



The Dawn of the Deep Tech Ecosystem

Journalist Exclusive Content Release

Embargoed Until 00:01 ET on 14 March 2019

MARCH 2019

BCG and Hello Tomorrow Deep Tech Publication

First Abstract Release

"The report is based on in-depth interviews, market research, examinations of funding, patent and publication data, and a survey of more than 2,000 startups from the Hello Tomorrow Challenge, which assesses deep tech startups on four criteria: technological innovation, business model, team skills, and expected impact.

The report examines seven fields of deep tech endeavor and the roles of multiple types of deep tech ecosystem participant.

We take a tour of the evolving deep tech ecosystem and offer some observations on how the different types of participants can maximize the value of their efforts. If indeed we are on the cusp of a new era in technology R&D, we set the stage for what is to come and, in particular, how corporations, investors, and startups need to think about their roles in the future."

Agenda

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Deep tech is on
the rise globally

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China and the US are
leading the deep
tech race

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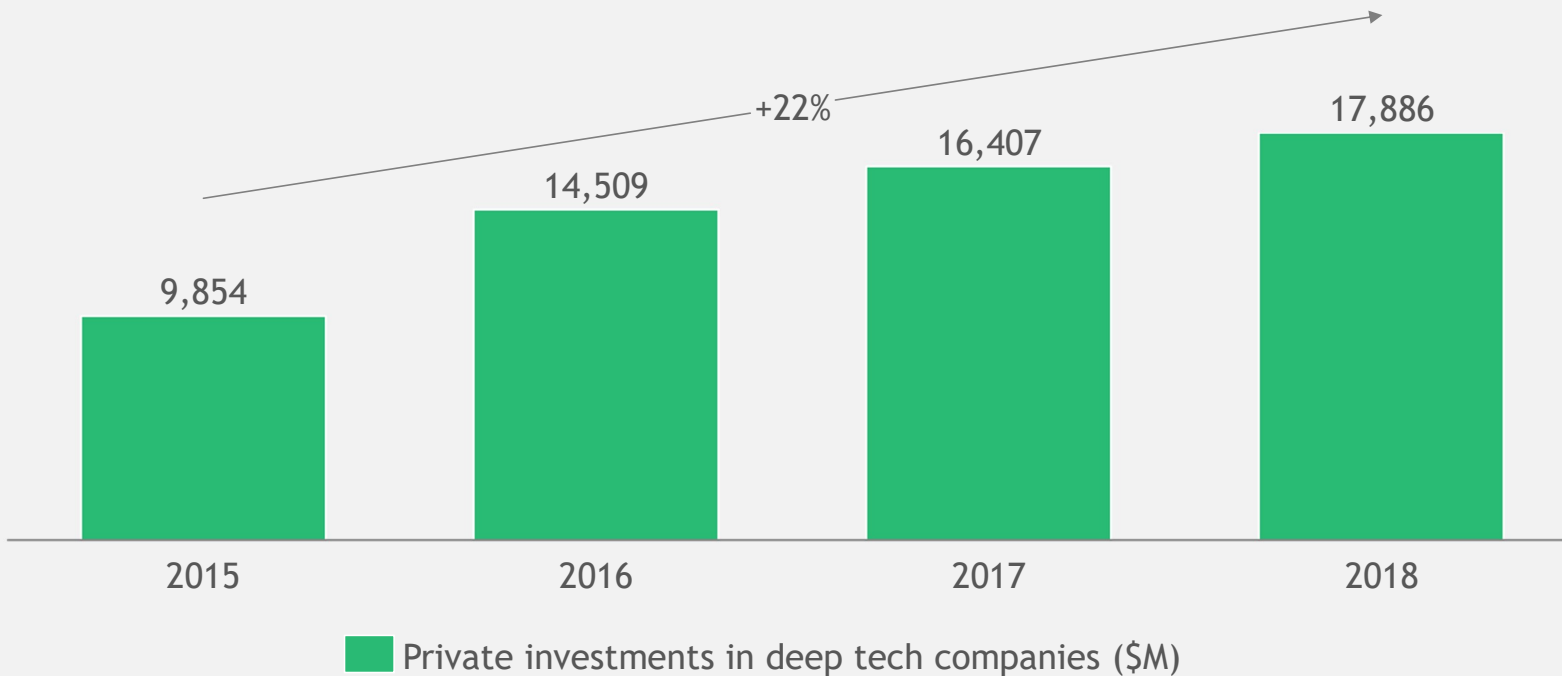
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Meet the new
breed of
deep tech startups

