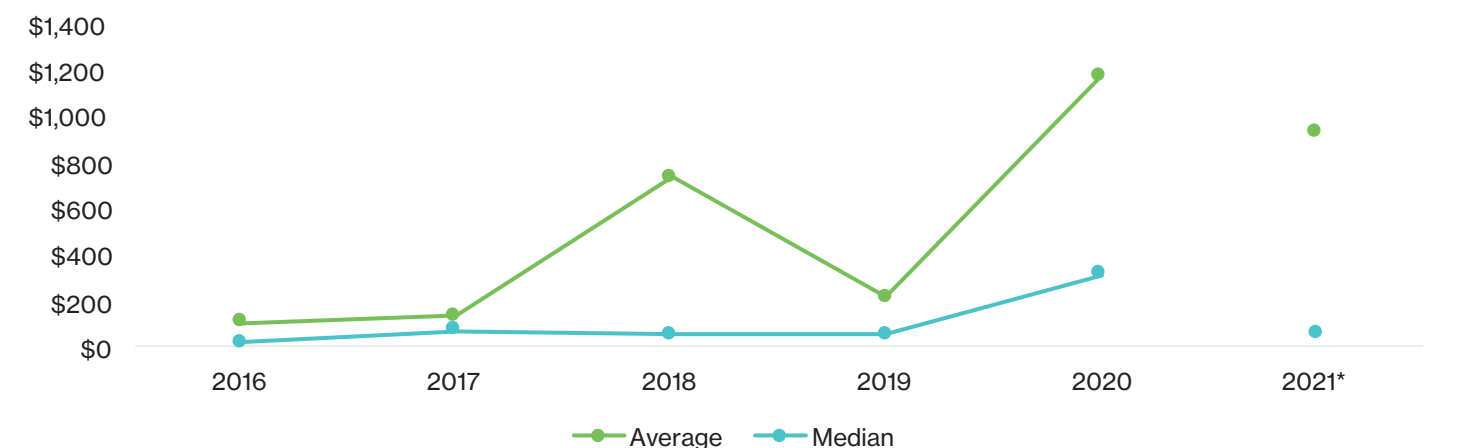
Source: PitchBook  
\*As of August 31, 2021

## Global VC Exit Activity in Climate Change (\$B)



Source: PitchBook  
\*As of August 31, 2021

## Average & Median Exit Valuations in Climate Change (\$M)



Source: PitchBook  
\*As of August 31, 2021



# Human Health

No industry has featured more prominently in the public domain than those related to Human Health. The COVID-19 pandemic has cast a bright spotlight on a sector already fueled by long-term trends of growing populations, extending lifespans, and the ascent of age-related diseases. In tandem, agriculture and food required to sustain the growing population, in an environmentally positive way, has created a need for innovation that leverages some of the same advances in biosciences, as well as other technological breakthroughs in material science, big data and robotics.

A major share of the Human Health segment relates to therapeutic ventures, which - unlike most other segments of Tough Tech - benefit from a well-established innovation ecosystem, built on decades of progress in molecular biosciences. More recent examples of such innovations include CRISPR-based genome editing technologies, cell-based therapies, mRNA therapeutics, and vaccines. The growth and accessibility of high-throughput methods, such as sequencing or proteomics, coupled

with advances in machine learning and data science approaches, promise to continue to drive innovation in this space, offering new and more personalized treatment and diagnostic modalities. Besides advances in molecular biosciences, a new breed of Tough Tech companies are being formed at the intersection of the life science and physical or engineering domains. Companies like *Kytopen* and *Cellino* will be foundational to further development and scaling of the next generation of therapies.

The COVID-19 pandemic has resurfaced the importance of public health, infectious disease testing, and vaccination, re-emphasizing the work of companies like *Biobot*, *E25Bio*, and *Vaxess Technologies*. All of whom continue to contribute to fighting the pandemic, and ensure our readiness for future outbreaks of infectious diseases.

Despite the tremendous advances in treatment and diagnostics over the last few years, significant challenges remain. Autoimmune or neurodegenerative diseases and certain types of cancer will likely require new, bold approaches like those pioneered by *Lucy Therapeutics*.

In the agtech and foodtech sectors, a clear trend towards sustainability and reduction of carbon footprint has materialized in the form of alternative proteins, with several companies reaching multi-billion dollar valuations in recent years. The proliferation of indoor farming and technologies that extend shelf life of produce is resulting in more resilient and sustainable supply chains. Companies like *Mori*, has pioneered natural protective coatings of food from fresh cut vegetables to protein to preserve freshness. Lastly, the field of synthetic biology is coming of age with companies pursuing large-scale production of both industrial and specialty chemicals, textiles, leather substitutes, and other materials through use of genetically engineered microorganisms.

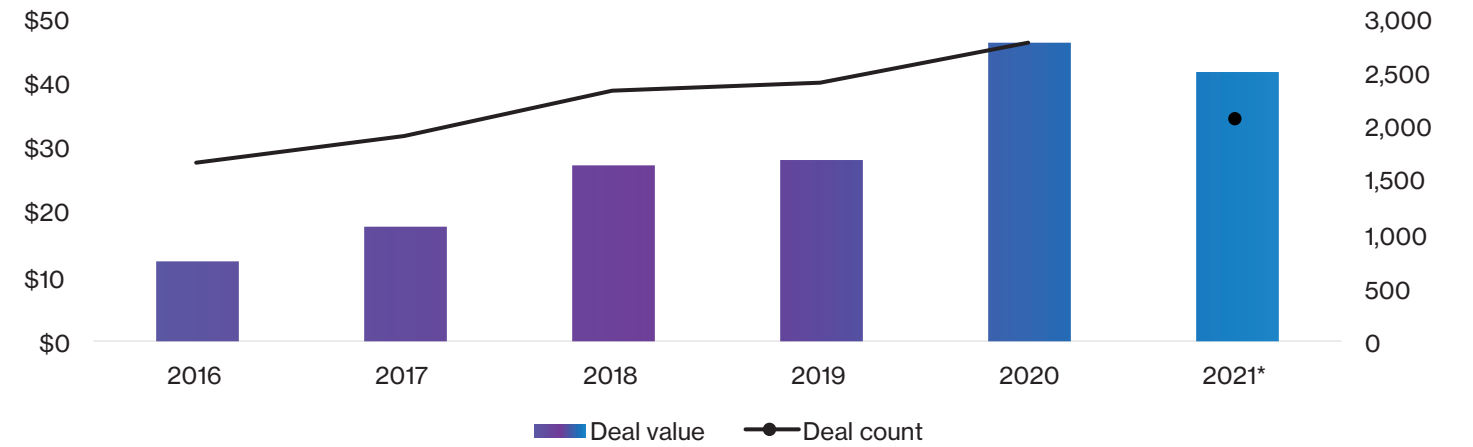
Given the size of the challenges ahead, the pace of discovery, innovation, and the convergence of biological sciences and other domains, ranging from engineering to machine learning and big data, we expect the strong growth in this sector to continue.

## Human Health Deal Activity

Investor	Deal count	Investor	Deal count
OrbiMed	94	Alexandria Venture Investments	56
RA Capital Management	89	GV	49
SOSV	68	Logos Capital	44
Casdin Capital	65	Perceptive Advisors	41
Keiretsu Forum	61	Khosla Ventures	41
Cormorant Asset Management	58	Foresite Capital Management	41

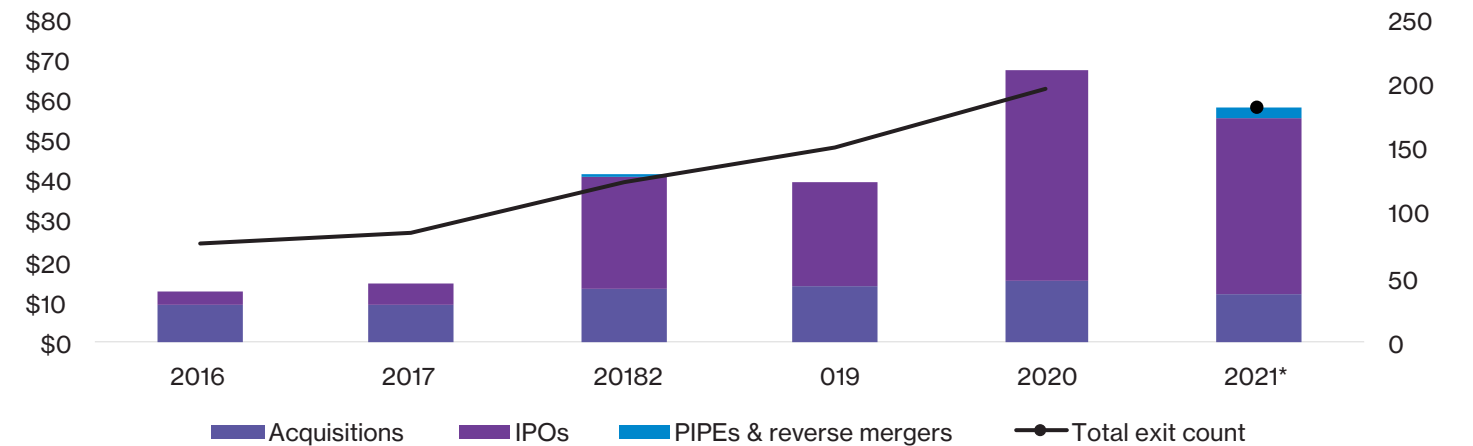
Source: PitchBook  
\*January 2020 - August 2021

## Global VC Deal Activity in Human Health (\$B)



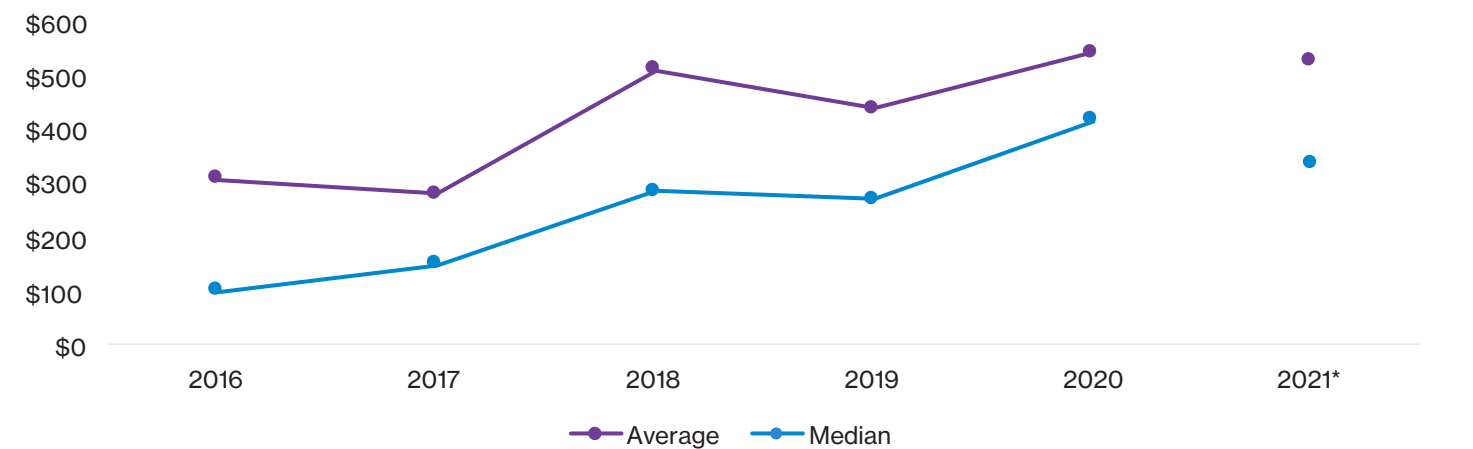
Source: PitchBook  
\*As of August 31, 2021

## Global VC Exit Activity in Human Health (\$B)



Source: PitchBook  
\*As of August 31, 2021

## Average & Median Exit Valuations in Human Health (\$M)



Source: PitchBook  
\*As of August 31, 2021



# Advanced Systems & Infrastructure

2

2020 was a pivotal year for Tough Tech startups in Advanced Systems & Infrastructure. COVID-19 lockdowns forced many to abandon their daily commutes, work from home, and communication technologies and computing systems became more commonly accepted as critical infrastructure. At the same time, the semiconductor shortage and COVID-related supply chain delays caused U.S. government agencies and the Biden Administration to prioritize domestic manufacturing initiatives with renewed urgency.

These recent events played an undeniable role in 2021's rapid increase in Advanced Systems & Infrastructure venture capital deal activity. At \$20 billion invested in the first eight months of this year, venture investment is already 45% higher in 2021 than 2020. Deal sizes and pre-money valuations have similarly skyrocketed. This increase in venture activity is expected to continue through the remainder of 2021 and beyond, well after governments lift COVID-19 restrictions, due to several

underlying megatrends.

First, the global demand for data processing is exponentially increasing, as more industries pursue computationally-intensive systems, such as artificial intelligence, sensors, and edge computing. Simultaneously, companies are not simply asking for more data processing, but they are also demanding faster, higher quality, and more efficient solutions to enable new products and industries, such as autonomous vehicles. This demand for faster, better data processing has grown to rates that dramatically outpace Moore's Law, thereby driving Tough Tech startups like *Hyperlight*, *Zapata Computing*, and *Analytical Space* to pursue innovations in semiconductors, quantum computing, and spacetechnology, respectively.

Second, novel manufacturing processes, like 3D printing and industrial automation platforms, will enable more efficient, sustainable solutions to global issues. One key sector within this grouping is the built environment. Prohibitive coastal housing

costs have driven demand for flexible living situations, leading most venture capital investment to concentrate in modular and 3D-printed buildings. These have lower build costs and materials waste, smaller environmental impact, and shorter project timelines compared to incumbent systems. *Woho* is one of these, enabling a new way to build high-rise buildings with unprecedented quality, precision and efficiency.

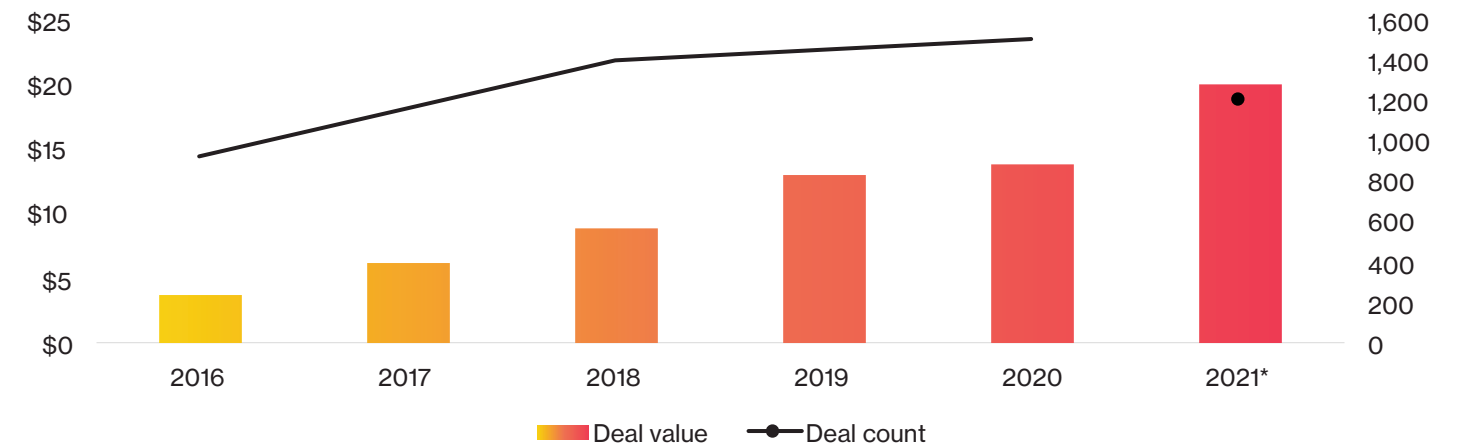
Lastly, all commercial and industrial manufacturing processes leverage a wide multitude of technologies. They require thousands of process steps, as well as incredible precision, all of which create opportunities for intellectual property development. Additionally, the manufacturing requirements and limitations define the final design. Therefore, a domestic U.S. manufacturing industry helps reduce the technology-to-market barrier for academic research on process technologies and new product designs, and thus creates a positive feedback loop for continued Tough Tech research and innovation.

## Advanced Systems & Infrastructure Deal Activity

Investor	Deal count	Investor	Deal count
SOSV	39	Plug and Play Tech Center	16
Alumni Ventures Group	27	Khosla Ventures	16
Keiretsu Forum	24	Tiger Global Management	15
Y Combinator	20	Intel Capital	15
Gaingels	18	The Engine	14

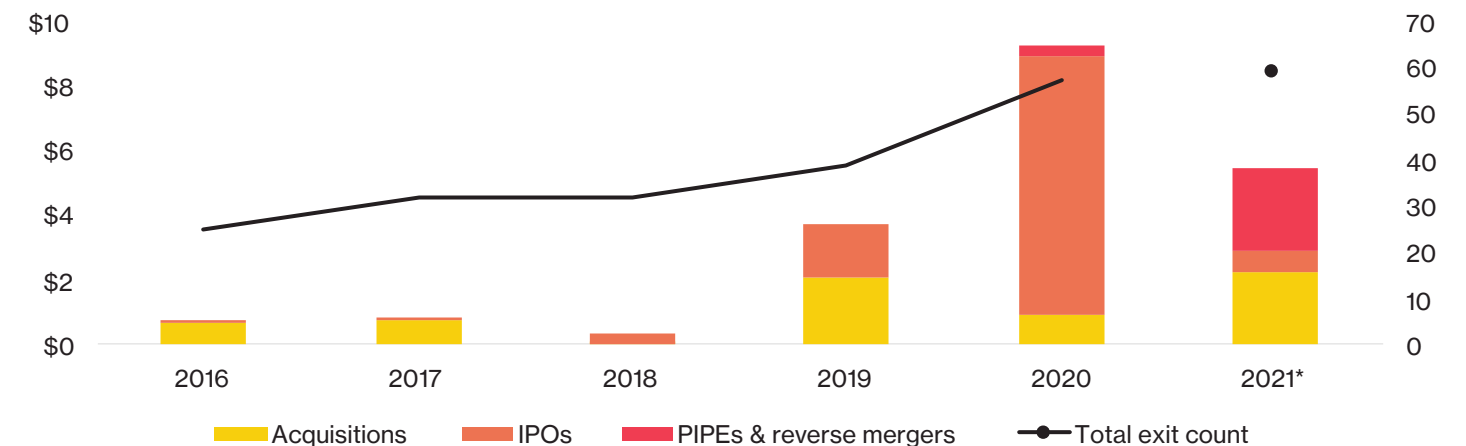
Source: PitchBook  
\*January 2020 - August 2021

## Global VC Deal Activity in Advanced Systems & Infrastructure (\$B)



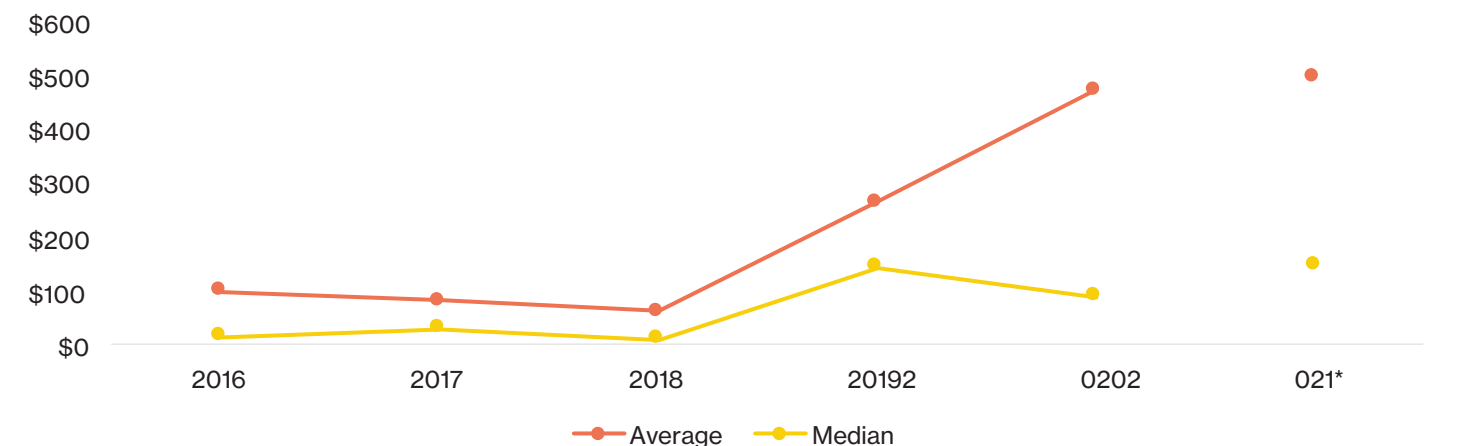
Source: PitchBook  
\*As of August 31, 2021

## Global VC Exit Activity in Advanced Systems & Infrastructure (\$B)



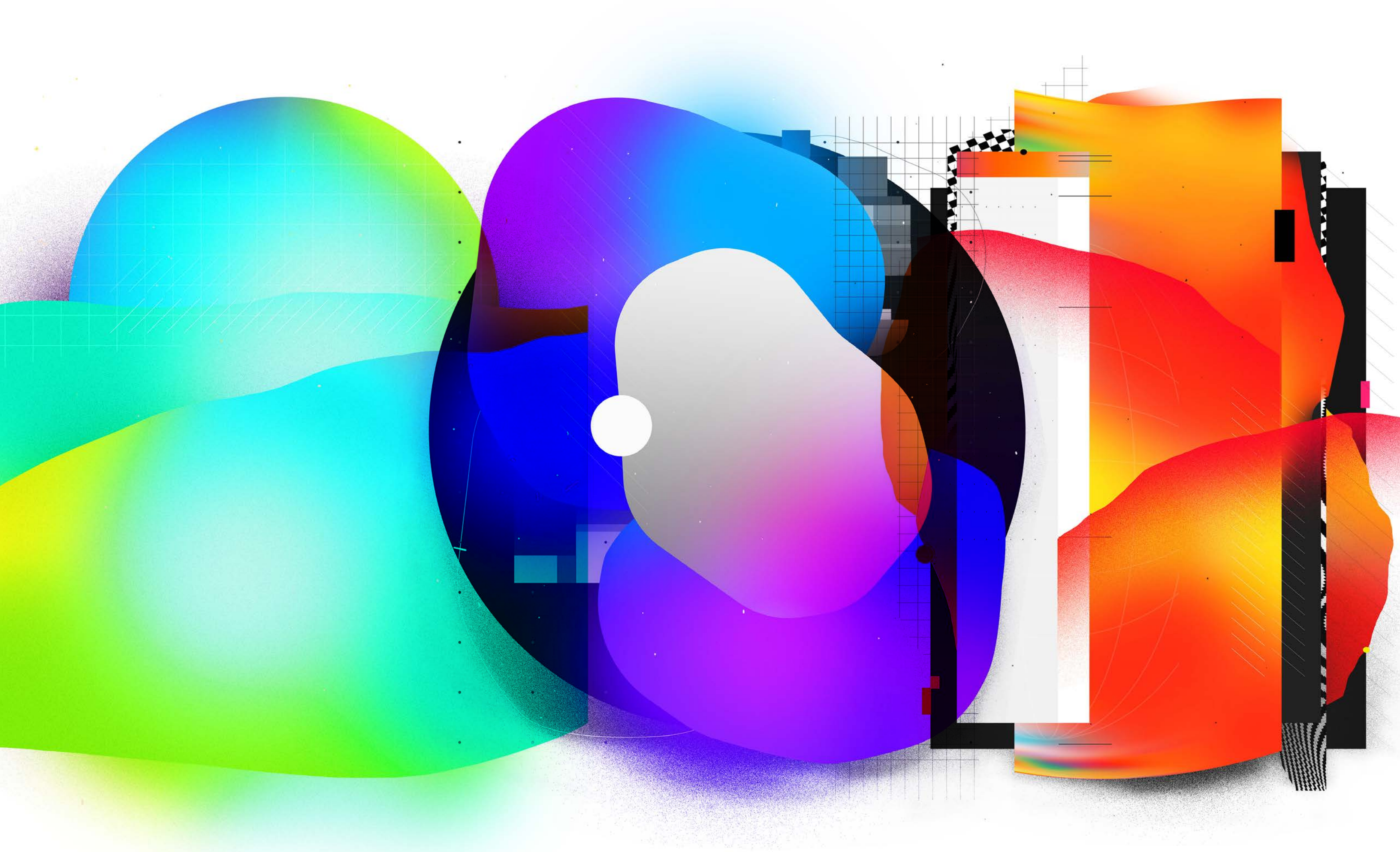
Source: PitchBook  
\*As of August 31, 2021

## Average & Median Exit Valuations in Advanced Systems & Infrastructure (\$M)



Source: PitchBook  
\*As of August 31, 2021







# 3D printing

## Key takeaways

- *The 3D-printing sector nears \$1 billion in annual VC funding. With three months left in the year, new highs in both deal value and volume could be attained.*
- *Standout companies that recently raised include Formlabs, which closed \$150.0 million in funding in May 2021, and NewMed Medical, which raked in \$100.0 million in March 2021.*

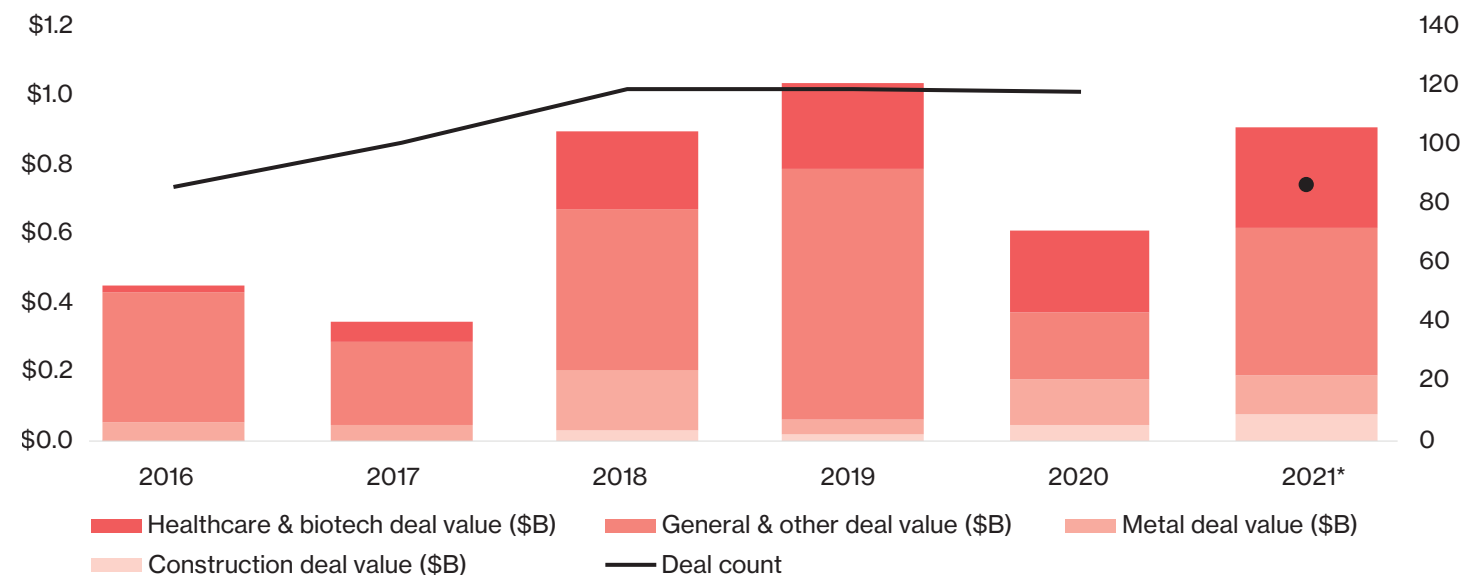
**3**D printing is expanding into multiple industries, while adopting an ever-growing list of printing materials. The leading areas—metal and polymer printing—have moved far beyond prototyping and small-batch production as companies improved material throughput and performance. Greater integration between hardware and software has enabled better simulation of physical processes such as furnace firing and improved real-world performance by compensating for variability in forces upon materials. Leading these advancements, venture-backed metal printing companies have grown especially prominent, with two Massachusetts-based companies, *Desktop Metal* and *Markforged*, completing SPAC mergers with initial valuations at \$2.5 billion and \$2.1 billion, respectively. As materials testing advances, complex geometries across prints will enable more parts for niche uses. Coupled with expanded distribution networks and customer bases, market opportunities have

widened for well-funded, mature businesses within the segment.

Beyond metal printing in manufacturing, the 3D-printing sector is expanding into other verticals. In construction, companies including *ICON Technology* and *Mighty Buildings* are aiming to build 3D-printed, cost-effective homes for communities in developed and developing countries. In healthcare, 3D printing for personalized dental aligners is already offered at scale, with other companies focusing on 3D-printed joint replacements, among other areas. Lastly, 3D printing is gaining footing in foodtech, as companies such as *Redefine Meat* are trying to produce better meat replacements.

Looking ahead, key areas of development for 3D-printing companies will continue to include throughput and material performance—both areas of ongoing innovation—but also demonstration of cost efficiency for new applications spanning meat alternatives and construction.

## 3D printing VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights

### Carbon

**Carbon** is a 3D printing technology company pioneering a process called Carbon Digital Light Synthesis™. Carbon DLS is a resin-based 3D printing process that uses digital light projection, oxygen-permeable optics, and engineering-grade materials to produce polymeric parts with exceptional mechanical properties, resolution, and surface finish.