Slides: 20-27

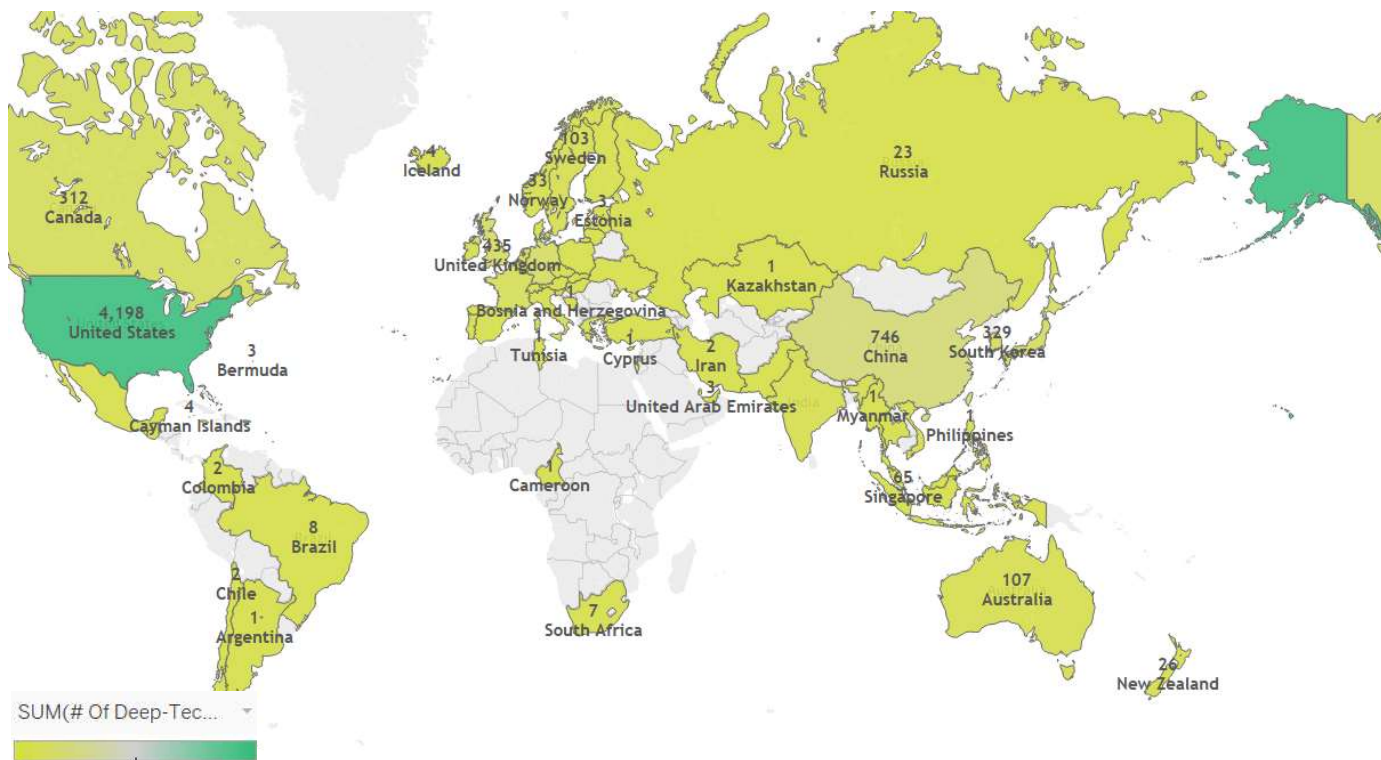
1. Deep tech is on the rise globally

Global Private Investments In Deep Tech Have Soared



Includes investment in seven deep tech categories: advanced materials, artificial intelligence, biotechnology, blockchain, drones and robotics, photonics and electronics, and quantum computing. Private investment sums are based on transactions with disclosed amounts. Some 41% of private investments in deep tech companies remain undisclosed.
Source: Capital IQ, Quid, BCG Center for Innovation Analytics