Founded 2013 | Georgia, United States

Privately held

Total Capital Raised: \$682M

### formlabs

**Formlabs** is a manufacturer of 3D printing solutions including the Form 3, Form 3B, Form 3L, and Form 3BL powered by an advanced form of stereolithography (SLA) called Low Force Stereolithography (LFS)™ 3D printing, Form Wash and Form Cure post-processing solutions, Fuse 1 SLS 3D printer, and Form Cell manufacturing solution. Formlabs also develops its own suite of high-performance materials.

Founded 2011 | MA, United States

Privately held

Total Capital Raised: \$253M

### Desktop Metal

**Desktop Metal** is a manufacturer of 3D printing solutions with applications that range from rapid prototyping to mass production. Its machines can print in various metal alloys as well as carbon fiber.

Founded 2015 | MA, United States

Publicly traded

Total Capital Raised: \$732M

## 3D printing VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Formlabs</b>	General & Other	\$150M Series E	May 19, 2021	2011	Massachusetts, United States
<b>NewMed Medical</b>	Healthcare & Biotech	\$100M Series C	March 25, 2021	2015	Shanghai, China
<b>VulcanForms</b>	Metal	\$69M Series B	May 15, 2020	2015	Massachusetts, United States
<b>Nexa3D</b>	General & Other	\$55M Series C	May 17, 2021	2016	California, United States
<b>Candid Care</b>	Healthcare & Biotech	\$54M Series C	December 03, 2020	2017	New York, United States
<b>Triastek</b>	Healthcare & Biotech	\$51M Series B	June 16, 2021	2015	Nanjing, China
<b>Arris Composites</b>	General & Other	\$48M Series B	March 05, 2020	2017	California, United States
<b>nTopology</b>	General & Other	\$42M Series C	September 29, 2020	2015	New York, United States
<b>Seurat</b>	Metal	\$41M Series B	June 22, 2021	2015	California, United States
<b>Velo3D</b>	Metal	\$40M Series D	June 15, 2020	2014	California, United States
<b>Mighty Buildings</b>	Construction	\$40M Series B	February 09, 2021	2017	California, United States
<b>Zenyum</b>	Healthcare & Biotech	\$40M Series B	May 31, 2021	2018	Singapore, Singapore

Source: PitchBook  
\*January 2020 - August 2021

# Advanced & quantum computing

## Key takeaways

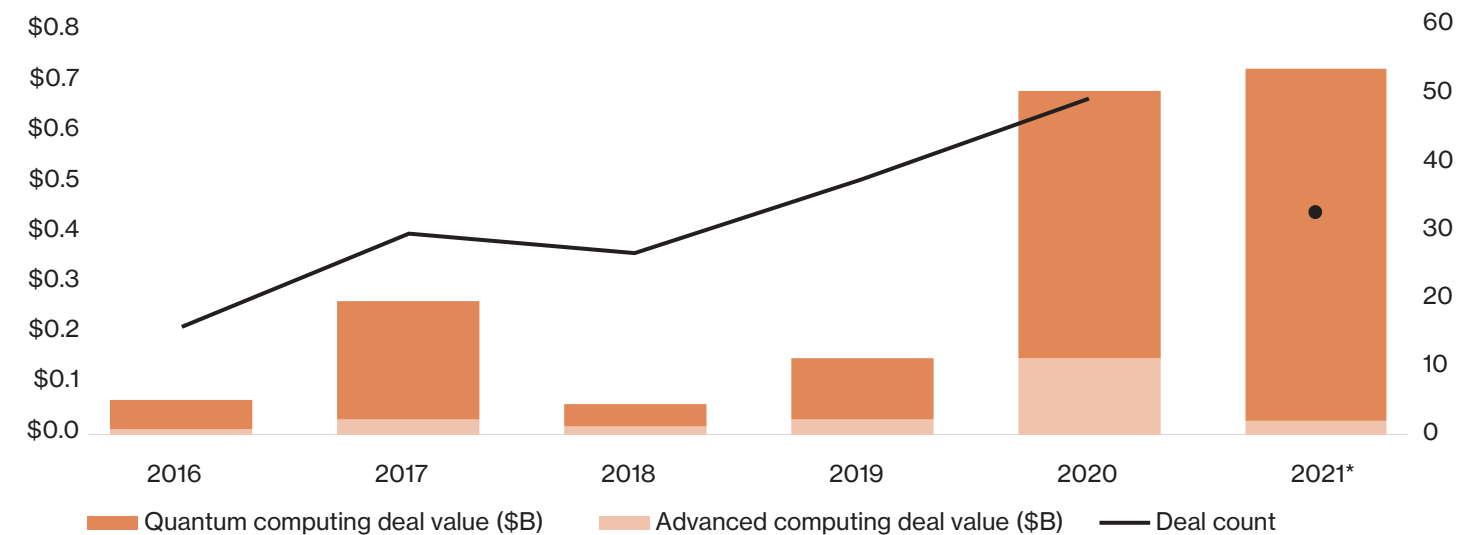
- *Advanced and quantum computing has enjoyed an uptick in investor interest, with close to \$730 million invested across 81 financings since the start of 2020.*
- *Commercial applications of quantum computing remain concentrated in data processing, but new developments continue to draw investor interest.*

**Q**uantum computing has long been a key research area within academic labs, but as researchers have made steady advances in the technology, investor interest has picked up. Global venture funding alone has eclipsed \$700 million since 2020's start, with the bulk concentrated in pure play quantum computing companies. Often those looking to develop on-site quantum computational systems to enhance companies' capabilities. The impact of quantum computing in the medium and long term can hardly be overstated, with analysts projecting \$450 billion to \$850 billion of value creation in the next 15 to 30 years. Key applications will include simulation of complex ecosystems—from drug discovery to fluid dynamics to securities pricing. More companies will likely launch in coming years to tackle those

applications as the segment moves toward broader commercialization—especially with improving error-correction rates by introduction of additional qubits and other techniques such as ion traps.

Meanwhile, other advanced computing companies include startups developing postquantum cryptography technologies, such as lattice-based cryptography, hash-based schemes, multivariate cryptography, and quantum key distribution (QKD). These technologies will eventually become required for classical computers, as current encryption methods are fallible in a quantum computing paradigm. Looking ahead, the key development goals for quantum computing companies are the continued expansion of qubit capacity and improvements in signal noise reduction.

## Advanced & quantum computing VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights

### Ψ PsiQuantum

**PsiQuantum** is developing a general-purpose silicon photonic computer designed to facilitate quantum computing operations.

Founded 2016 | California, United States

Privately held

Total Capital Raised: \$745M

### BEYOND IDENTITY

**Beyond Identity** builds a passwordless authentication platform that collects dozens of user and device risk signals during each login – enabling customers to enforce continuous, risk-based access control. Its architecture replaces passwords with the proven asymmetric cryptography that underpins TLS and protects trillions of dollars in transactions daily.

Founded 2020 | New York, United States

Privately held

Total Capital Raised: \$105M

## Advanced & quantum computing VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>PsiQuantum</b>	Quantum Computing	\$450M Series D	July 27, 2021	2016	California, United States
<b>PsiQuantum</b>	Quantum Computing	\$229M Series C	April 06, 2020	2016	California, United States
<b>Xanadu</b>	Quantum Computing	\$100M Series B	May 25, 2021	2016	Toronto, Canada
<b>Rigetti</b>	Quantum Computing	\$79M Series C	August 04, 2020	2013	California, United States
<b>Beyond Identity</b>	Advanced Computing	\$75M Series B	December 08, 2020	2020	New York, United States
<b>IonQ</b>	Quantum Computing	\$62M Series C	June 16, 2020	2015	Maryland, United States
<b>Cambridge Quantum Computing</b>	Quantum Computing	\$52M Series D	December 09, 2020	2014	Cambridge, United Kingdom
<b>Zapata Computing</b>	Quantum Computing	\$38M Series B	November 19, 2020	2017	Massachusetts, United States
<b>Pasqal</b>	Quantum Computing	\$30M Series A	June 08, 2021	2019	Paris, France
<b>Beyond Identity</b>	Advanced Computing	\$30M Series A	April 08, 2020	2020	New York, United States
<b>Quantum Xchange</b>	Quantum Computing	\$23M Series A	January 07, 2021	2016	Maryland, United States
<b>QC Ware</b>	Quantum Computing	\$21M Series B	July 27, 2021	2014	California, United States

Source: PitchBook  
\*January 2020 - August 2021



# Advanced manufacturing

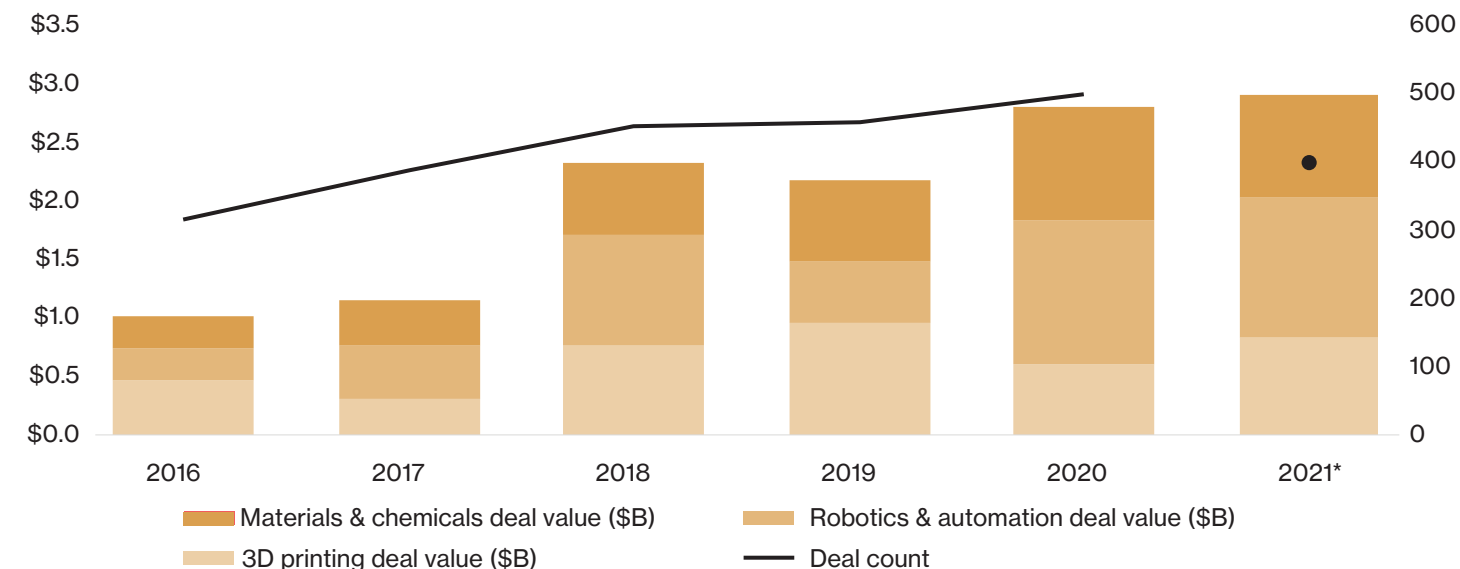
## Key takeaways

- *Advanced manufacturing has notched its most lucrative year yet, with nearly \$3 billion in aggregate VC invested in 2021 through August 31.*
- *Key areas of innovation include increasing application of novel materials to improve capabilities, while reducing costs and emissions; expanding 3D-printing capabilities, including simulation with advanced software systems; and further investment into biofabrication.*

**D**ownwind of 3D printing, new materials, and robotics, advanced manufacturing unites key technical advances in all of these segments to blend traditional manufacturing methods while pioneering new applications at scale. VCs have taken note, completing just shy of 500 rounds in 2020 for a combined \$2.8 billion and already investing almost \$3 billion thus far in 2021 across nearly 400 completed transactions. Increasingly successful liquidity outcomes have underlined that rate of investment, with close to 50 completed exits in the past 20 months for well over \$6 billion in value. Often dubbed Industry 4.0, the shift to automation and technical innovation across manufacturing processes—especially as governments reshore critical capabilities after the COVID-19-induced supply chain shocks—remains a policy priority. In addition, new companies are increasingly re-imagining manufacturing of traditional

commodities such as cement and steel in a carbon-neutral way, while remaining cost competitive with the incumbent methods. Such development has brightened the outlook for investors and founders within the space and improved the potential for liquidity avenues. However, implementation remains challenging given the need to overhaul extant processes and integrate older equipment and facilities with newer technologies. Although increasing cybersecurity concerns and the ability to remotely conduct workflows were underscored during the pandemic, bringing forward spend on tech stacks and especially capital expenditure (CapEx) remains a hurdle. As a result, VC-backed advanced manufacturers are showcasing their cost-saving, interoperable solutions, which will continue to aid adoption going forward.

## Advanced manufacturing VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Bright Machines** uses artificial intelligence, machine learning, and production data to develop robots that are sensor-rich, have computer vision, and are adaptable, enabling clients to have improved yields at lower costs.

Founded 2018 | California, United States

Publicly traded

Total Capital Raised: \$434M



**Solugen** creates plant-derived substitutes of petroleum-based products using enzymatic technology to transform plant sugars. The company's BioForge manufacturing platform is currently operating at a 10,000 ton per year capacity.

2016 | Texas, United States

Privately held

Total Capital Raised: \$440M

## Advanced manufacturing VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Formlabs</b>	3D Printing	\$150M Series E	May 19, 2021	2011	Massachusetts, United States
<b>RWDC Industries</b>	Materials and Chemicals	\$133M Series B	May 05, 2020	2015	Singapore
<b>Monolith Materials</b>	Materials and Chemicals	\$120M Series C	June 17, 2021	2012	Nebraska, United States
<b>H2 Green Steel</b>	Robotics and Automation	\$105M Series A	April 26, 2021	2020	Stockholm, Sweden
<b>Flexiv</b>	Robotics and Automation	\$100M Series B	December 30, 2020	2016	California, United States
<b>NewMed Medical</b>	3D Printing	\$100M Series C	March 25, 2021	2015	Shanghai, China
<b>Path Robotics</b>	Robotics and Automation	\$100M Series C	July 20, 2021	2014	Ohio, United States
<b>PureCycle Technologies</b>	Materials and Chemicals	\$76M Series C	November 25, 2020	2015	Florida, United States
<b>Manus Bio</b>	Materials and Chemicals	\$75M Series B	November 06, 2020	2011	Massachusetts, United States
<b>VulcanForms</b>	3D Printing	\$69M Series B	May 15, 2020	2015	Massachusetts, United States

Source: PitchBook  
\*January 2020 - August 2021

# Agtech & foodtech

## Key takeaways

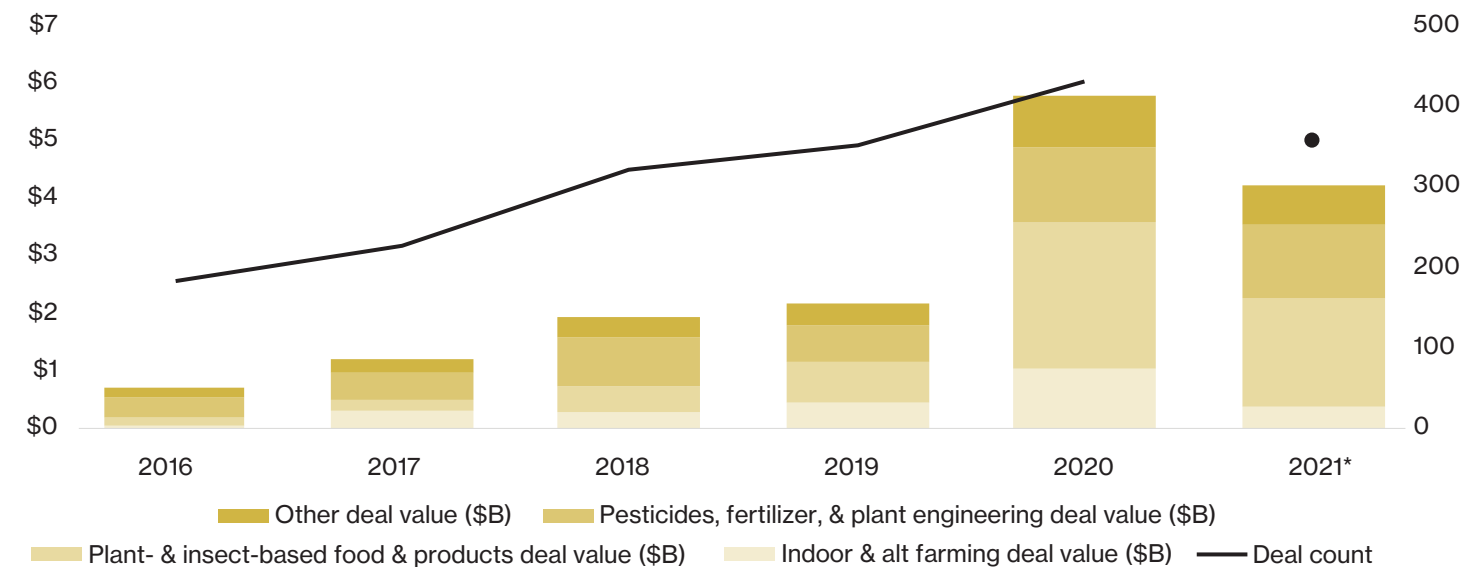
- *The agtech & foodtech segment has experienced a record surge of venture funding between January 2020 and August 2021, with \$10.7 billion invested across nearly 800 completed VC financings.*
- *Foodtech continues to be concentrated in novel proteins and ingredients manufacturing, though some companies are developing innovative equipment and dedicated software plays.*

**B**etween 2019 and 2020, the agtech & foodtech segment saw a spectacular year-over-year jump in aggregate VC invested, surging from \$2.2 billion to \$6.1 billion. That tally may be matched in 2021, which has seen 359 completed transactions at \$4.6 billion in aggregate value through the end of August. Venture firms have been active within both spaces, as demand for energy efficient alternative proteins and novel ingredients, free of animal products, grew throughout the 2010s. In the past two years, such funding surged due to the commercial success of alternative and cultured meats companies such as *Beyond Meat*, *Impossible Foods*, and *Memphis Meats*. In turn, growing awareness of the harmful environmental and health effects of fertilizer overuse in key farming areas led to pushes for organic produce and sustainable fertilizers and pesticides

through new production methods or alternative approaches, such as microbe-based fertilizers. Meanwhile, other agtech companies are developing inputs into incumbency chains, such as seed coatings, produce coatings, indoor farming for localized food production and distribution, and more.

Given incumbents' competition, many agtech companies will fold into existing local organic produce ecosystems and focus on efficient distribution and superior quality, while others will provide top-quality products and inputs into agricultural production and supply chains. Foodtech companies will continue to expand production and compete for category leadership in alternative proteins by diversifying product types.

## Agtech & Foodtech VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Pivot Bio** creates microbial nitrogen fertilizers intended to replace synthetic nitrogen fertilizer. These fertilizers help farmers grow crops that can capture and metabolize nitrogen from the atmosphere, reducing the need for petrochemical fertilizers and the cost of farming, improving health, and creating a cleaner future.

Founded 2010 | California, United States

Privately held

Total Capital Raised: \$692M



**Impossible Foods** makes alternative protein products like the Impossible Burger from plants. To achieve similar taste profiles to meat, the company simulates animal-based heme from the leghemoglobin molecule found naturally in the roots of soy plants.

Founded 2011 | California, United States

Privately held

Total Capital Raised: \$1.5B

## Agtech & Foodtech VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Indigo Agriculture</b>	Pesticides, Fertilizer, and Plant Engineering	\$535M Series F	June 22, 2020	2013	Massachusetts, United States
<b>Impossible Foods</b>	Plant & Insect-based Food Products	\$500M Series F	March 13, 2020	2011	California, United States
<b>Pivot Bio</b>	Pesticides, Fertilizer, and Plant Engineering	\$430M Series D	July 19, 2021	2010	California, United States
<b>Ynsect</b>	Plant & Insect-based Food Products	\$372M Series C	October 06, 2020	2011	Evry, France
<b>Nature's FYND</b>	Plant & Insect-based Food Products	\$350M Series C	July 19, 2021	2012	Illinois, United States
<b>LIVEKINDLY</b>	Plant & Insect-based Food Products	\$335M Series B	October 14, 2020	2017	California, United States
<b>Perfect Day</b>	Plant & Insect-based Food Products	\$300M Series C	July 08, 2020	2014	California, United States
<b>Apeel</b>	Other	\$275M Series D	April 29, 2020	2012	California, United States
<b>NotCo</b>	Plant & Insect-based Food Products	\$235M Series D	July 26, 2021	2015	Santiago, Chile
<b>Motif</b>	Plant & Insect-based Food Products	\$226M Series B	June 16, 2021	2019	Massachusetts, United States

Source: PitchBook  
\*January 2020 - August 2021

# AI & ML

## Key takeaways

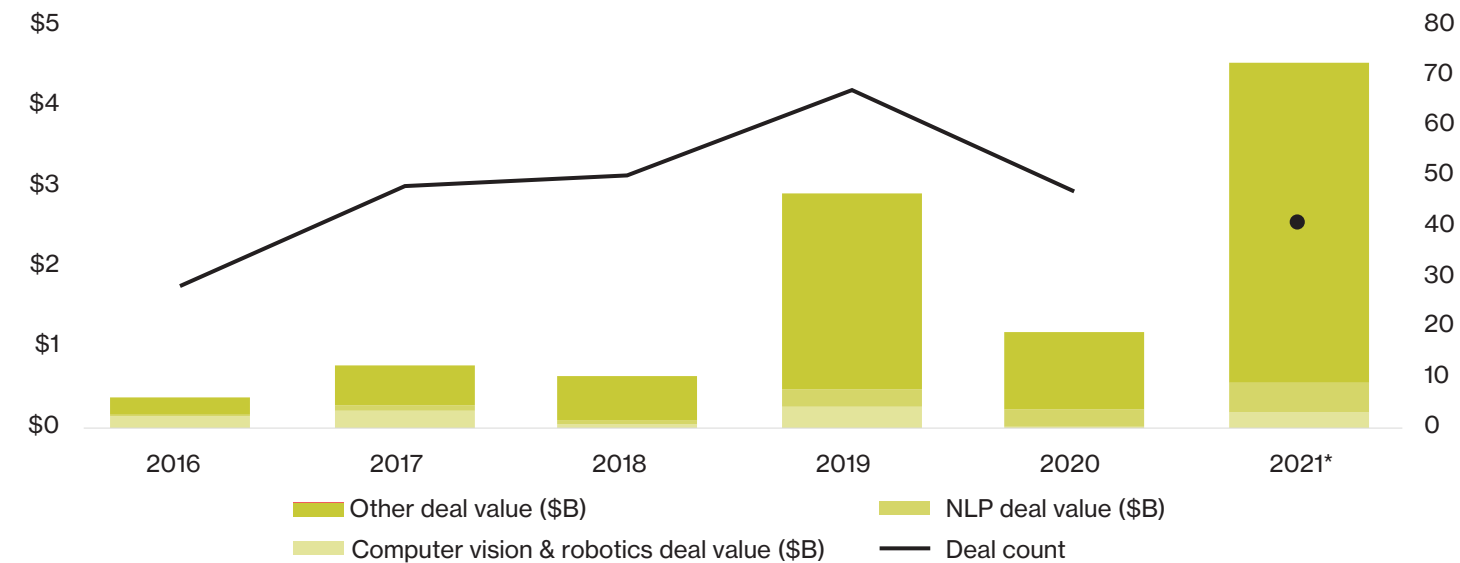
- \$8.6 billion in VC has been invested in the AI & ML space since the start of 2019, including \$4.5 billion invested in 2021 through August 31.
- Both startups and large, established players are pursuing key technical advances in and deployments of AI & ML, including increased usage of AI in chip design; tinyML and additional modeling; and self-programming capabilities.

**D**espite the tremendous growth in sector-specific applications of AI & ML, in areas ranging from retail and advertising to biotech and R&D (which are excluded from this section of the Tough Tech report), companies that focus on developing broad applications have seen growth surge, with a handful of rounds occurring in the computer vision, robotics, and natural language processing spaces. 2021 has already seen a record amount of venture capital invested across 41 completed transactions worldwide, with prominent companies such as *Databricks* and *OpenAI* commanding multibillion-dollar sums.

AI & ML tools are expected to continue to proliferate, as increasing studies showcase applications in grayer, more complex areas. While AI


& ML technologies have significantly advanced in the past five years, the computational power required to train and operate AI & ML platforms remains expensive, and dataset quality and completeness remain persistent issues. With proliferation of smart devices and data availability, many companies' target areas has also increasingly included real-time Edge AI computation, which requires better use of resources and energy as they run on the end devices. Addressing these issues will require innovation in hardware systems, such as semiconductors, as well as the AI & ML models themselves, data collection and cleaning, and training methods. Further innovation, particularly around model transparency, will likely draw continued interest, especially as commercial applications of AI & ML are proven out.

## AI & ML VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Databricks** is an enterprise software company that specializes in a cloud data platform based on the Apache Spark framework. Its software is used to process massive quantities of data and explore that data through AI models.

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**Founded 2013 | California, United States**

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**Privately held**

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**Total Capital Raised: \$3.5B**



**Scale AI** is building a data platform to accelerate the development of AI applications in LiDAR, image, video, and NLP annotation. APIs permit machine learning teams at companies like OpenAI, Lyft, Pinterest, and Airbnb to focus on building differentiated models versus labeling data.

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**Founded 2016 | California, United States**

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**Privately held**

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**Total Capital Raised: \$603M**

## AI & ML VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Databricks</b>	Other	\$1,600M Series H	August 31, 2021	2013	California, United States
<b>Databricks</b>	Other	\$1,000M Series G	February 01, 2021	2013	California, United States
<b>4Paradigm</b>	Other	\$700M Series D	January 22, 2021	2014	Beijing, China
<b>Scale AI</b>	Natural Language Processing (NLP)	\$325M Series E	April 13, 2021	2016	California, United States
<b>DataRobot</b>	Other	\$317M Series F	December 09, 2020	2012	Massachusetts, United States
<b>DataRobot</b>	Other	\$300M Series G	July 27, 2021	2012	Massachusetts, United States
<b>4Paradigm</b>	Other	\$230M Series C	December 02, 2020	2014	Beijing, China
<b>Scale AI</b>	Natural Language Processing (NLP)	\$154M Series D	December 01, 2020	2016	California, United States
<b>CloudMinds</b>	Computer Vision & Robotics	\$153M Series B	December 09, 2021	2015	Beijing, China
<b>Beyond Limits</b>	Other	\$133M Series C	September 22, 2020	2014	California, United States

Source: PitchBook  
\*January 2020 - August 2021



# Built environment

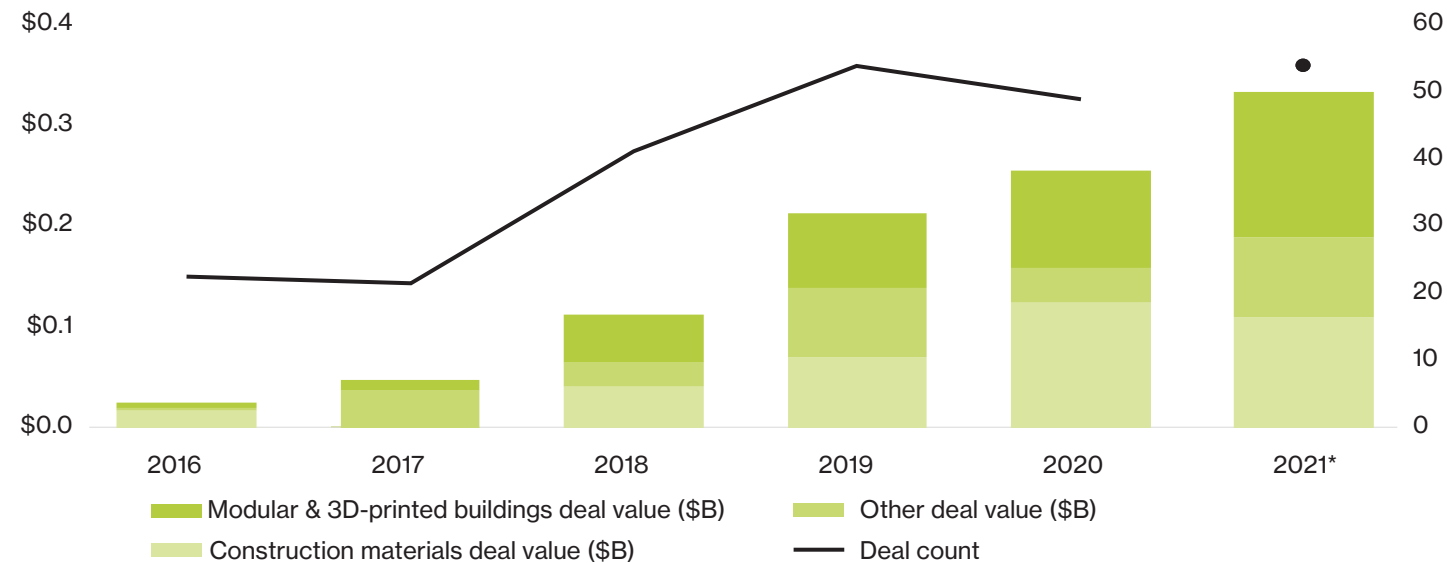
## Key takeaways

- *The built environment has completed 158 VC rounds since 2019, with 2021 already seeing well over \$300 million invested.*
- *Companies are benefiting from upstream technical advances in materials and 3D printing, which enable more efficient mass production.*
- *Many new companies are pursuing innovative modular building designs that are easier to assemble and more affordable and eco-friendly.*

**S**till relatively nascent in its development, the built environment is attracting more interest due to several macro factors. Increased cognizance of environmentally minded construction, the sector's large role in global carbon emissions, global housing shortages demanding more affordable and faster-to-market housing, and the impact of built environments on human health are driving factors within the sector. As prohibitive coastal housing costs drive up demand for flexible living situations, most of the VC invested has concentrated in modular and 3D-printed buildings that cut both the cost to build and materials wasted on site and significantly reduce project timelines. The acceleration of hybrid work models is also encouraging consumer interest in rapid, environmentally friendly housing models that can be constructed in a variety of geographies.