Deep Tech Is a Global Phenomenon: ~8,600 Companies in ~70 Markets



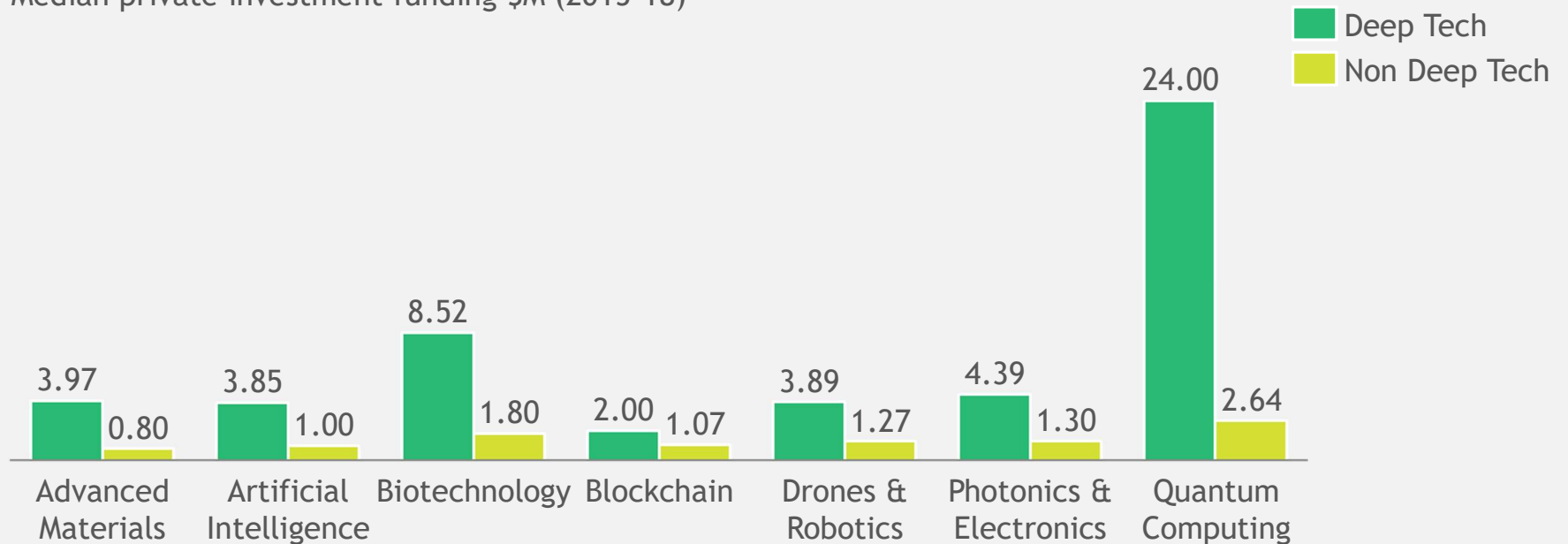
1 4,198 enter for Innovation Analytics.

Note: Analysis is based on 8,682 deep tech companies related to 16 technologies across seven categories: advanced materials, artificial intelligence, biotechnology, blockchain, drones and robotics, photonics and electronics, and quantum computing. Exhibit is missing geographic information for 199 companies. Greater China includes mainland China, Hong Kong, Macau, and Taiwan.