New materials and decarbonization of existing practices will be a focus of the sector's growth in the coming decades due to the high emissions associated with building components embodied in a structure. Examples include companies looking to make regenerative products, such as wood, more structurally sound and thus more scalable, companies decarbonizing major emissions offenders such as cement, steel, or aluminum, or those looking to introduce new materials from graphene and carbon composites or use synthetic biology to grow materials in labs. Opportunities remain as players in the built environment seek to bridge divides between the digital and physical realms—especially regarding integrating seamless communications between a connected home and mobile devices.

## Built environment VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights

### HALIO

**Halio** is commercializing advanced smart-tinting glass designed to dynamically respond to changing light conditions. By responding to changing light conditions, this glass provides shade and glare relief in seconds.

Founded 2010 | California, United States

Privately held

Total Capital Raised: \$344M

### Factory\_OS™

**Factory OS** builds mobile, weather-resistant modular homes with precision cutting and indoor material storage wastes, features that reduce construction wastes, control energy consumption, and make homes smart and technologically suitable.

Founded 2017 | California, United States

Privately held

Total Capital Raised: \$83M

## Built environment VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>ICON Technology</b>	Modular and 3D Printed Buildings	\$207M Series B	August 24, 2021	2017	Texas, United States
<b>Factory OS</b>	Modular and 3D Printed Buildings	\$60M Series B	November 20, 2020	2017	California, United States
<b>Boston Metal</b>	Construction Materials	\$50M Series B	January 07, 2021	2012	Massachusetts, United States
<b>SmartLam North America</b>	Construction Materials	\$49M Series	December 09, 2020	2012	Montana, United States
<b>Mighty Buildings</b>	Modular and 3D Printed Buildings	\$40M Series B	February 09, 2021	2017	California, United States
<b>ICON Technology</b>	Modular and 3D Printed Buildings	\$35M Series A	August 19, 2020	2017	Texas, United States
<b>Fortera</b>	Construction Materials	\$30M Series B	June 28, 2021	2019	California, United States
<b>Canvas</b>	Other	\$24M Series B	April 15, 2021	2013	California, United States
<b>Mighty Buildings</b>	Modular and 3D Printed Buildings	\$22M Series	July 13, 2021	2017	California, United States
<b>Abodu</b>	Modular and 3D Printed Buildings	\$20M Series A	July 15, 2021	2018	California, United States
<b>Dusty Robotics</b>	Other	\$16M Series A	June 11, 2021	2015	California, United States

Source: PitchBook  
\*January 2020 - August 2021



# Cleantech

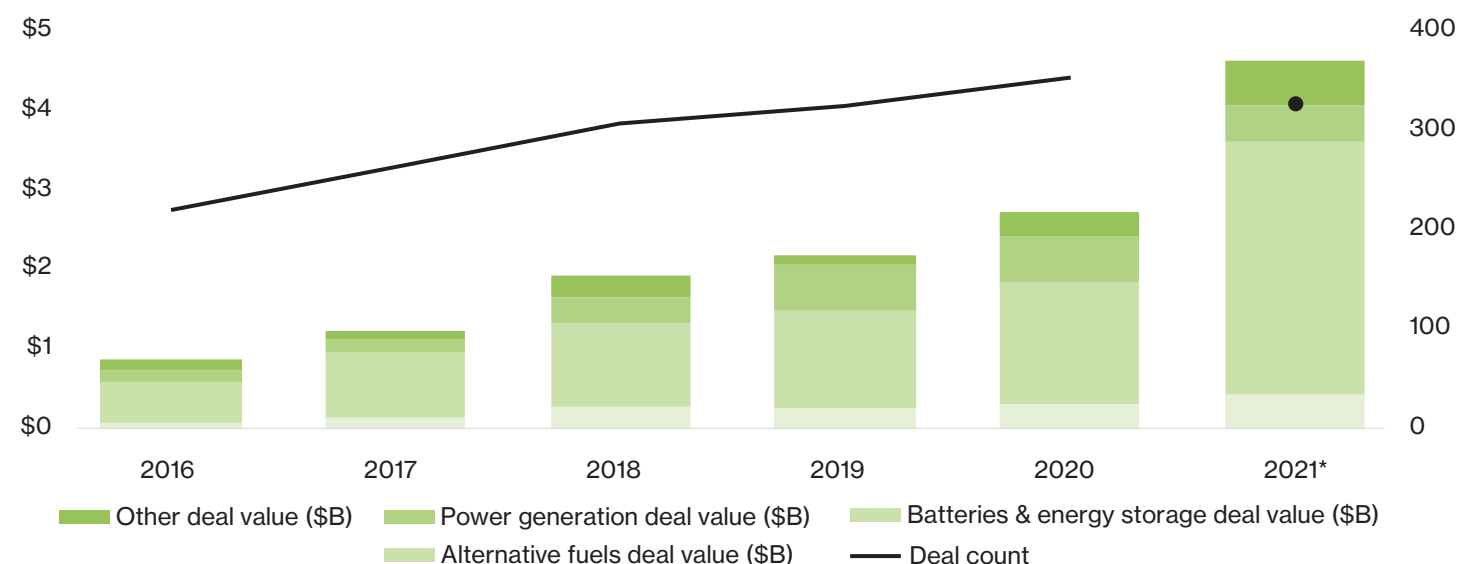
## Key takeaways

- *Cleantech venture funding has skyrocketed in 2021, leaping to \$4.5 billion, eclipsing all prior annual tallies. At 300+ deals, it is also on pace to set a record in deal count.*
- *Since January 2020, more than 20 cleantech companies, including QuantumScape and Li-Cycle, have gone public via reverse mergers with SPACs.*

**T**he macro factors supporting investor interest in cleantech companies have rarely been stronger or broader. In efforts to reduce the negative impacts of climate change, governments worldwide are passing more aggressive policies to electrify transportation and shift to carbon-free electricity production; earmarking billions of dollars to incentivize electric vehicle purchases, update electric grids, and expand solar plants. Large-scale corporate engagement with cleantech companies has also dramatically improved over the past two years—oil & gas majors have been particularly supportive of companies developing carbon capture and hydrogen fuel technologies.

However, in every year since 2011, companies developing next-generation battery and energy storage technologies, including *Solid Power* and *Form Energy*, have attracted the bulk of cleantech funding, as venture investors, automakers, and other multinational corporations have sought to capture slices of the rapidly growing EV and grid storage markets. Besides energy storage, increased investment has also gone toward companies looking to provide carbon-free power generation, such as *Commonwealth Fusion Systems* and *Quaise*, which are developing novel technologies for commercial nuclear fusion power plants and geothermal systems, respectively. Looking ahead, more investment is expected for cheaper recycling processes to build a circular economy for new energy technologies and more efficient cooling systems to allow societies to adapt to the changing climate.

## Cleantech VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Form Energy** is developing a new class of cost-effective, multi-day energy storage systems that will enable a reliable and fully renewable electric grid year-round. Its storage systems rely on iron-air technology optimized to store electricity for 100 hours at system costs competitive with legacy power plants.

Founded 2017 | MA, United States

Privately held

Total Capital Raised: \$366M



**Li-Cycle** is developing technologies to recycle lithium-ion batteries. Its current platform has a recovery rate of ≥95% of all materials. The company is also building a network of logistics partners to transport batteries to its facilities.

Founded 2016 | Ontario, Canada

Publicly traded

Total Capital Raised: \$315M



**Sila Nanotechnologies** enables lighter, safer, higher energy density lithium-ion batteries for mass adoption of electric vehicles, smarter, longer-lasting portable electronics, and broader use of renewable power sources. The Sila anode has 20% more energy density than standard Li-ion solutions, a smaller battery footprint, and drop-in capability.

Founded 2011 | California, United States

Privately held

Total Capital Raised: \$933M

## Cleantech VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Redwood Materials</b>	Batteries & Energy Storage	\$700M Series C	July 28, 2021	2017	Nevada, United States
<b>Sila Nanotechnologies</b>	Batteries & Energy Storage	\$590M Series F	January 07, 2021	2011	California, United States
<b>Swell</b>	Batteries & Energy Storage	\$450M Series B	December 10, 2020	2014	California, United States
<b>Form Energy</b>	Batteries & Energy Storage	\$200M Series D	July 22, 2021	2017	Massachusetts, United States
<b>QuantumScape</b>	Batteries & Energy Storage	\$200M Series F	June 16, 2020	2010	California, United States
<b>SolidEnergy Systems (SES)</b>	Batteries & Energy Storage	\$139M Series D	April 19, 2021	2012	Massachusetts, United States
<b>Solid Power</b>	Batteries & Energy Storage	\$130M Series B	May 03, 2021	2011	Colorado, United States
<b>Monolith Materials</b>	Alternative Fuels	\$120M Series C	June 17, 2021	2012	Nebraska, United States
<b>Verkor</b>	Batteries & Energy Storage	\$119M Series B	July 06, 2021	2020	Grenoble, France
<b>Enpal</b>	Power Generation	\$119M Series B	July 08, 2021	2017	Berlin, Germany

Source: PitchBook  
\*January 2020 - August 2021

# Life sciences

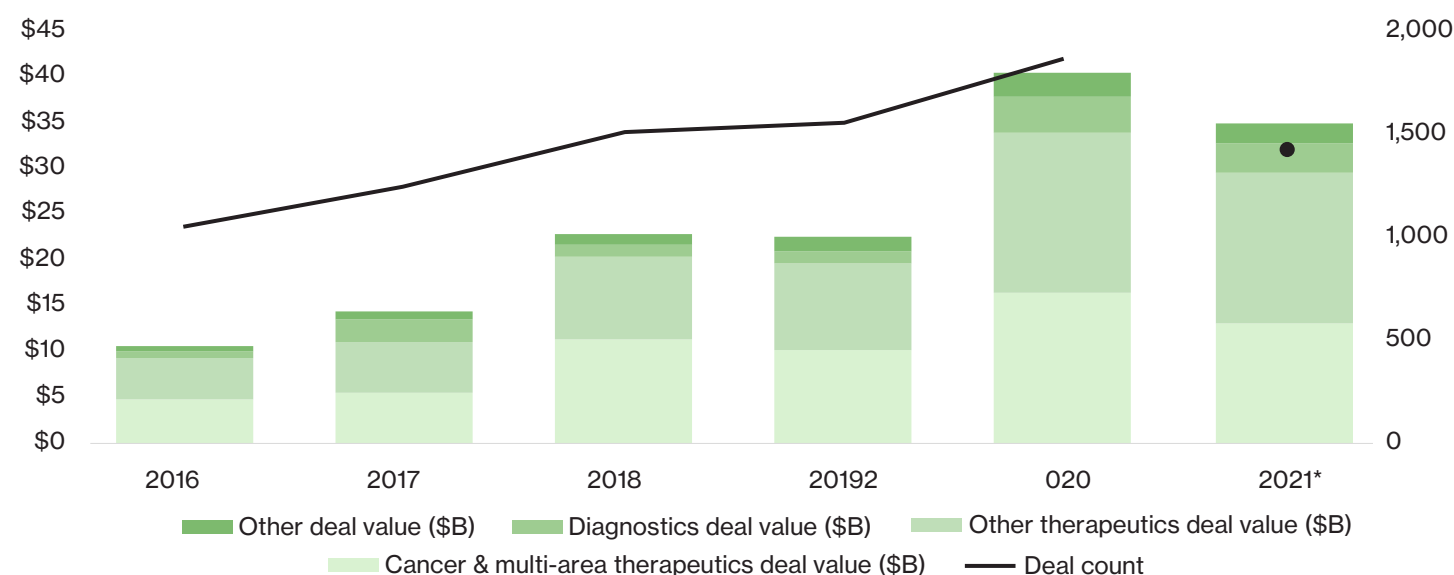
## Key takeaways

- *The largest Tough Tech segment, life sciences, has seen a profusion of VC invested in 2020 and 2021, with close to \$40 billion invested last year and nearly \$35 billion invested this year to date.*
- *Key areas of development in therapeutics include genome editing, cell-based therapies, immunotherapies and RNA-based methods across various indications.*

**B**y a large margin, life sciences is the largest Tough Tech sector. Well over \$70 billion has been invested across thousands of rounds since the start of 2020. The bulk of funding has concentrated in therapeutics for both oncology and other diseases. Due to industry economics and regulatory agency approvals, many orphan drugs developed for rare diseases receive plenty of capital. Some diseases' rarity enables more precise treatments based on the characteristics of the disorder or the attacking virus/bacteria. Life sciences' flood of capital was inevitable given the steady technological advances over the past decade that enabled speedy innovation within the sector—from rapid simulations of therapy effects via improved computing to genomics to advanced techniques such as CRISPR.

Many of those trends led to the shift toward personalized medicine, wherein a patient's characteristics determine the method and type of drugs developed for their condition. Although production techniques will need to be honed to efficiency, given the unique scalability challenges of personalized therapies, the advent of next-generation techniques will aid that. Due to demographics, intellectual property expirations, higher levels of income across more nations, and the emergence of novel diseases as lifespan increases around the globe, demand is rising. However, venture backers are seeing greater rates of liquidity than ever before, with well over \$60 billion alone in exit value in 2020. Thus, VCs continue to fund numerous startups, with plenty of capital to pursue new avenues of innovation. As the sophistication of therapies increasingly demands expertise—thus leading to competition—industry experience will continue to be priced at a premium.

## Life sciences VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights

### GRAIL

GRAIL uses high-intensity sequencing, population-scale clinical trials, and state of the art computer science and data science to enhance the scientific understanding of cancer biology and develop blood tests for early-stage cancer detection.

Founded: 2015 | California, United States

Publicly traded

Total Capital Raised: \$2B

### moderna

Moderna is a biotechnology company that produces medicines and vaccine technologies made of messenger RNA. Its vaccine platform inserts synthetic nucleoside-modified mRNA into human cells using a coating of lipid nanoparticles. Moderna's COVID-19 vaccine has proven to be widely effective against the novel coronavirus.

Founded 2010 | MA, United States

Publicly traded

Total Capital Raised: \$3.9B

## Life sciences VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
MGI Tech	Diagnostics	\$1,000M Series B	May 28, 2020	2016	Shenzhen, China
Resilience	Therapeutics - Oncology	\$755M Series B	October 23, 2020	2020	California, United States
EQRx	Therapeutics - Other	\$570M Series B	January 11, 2021	2019	Massachusetts, United States
ElevateBio	Therapeutics - Other	\$525M Series C	March 15, 2021	2017	Massachusetts, United States
Lyell	Therapeutics - Oncology	\$493M Series C	March 05, 2020	2018	California, United States
Laronde	Therapeutics - Other	\$440M Series B	August 30, 2021	2017	Massachusetts, United States
Sana Biotechnology	Therapeutics - Other	\$435M Series B	June 11, 2020	2018	Washington, United States
insitro	Therapeutics - Other	\$400M Series C	April 07, 2021	2018	California, United States
GRAIL	Diagnostics	\$390M Series D	May 06, 2020	2015	California, United States
RBNC Therapeutics	Therapeutics - Other	\$340M Series A	September 03, 2020	2020	California, United States

Source: PitchBook  
\*January 2020 - August 2021

# Materials

## Key takeaways

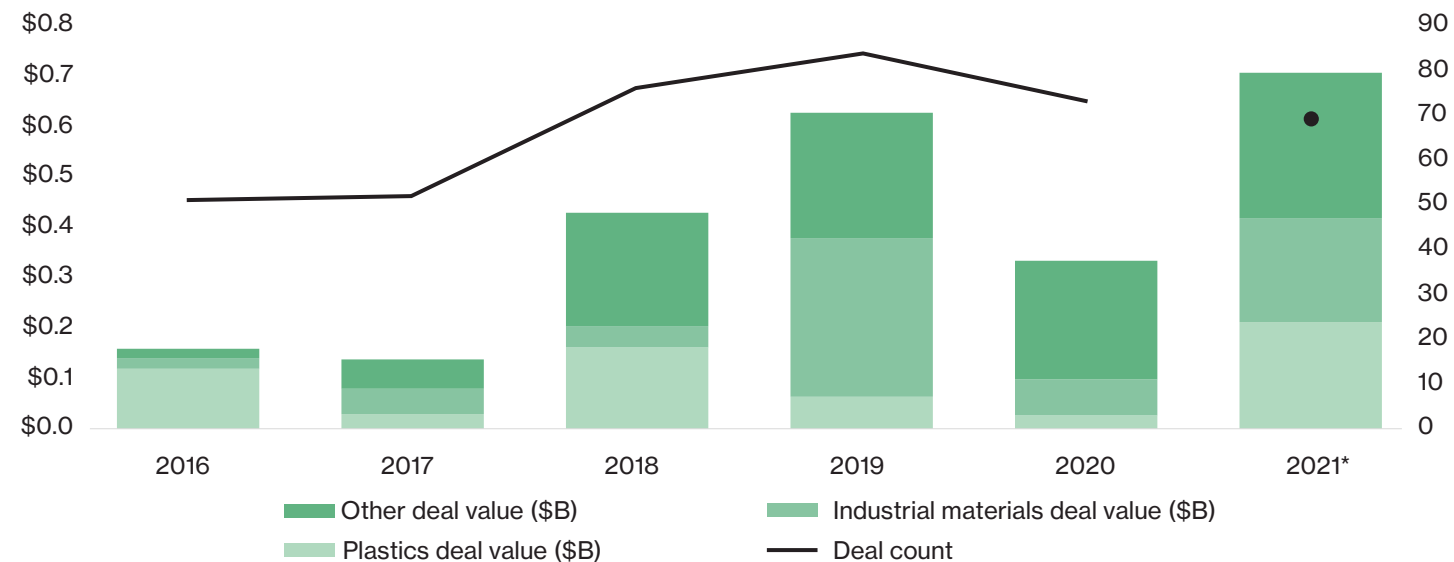
- *\$448.2 million has already invested in VC deals in 2021 so far, the materials sector is on track to see a record high in both deal count and total invested capital.*
- *Increasing emphasis on sustainability and creating a circular economy is boosting R&D across many materials, ranging from carbon-free cement, steel, and wood-derived construction materials to textiles and recyclable and biodegradable plastics.*

**B**etween 1995 and 2015, emissions from the materials production sector increased by 120%—making up nearly 25% of global output. As a result, the materials sector has seen a dramatic drive towards sustainability with the majority of venture funding in recent years going to companies re-imagining traditional material production.

Companies in the industrial materials sector, such as *Boston Metal* and *H2 Green Steel*, are pursuing cheaper, low-emissions production processes for materials including steel, cement, and aluminum. At the same time, companies such as *Modern Meadow* focus on sustainable production of leather and textile materials using biotechnology. Beyond these companies, key technical advances have recently been made in conductivity, alloy composition, catalysts, biofabrication, and more.

Given incumbency advantages, much of the business opportunities will likely plug into existing value chains, as strategic partners or suppliers. Corporate openness to this business strategy has already led to a jump in exits in the materials space, thereby signifying potentially lucrative opportunities for venture backers and founders alike. As governments pass ever-more-stringent emission policies and regulations, investment in companies developing more sustainable, lower-emission products and manufacturing processes is expected to increase beyond 2021—a year that will likely set records in both deal count and total capital invested within this segment.

## Materials VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Redwood Materials** recycles and processes scrap from battery cell production and consumer electronics like cell phone batteries, laptop computers, power tools, power banks, scooters, and electric bicycles.

Founded 2017 | NV, United States

Privately held

Total Capital Raised: \$825M



**Bolt Threads** is creating performance fibers and fabrics using proprietary breakthroughs in industrial biotechnology. Working at the molecular level, Bolt Threads turns renewable raw materials into products with properties that meet specific consumer needs.

Founded 2009 | California, United States

Privately held

Total Capital Raised: \$214M



**Modern Meadow** creates biofabricated leather materials that deliver enhanced material performance and sustainability compared to traditional materials, enabling customers to get modified leather products without harming animals.

Founded 2011 | NJ, United States

Privately held

Total Capital Raised: \$335M

## Materials VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Redwood Materials</b>	Other	\$700M Series C	July 28, 2021	2017	Nevada, United States
<b>Modern Meadow</b>	Plastics & Biobased Materials	\$130M Series C	April 28, 2021	2011	New Jersey, United States
<b>H2 Green Steel</b>	Industrial Materials	\$105M Series A	April 26, 2021	2020	Stockholm, Sweden
<b>Boston Metal</b>	Industrial Materials	\$50M Series B	January 07, 2021	2012	Massachusetts, United States
<b>SmartLam North America</b>	Industrial Materials	\$49M Series A	December 09, 2020	2012	Montana, United States
<b>Redwood Materials</b>	Other	\$40M Series B	July 08, 2020	2017	Nevada, United States
<b>Infinite Fiber Company</b>	Plastics & Biobased Materials	\$36M Series B	June 30, 2021	2016	Espoo, Finland
<b>Fortera</b>	Industrial Materials	\$30M Series B	June 28, 2021	2019	California, United States
<b>Twine</b>	Other	\$28M Series D	May 19, 2021	2015	Petah Tiqva, Israel
<b>Vericool</b>	Plastics & Biobased Materials	\$23M Series A	April 03, 2020	2015	California, United States

Source: PitchBook  
\*January 2020 - August 2021

# Medtech

## Key takeaways

- *After nearly linear growth in venture funding throughout the 2010s, medtech is poised to see a record tally of VC invested in 2021, with well over \$6 billion already invested across close to 600 transactions.*
- *Investors have demonstrated interest in companies that develop nonpharmacological treatments such as surgical robots and improved diagnostic tools—particularly those that can empower preventive care.*

**T**hroughout the 2010s, medtech venture funding within Tough Tech surged, with no sign of slowing down as the 2020s commenced.

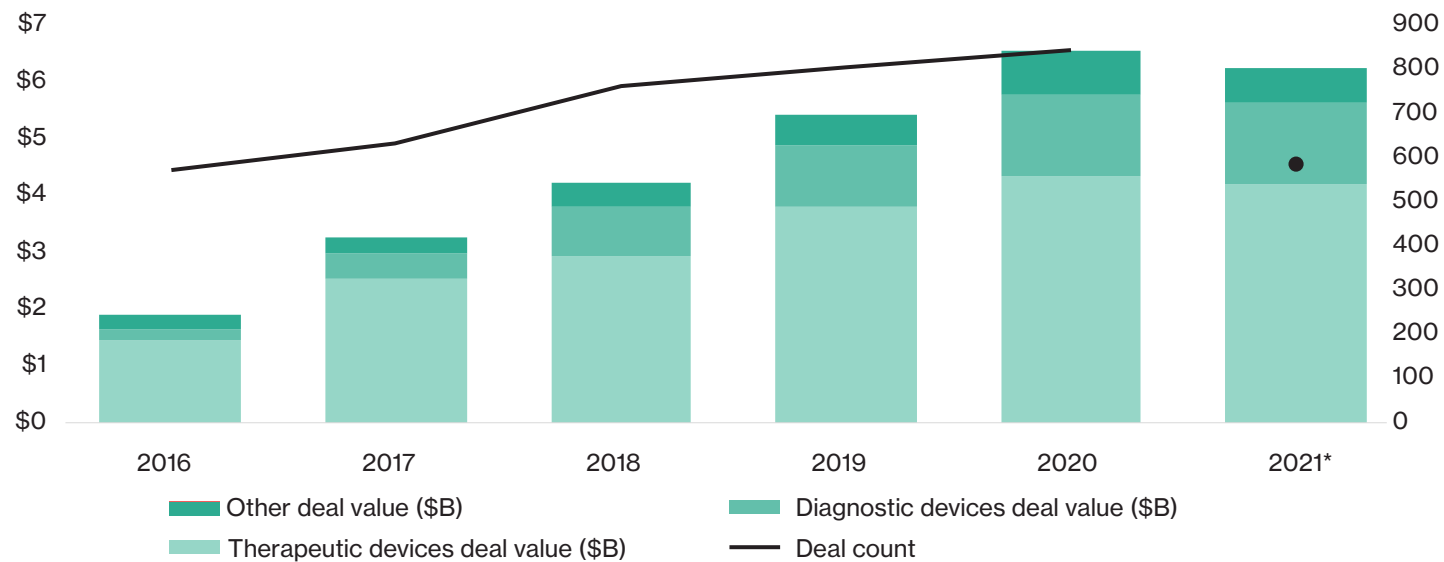
Driven by supportive macro factors such as aging demographics and increased spending on healthcare, the sector has seen innovation in virtually all domains. Medtech received continued investment in robotic surgical platforms—with *CMR Surgical* raising \$600 million in 2021 alone—and technological improvements in imaging and diagnostic devices, as well as focusing on cardiac diseases. At the same time, COVID-19 spurred investments into diagnostic companies that offer affordable, point-of-care tests for infectious diseases.

In clinical settings, care providers are increasingly empowered with integrated diagnostics platforms that can better assess patient health. Simultaneously,

the advent of connected solutions and digitizing platforms is shifting many medtech devices closer to patient and consumer homes, with companies offering products spanning from diagnostic tests and health monitors to wearable defibrillators.

Lastly, the vanguard of information-sourcing tools continues to develop as increasingly rich and varied datasets are generated by intimate, noninvasive monitoring sensors. Startups are pursuing brain-computer interfaces that will revolutionize care options for older adults and people with disabilities. Going forward, better integration between digital and hardware in medtech systems will likely be the focal area for entrepreneurs and investors alike.

## Medtech VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Exo** is a health information and devices company that is modernizing medical imaging through its high-performance handheld ultrasound platform and AI. Exo is also commercializing Exo Works, an ultrasound workflow solution that connects with any DICOM-enabled ultrasound system.

Founded 2015 | California, United States

Privately held

Total Capital Raised: \$322M



**Neuralink** creates brain-machine interfaces with the goal of building a system with at least two orders of magnitude more communication channels (electrodes) than current clinically-approved devices. Its device, called the Link, can record from 1024 electrodes and is designed to be safe, fully wireless, communicate through the skin, and can be used by patients in their homes.

Founded 2016 | California, United States

Privately held

Total Capital Raised: \$363M

## Medtech VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>CMR Surgical</b>	Therapeutic Devices	\$600M Series D	June 27, 2021	2014	Cambridge, United Kingdom
<b>Exo</b>	Diagnostic Devices	\$220M Series C	July 29, 2021	2015	California, United States
<b>Neuralink</b>	Therapeutic Devices	\$205M Series C	July 30, 2021	2016	California, United States
<b>CardiMED</b>	Therapeutic Devices	\$200M Series C	October 01, 2020	2015	Shanghai, China
<b>Visby Medical</b>	Diagnostic Devices	\$166M Series D	May 31, 2020	2012	California, United States
<b>Peijia Medical</b>	Therapeutic Devices	\$151M Series	May 05, 2020	2013	Suzhou, China
<b>Element Science</b>	Therapeutic Devices	\$145M Series C	March 03, 2020	2011	California, United States
<b>MicroPort CardioFlow</b>	Therapeutic Devices	\$130M Series D	April 16, 2020	2015	Shanghai, China
<b>URA Health</b>	Other	\$129M Series B	March 17, 2020	2013	Oulu, Finland
<b>eCential Robotics</b>	Therapeutic Devices	\$121M Series	January 19, 2021	2009	Gières, France

Source: PitchBook  
\*January 2020 - August 2021



# Mobility

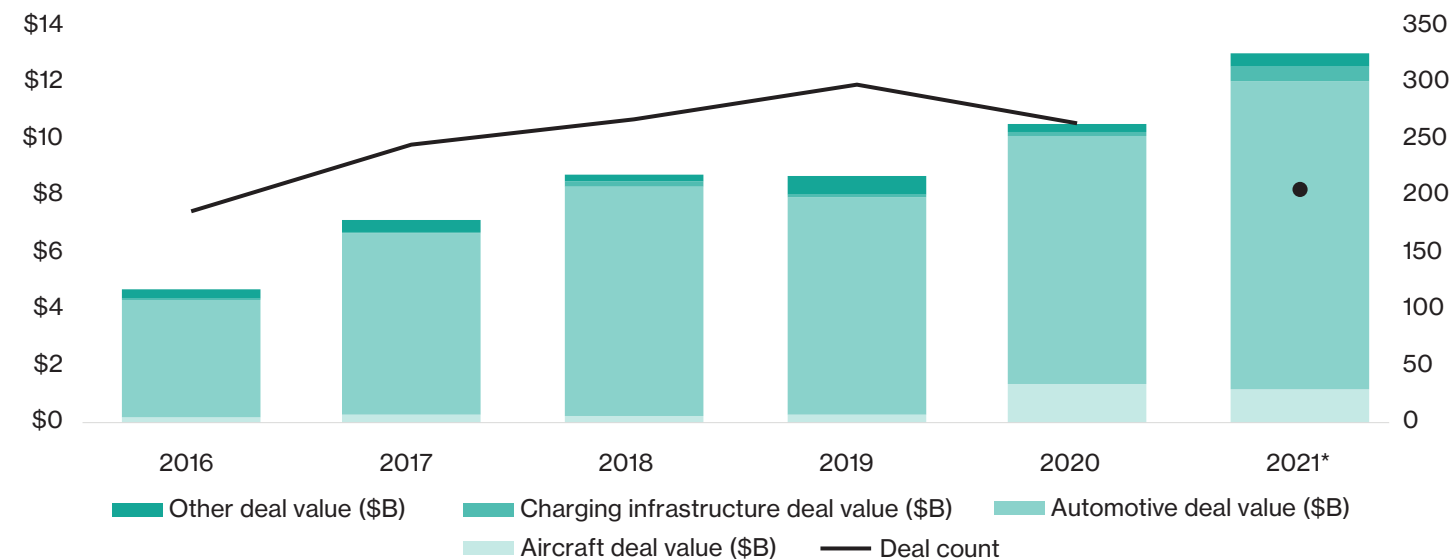
## Key takeaways

- *Of the vast sums of capital flowing into mobility—\$13.0 billion across 206 transactions completed in 2021 through August 31—the bulk has been concentrated in the automotive space, primarily development of autonomous and electric vehicles.*
- *Although air transport has attracted less capital, there has been an uptick in the past two years in aggregate VC invested in the space, at well over \$1 billion per year in 2020 and 2021 to date.*

Over the past several years, huge sums of capital have flowed into the mobility segment. Between 2014 and 2021 to date, annual tallies of VC invested leapt from roughly \$400 million to \$13 billion, with financing volume growing at a linear rate until recently. Competition is fierce, with 2021's median late-stage financing size already surging to more than double that observed last year, spurred by large raises from prominent mobility companies, such as *Faraday Future* and *Weltmeister*. Additionally, many companies pursuing electric vehicles and supporting technologies for autonomous vehicles have decided to go public, including *Rivian*, which recently announced plans to IPO, and *Luminar Technologies* and *Embark*, which are among the 20 mobility companies that completed reverse mergers with SPACs in 2020 and 2021.

Given the determined push into EV manufacturing by incumbent carmakers, such as Volkswagen and Ford, as well as Tesla, which continues to ramp up its EV production, considerable competition exists in the electric vehicle market. Ample market opportunities also remain in EV charging infrastructure, which is supported by both government funding and increasing consumer demand. Although this infrastructure build-out will take time, the inevitable electrification of transportation will produce many market niches for the foreseeable future. Key technical challenges that innovative mobility businesses are tackling include: better integration between autonomous driving systems' hardware and software to enable navigation of more complex terrain; cost-competitive battery capacity; expanded training datasets; and improvements in sensor networks' capacity and capabilities.

## Mobility VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**Rivian** is an electric vehicle company commercializing a connected electric platform that can be flexibly applied to a range of applications, including consumer vehicles as well as B2B products such as the Amazon last-mile delivery vans. Its electric pickup trucks, the R1T and R1S, are produced at a manufacturing plant in Normal, Ill., and are slated for delivery in late 2021.

Founded 2009 | California, United States

Privately held

Total Capital Raised: \$11.1B



**Joby Aviation** is a transportation company developing an all-electric vertical takeoff and landing aircraft which it intends to operate as part of a fast, quiet, and convenient air taxi service beginning in 2024. The aircraft, which has a maximum range of 150 miles on a single charge, can transport a pilot and four passengers at speeds of up to 200 mph.

Founded 2009 | California, United States

Publicly traded

Total Capital Raised: \$1.6B

## Mobility VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
Rivian	Automotive	\$2,650M Series F	January 19, 2021	2009	California, United States
Rivian	Automotive	\$2,500M Series E	July 10, 2020	2009	California, United States
Rivian	Automotive	\$2,500M Series G	July 23, 2021	2009	California, United States
Horizon Robotics	Automotive	\$1,500M Series E	June 11, 2021	2015	Beijing, China
Weltmeister	Automotive	\$1,470M Series D	September 09, 2020	2012	Shanghai, China
Enovate Motors	Automotive	\$735M Series B	October 13, 2020	2015	Shanghai, China
Joby Aviation	Aircraft	\$590M Series C	January 15, 2020	2009	California, United States
Li Auto	Automotive	\$550M Series D	June 24, 2020	2015	Beijing, China
Leapmotor	Automotive	\$525M Series B	January 27, 2021	2015	Hangzhou, China
Hozon	Automotive	\$454M Series C	December 02, 2020	2014	Shanghai, China

Source: PitchBook  
\*January 2020 - August 2021

# Nanotechnology

## Key takeaways

- With \$1.9 billion invested in the past 20 months, nanotechnology companies are experiencing unprecedented investor interest.
- Some of the larger transactions explain the surge in funding, with companies such as handheld ultrasound platform *Exo* and orphan drug developer *Glycomine*, exemplifying the diverse ways that nanotechnology can be deployed.

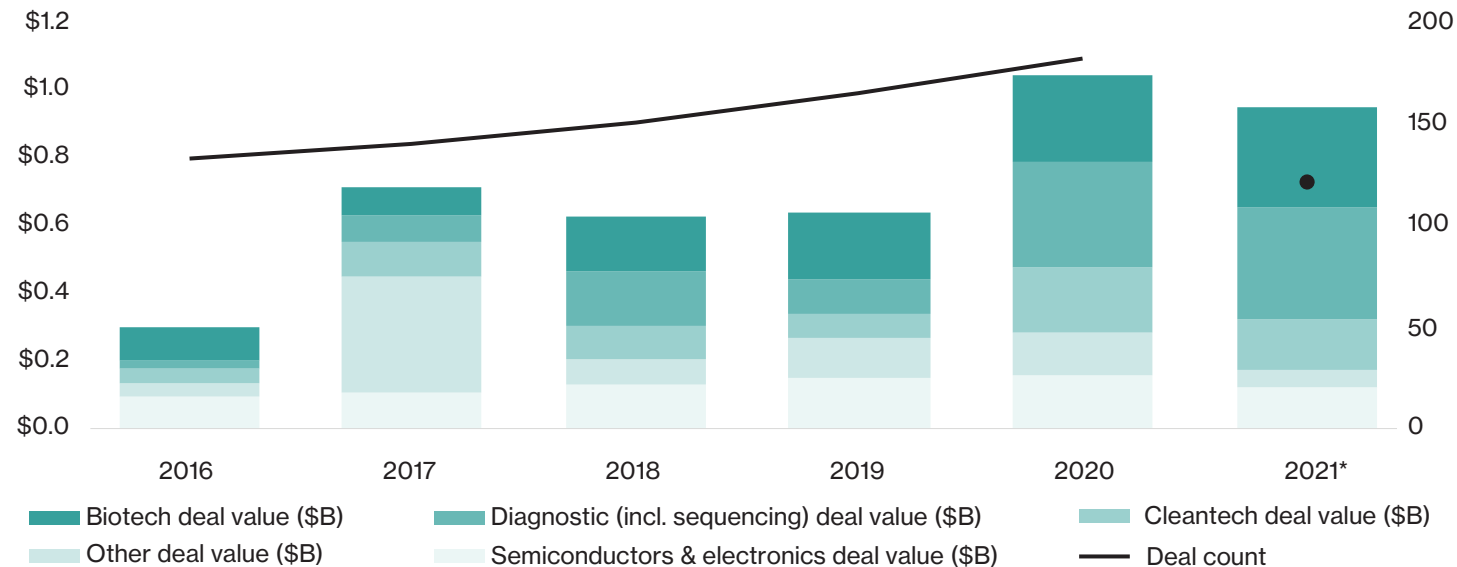
**T**he most diverse sector of Tough Tech is nanotechnology because it applies to a broad range of end verticals. With the unifying feature being a technology with features at the micro- and nano-scale, companies in this space are pursuing applications ranging from industrial materials, cleantech, and semiconductors, to biotech and other sectors.

As a key area for nanotechnology, the battery industry has received several investments, with companies including *Nanoramic Laboratories* and *Factorial Energy* pursuing proprietary nanoparticle materials that would allow EV drivers to travel farther between charges. Underscoring the attractiveness of the technology for energy storage, Israeli battery developer *StoreDot* recently announced its plan for a public debut via SPAC.

In biotech, companies such as *Seer* are using new nanomaterials to revolutionize the field of proteomics. Other companies, including *Glycomine* and *NexImmune*, leverage nanoparticles as intracellular delivery vehicles for small-molecule and biological therapeutics. New treatment modalities, such as *NaNotics*, use nanoparticles to deplete specific molecules from circulation.

Batteries and semiconductors are enjoying record investor interest and broad governmental support due to their applications into national security and the transition to clean energy. And with the biotech sector benefiting from long-term tailwinds, including an aging population, nanomaterials will likely continue to proliferate into more industries.

## Nanotechnology VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**NexImmune** is an emerging biopharmaceutical company advancing a new generation of immunotherapies based on proprietary AIM™ technology. This nanotechnology platform, originally developed at Johns Hopkins University, is the foundation for an approach to immunotherapy in which the body's own immune system is stimulated to orchestrate a targeted T-cell response against a disease.

Founded 2014 | MA, United States

Privately held

Total Capital Raised: \$66M



**Nanoramic Laboratories** is commercializing high temperature ultracapacitor technology born from R&D funded by NASA, the Department of Energy, and the Department of Defense. The company is the exclusive designer, manufacturer, and licensor of Neocarbonix™ electrodes, Fastcap® Ultracapacitors and Thermexit™ thermal interface gap filler pads for industries like electric vehicle batteries and consumer and industrial electronics.

Founded 2009 | MA, United States

Privately held

Total Capital Raised: \$109M

## Nanotechnology VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Exo</b>	Diagnostic	\$220M Series C	July 29, 2021	2015	California, United States
<b>Nanox</b>	Diagnostic	\$110M Series B	July 28, 2020	2011	Neve Ilan, Israel
<b>Glycomine</b>	Biotech	\$68M Series B	June 23, 2021	2014	California, United States
<b>QitanTech</b>	Diagnostic	\$62M Series B	June 08, 2021	2016	Chengdu, China
<b>NaNotics</b>	Biotech	\$60M Series B	April 01, 2021	2015	California, United States
<b>Nutcracker Therapeutics</b>	Biotech	\$60M Series B	September 23, 2020	2017	California, United States
<b>Molekule</b>	Cleantech	\$58M Series C	February 25, 2020	2014	California, United States
<b>Nearfield Instruments</b>	Semiconductors and Electronics	\$57M Series B	July 29, 2021	2016	Rotterdam, Netherlands
<b>Seer</b>	Biotech	\$55M Series D	May 12, 2020	2017	California, United States
<b>Exo</b>	Diagnostic	\$51M Series B	November 09, 2020	2015	California, United States

Source: PitchBook  
\*January 2020 - August 2021

# Robotics & drones

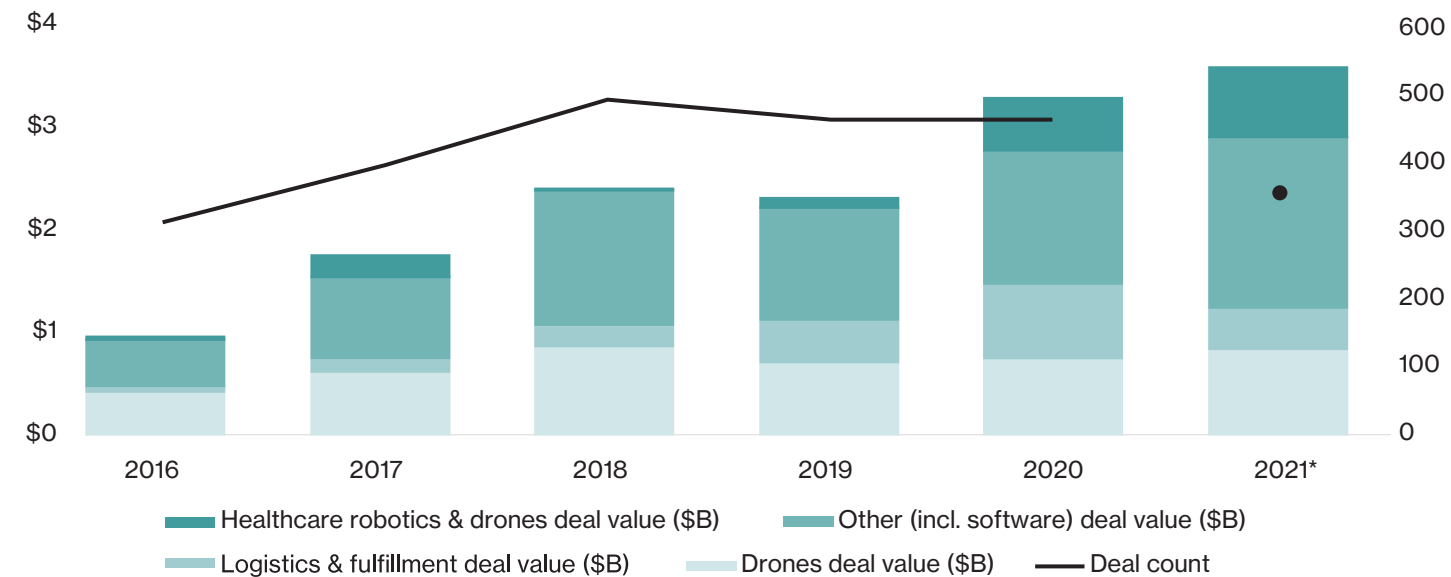
## Key takeaways

- *Within the robotics & drones space, \$4.3 billion has already been invested in 2021 across close to 400 completed financings. These figures compare favorably with the \$3.2 billion invested in 2020 across 473 completed rounds worldwide.*
- *A handful of large exits have boosted 2021 tallies to an all-time exit value high of \$2.3 billion.*

The robotics & drones segment is experiencing unprecedented interest from investors, as technologies advance and deepen immersion into multiple sectors. Agricultural use cases, surgical robotics, last-mile delivery, and warehouse automation have been investor focal points—especially given how rapidly some of the mature companies within this space have been able to exit. Retaining roughly the same proportion of deal value as in the past, unmanned autonomous systems (UAS) also remain a focus for investors. Yet the broader ecosystem of robotics & drones—and software players in particular—continues to accumulate investment. Use cases are also mushrooming as chip design advances increase computational power, incremental battery improvements boost energy longevity, and training data is increasingly available.

One notable company in the space is *CMR Surgical*, which closed on \$600 million in summer 2021 from Tencent and SoftBank, among other firms, in order to broaden commercialization of its primary flagship product, robotic system Versius. Such well-funded companies will continue to push commercialization efforts and thus likely raise additional large rounds to fund expansion. However, technical innovations remain a focus of R&D within the space—especially as the push to replace overly manual, taxing tasks intensifies. In the long term, demand for next-generation actuators and sensors will likely ramp up. Robotic systems for use cases ranging from warehouses to operating rooms need to closely mimic human nervous system and physical performance levels. Examples include the dexterity of fast-twitch muscle fibers and integrated holistic movements between visual recognition and muscular reaction times. More broadly, similar technical innovation will be demanded across multiple robotics systems, thereby necessitating sustained R&D by Tough Tech robotics companies.

## Robotics & drones VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights



**CMR Surgical** manufactures the Versius, a next-generation surgical robot designed to make robotic minimal access surgery universally accessible and affordable.

Founded 2014 | Cambridge, United Kingdom

Privately held

Total Capital Raised: \$1B

## zipline

**Zipline** has built the world's fastest and most reliable delivery drone as well as the world's largest autonomous logistics network. It delivers medical products to local health facilities from distribution centers in Ghana and Rwanda. To date, its systems have made more than 175,000 commercial deliveries.

Founded 2011 | California, United States

Privately held

Total Capital Raised: \$553M

## Robotics & drones VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>CMR Surgical</b>	Healthcare	\$600M Series D	June 27, 2021	2014	Cambridge, United Kingdom
<b>Berkshire Grey</b>	Logistics & Fulfillment	\$263M Series B	January 21, 2020	2013	Massachusetts, United States
<b>Zipline</b>	Healthcare	\$250M Series E	June 30, 2021	2011	California, United States
<b>Skydio</b>	Drones	\$171M Series D	March 01, 2021	2014	California, United States
<b>CloudMinds</b>	Other	\$153M Series B	April 09, 2021	2015	Beijing, China
<b>Locus Robotics</b>	Logistics & Fulfillment	\$150M Series E	February 17, 2021	2014	Massachusetts, United States
<b>Agile Robots</b>	Other	\$130M Series B	January 27, 2021	2018	Munich, Germany
<b>H2 Green Steel</b>	Other	\$105M Series A	April 26, 2021	2020	Stockholm, Sweden
<b>Flexiv</b>	Other	\$100M Series B	December 30, 2020	2016	California, United States
<b>GreyOrange</b>	Logistics & Fulfillment	\$100M Series D	September 10, 2020	2011	Singapore, Singapore

Source: PitchBook  
\*January 2020 - August 2021



# Semiconductors

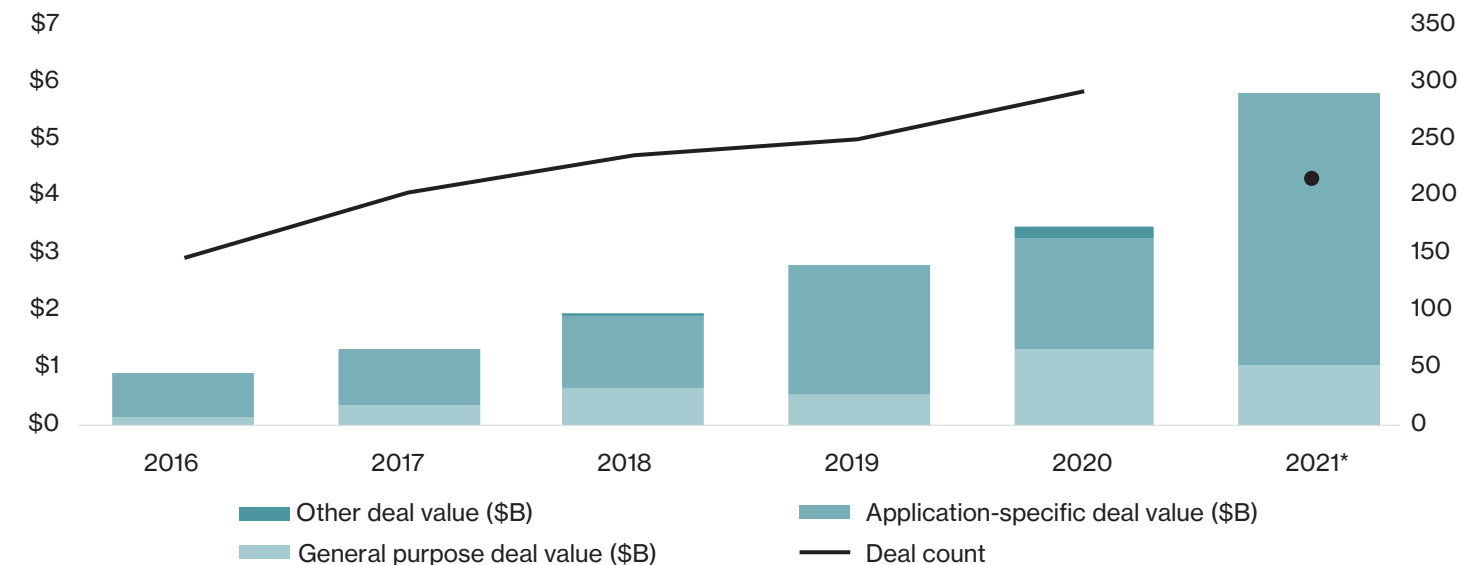
## Key takeaways

- *Semiconductors rose to the forefront of Tough Tech dialogues in 2020, as multiple industries suffered from pandemic-related constrictions in chip manufacturing, leading governments to renew efforts to foster domestic semiconductor production.*
- *Application-specific semiconductors have drawn the bulk of VC invested—especially in 2021 to date—as multiple industries demand ever-increasing computational power and customization.*

**C**apital has poured into the semiconductor segment, with close to \$6 billion invested through late summer 2021 across 200+ financings. Many semiconductor startups are maturing into enterprises capable of commanding larger sums, including Graphcore's \$300 million+ round in July 2021. Liquidity has followed suit, encouraging later-stage funding—especially given large exits from NUVIA, Cambricon Technologies, GalaxyCore, and others. Many governments and incumbent tech giant initiatives are laser-focusing on semiconductors. From Apple's introduction of M1 chips to government funding expansions or launches of production facilities within their own borders, the need for innovation and widespread production of semiconductors is intensifying.

The semiconductor production process remains highly sophisticated, requiring thousands of technical steps paired with incredible precision, while semiconductor applications are growing increasingly complex. Beyond the power density challenges of systems on chips, the edge use cases introduced by advancing autonomous automotive systems demand significant customization. Some automotive manufacturers have even begun designing chips in-house. Companies in other sectors may elect to take on as much of the semiconductor production chain in-house as they can justify. However, such recourse will only prompt further VC investment into startups across the segment, as the frontier of semiconductor innovation will be continually advanced by market needs.

## Semiconductors VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights

### GRAPHCORE

Graphcore has built a processor called the Intelligence Processing Unit (IPU) that enables AI researchers to undertake entirely new types of work, not possible using current technologies, to drive the next advances in machine intelligence.

Founded 2016 | Bristol, United Kingdom

Privately held

Total Capital Raised: \$713M



Horizon Robotics builds edge AI computing platforms for intelligent vehicles. It was the first Chinese company to commercialize both autonomous driving processors and software. Horizon's solutions power advanced driver-assistance systems (ADAS), autonomous driving and intelligent in-cabin AI applications.

Founded 2015 | Beijing, China

Privately held

Total Capital Raised: \$3.4B

## Semiconductors VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
Horizon Robotics	Application Specific	\$1,500M Series E	June 11, 2021	2015	Beijing, China
Horizon Robotics	Application Specific	\$400M Series C2	January 07, 2021	2015	Beijing, China
Horizon Robotics	Application Specific	\$350M Series C3	February 10, 2021	2015	Beijing, China
Graphcore	General Purpose	\$307M Series E	July 21, 2021	2016	Bristol, United Kingdom
Horizon Robotics	Application Specific	\$300M Series D	May 01, 2021	2015	Beijing, China
ESWIN Computing	General Purpose	\$281M Series B	June 08, 2020	2016	Beijing, China
Enflame Technology	Application Specific	\$275M Series C	January 05, 2021	2018	Shanghai, China
Biren Technology	General Purpose	\$245M Series C	March 30, 2021	2019	Shanghai, China
NUVIA	Application Specific	\$239M Series B	September 24, 2020	2019	California, United States
Biren Technology	General Purpose	\$230M Series B	August 20, 2020	2019	Shanghai, China

Source: PitchBook  
\*January 2020 - August 2021

# Spacetechn

## Key takeaways

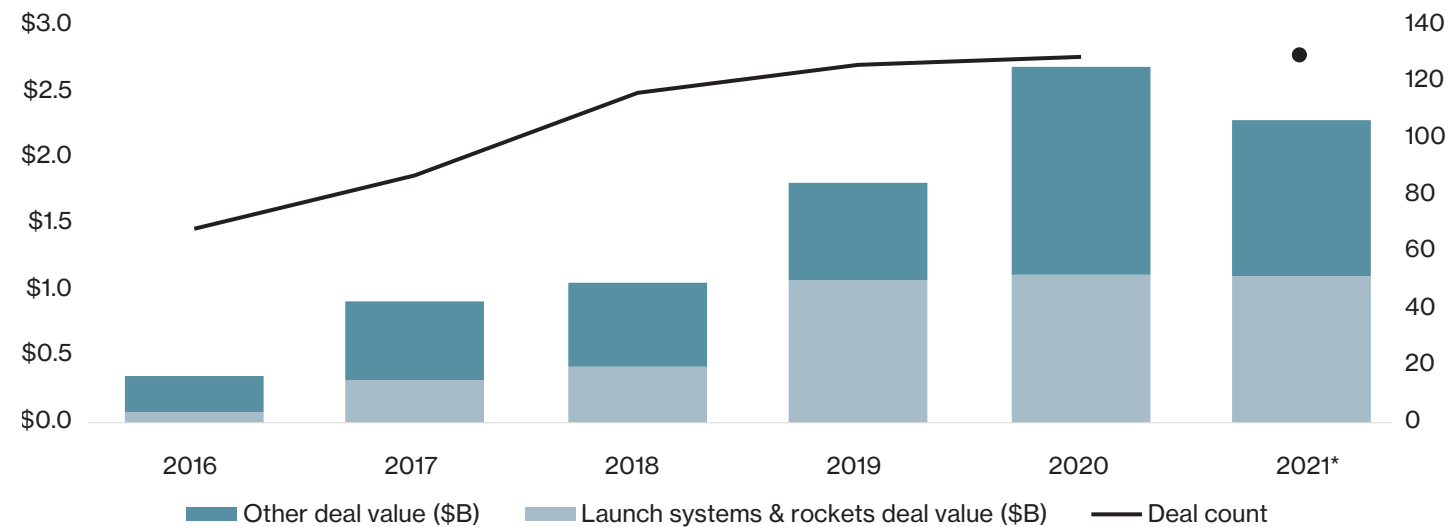
- *Spacetechn funding has skyrocketed in the past five years, cresting at 129 completed financings in 2021 to date, for a total of \$2.3 billion, favorably compared to 2020's 129 completed rounds at \$2.7 billion.*
- *The next generation of spacetechn companies are addressing challenges with in-space manufacturing, satellite propulsion, space debris cleanup, earth observation, and global internet connectivity.*

In the past two years, spacetechn companies working to make more cost-effective rockets and launch systems have achieved monumental technical and commercial milestones. Incumbents such as *SpaceX*, *Blue Origin*, and *Virgin Galactic* have continued to pave the way toward private, consumer space access by dramatically reducing the cost to get to space on a price-per-weight basis. Meanwhile, younger companies such as *Rocket Lab* and *Astra* have announced SPAC mergers at initial valuations of \$4.1 billion and \$2.1 billion, respectively.

Now, the next generation of spacetechn companies is tackling in-space systems and service opportunities, including in-space manufacturing, satellite propulsion, and space debris cleanup. Notable groups in this realm include *Amazon's Project Kuiper* and *SpaceX's Starlink*, which aim to deploy satellite

internet constellations to provide global internet access and, potentially, a positioning, navigation, and timing (PNT) alternative to GPS. Other prominent companies include: *Kymeta*, which develops low-power satellite antennae that support mobile satellite-cellular connection; *Astroscale*, which is working to provide space debris removal services; and *Planet Labs*, which plans to offer earth imaging services for applications such as climate monitoring, crop yield prediction, and disaster response. These market opportunities are expected to accelerate growth for in-space systems and services over the coming years.

## Spacetechn VC deal activity



Source: PitchBook  
\*As of August 31, 2021

## Company Highlights

### Relativity

**Relativity Space** is developing a proprietary 3D-printed rocket, which it claims uses 100x fewer parts compared to traditional rockets. The company is looking to leverage this technology in order to build the first autonomous rocket production facility and offer satellite launch services.

Founded 2015 | California, United States

Privately held

Total Capital Raised: \$1.3B



**Accion Systems** is developing satellite in-space propulsion systems that leverage its proprietary ion beam technology. The company claims that its system achieves the highest thrust-to-power ratio on the market compared to its direct competitors.

Founded 2014 | MA, United States

Privately held

Total Capital Raised: \$66M

## Spacetechn VC deals\*

Company name	Segment	Deal details	Close date	Founded	Headquarters
<b>Relativity Space</b>	Launch Systems & Rockets	\$650M Series E	June 08, 2021	2015	California, United States
<b>Relativity Space</b>	Launch Systems & Rockets	\$500M Series D	November 23, 2020	2015	California, United States
<b>ZhangGuangWeiXing</b>	Other	\$372M Series	November 29, 2020	2014	Changchun, China
<b>Astranis</b>	Other	\$280M Series C	April 14, 2021	2015	California, United States
<b>Kymeta</b>	Other	\$215M Series B	September 17, 2020	2012	Washington, United States
<b>LandSpace</b>	Launch Systems & Rockets	\$173M Series C	September 09, 2020	2015	Beijing, China
<b>iSpace</b>	Launch Systems & Rockets	\$171M Series B	August 25, 2020	2016	Beijing, China
<b>ABL Space Systems</b>	Launch Systems & Rockets	\$170M Series B	March 25, 2021	2017	California, United States
<b>Axiom Space</b>	Other	\$130M Series B	February 16, 2021	2016	Texas, United States
<b>Kineis</b>	Other	\$111M Series	February 03, 2020	2018	Ramonville-Saint-Agne, France

Source: PitchBook  
\*January 2020 - August 2021

## METHODOLOGY

The datasets informing this report were derived from the PitchBook Platform. To define Tough Tech, The Engine and PitchBook amassed fifteen subsectors that comprise Tough Tech via custom searches in the PitchBook Platform using keywords, industries, and verticals. Each custom search was then reviewed to add or exclude companies. In addition, two limiting criteria were utilized: the company founding date had to be on or after January 1, 2009, and the date range of the financings included for analysis of overall transactions had to be between and inclusive of January 1, 2012, and August 31, 2021. When assessing companies that span multiple subsectors (such as nanotechnology companies working in cleantech), we erred on the side of inclusion of the same company in multiple segments to make the individual subsegment views as complete as possible. We have unduplicated the list when aggregating data into the three primary segments and again, when aggregating into the overall Tough Tech sector. The key exceptions to overlapping sectors are summarized below:

- AI & ML segment excludes any companies related to advanced & quantum computing.
- Cleantech segment excludes any companies related to mobility or agtech & foodtech.
- Materials sector excludes any companies related to battery nanomaterials.
- Life sciences sector excludes any companies related to agtech & foodtech or medtech.
- Robotics & drones sector excludes any companies related to mobility, spacetechnology, and 3D printing.

Beyond this, PitchBook's customary methodology for venture datasets was utilized. For details, see the full list of PitchBook report methodologies here <https://pitchbook.com/news/articles/pitchbook-report-methodologies>

Please note that definitions of subsegments, and the introduction of the main segments, precipitated an update in the methodology from that used to generate the inaugural 2019 Tough Tech Report.



The Engine, built by MIT, is a venture firm that invests in early-stage companies solving the world's biggest problems through the convergence of breakthrough science, engineering, and leadership. Our mission is to accelerate the path to market for Tough Tech companies by providing access to a unique combination of investment, infrastructure, and community.