United States (4198)
 Greater China (746)
 Germany (455)
 United Kingdom (435)
 Japan (363)
 South Korea (329)
 Canada (312)
 France (241)
 Israel (195)
 Switzerland (147)
 India (129)
 Australia (107)
 Sweden (103)
 Netherlands (78)
 Italy (70)
 Spain (66)
 Singapore (65)
 Denmark (59)
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 Belgium (41)
 Ireland (39)
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 Norway (33)
 New Zealand (26)
 Russia (23)
 Poland (20)
 Portugal (10)

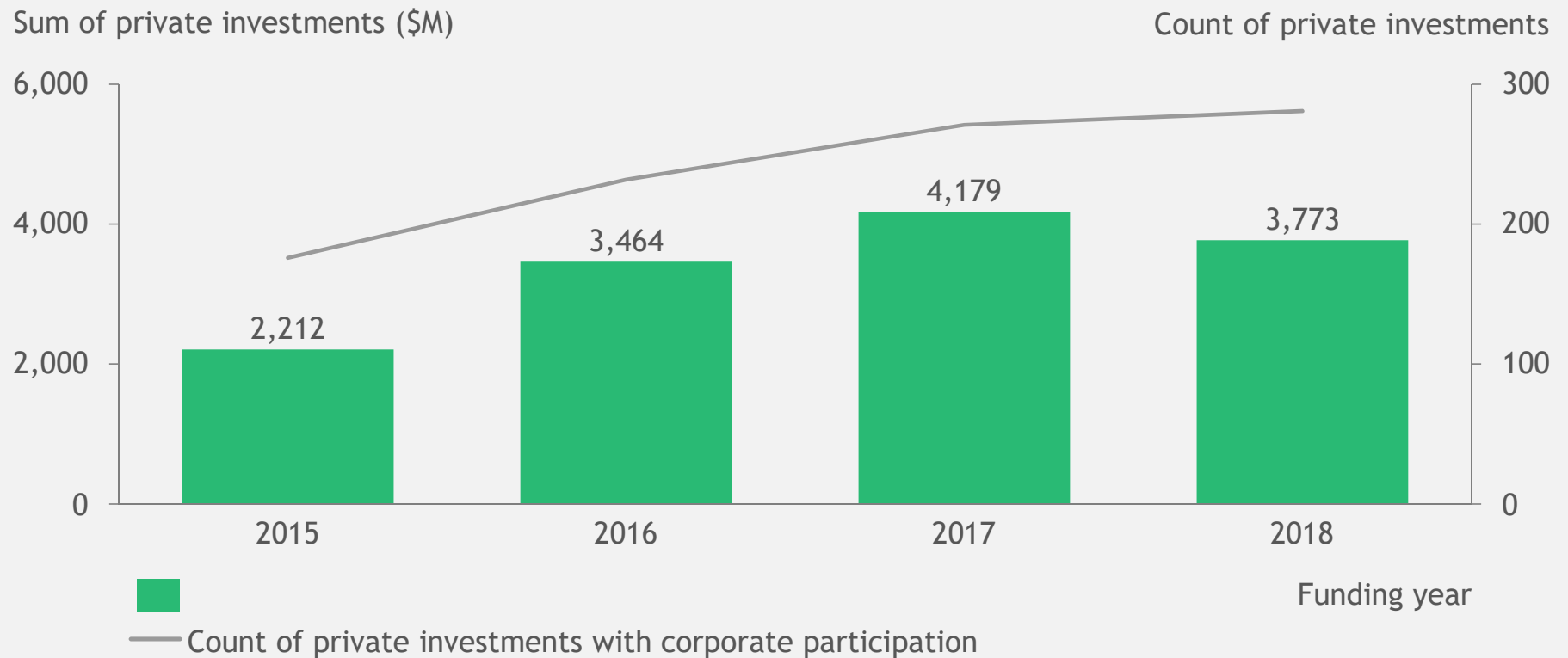
Deep Tech Companies Attract More Private Investment than Others

Median private investment funding \$M (2015-18)



Note Quantum computing has only 8 deep tech companies, with two raising a combined \$64 million in 2016 and 2017.
Source: Capital IQ, Quid, BCG Center for Innovation Analytics

Corporate Investing in Deep Tech startups rising



Includes investment in seven deep tech categories: advanced materials, artificial intelligence, biotechnology, blockchain, drones and robotics, photonics and electronics, and quantum computing.

Source: Capital IQ, Quid, BCG Center for Innovation Analytics

What is Driving Deep Tech rise?



The Rise of New
Platform
Technologies



Falling Barriers
of Entry



Growth in
Available Capital

1/ Deep Tech is the Next Stage of Continuous Progress in Platform Technologies



Chips & Computers 1960s-70's

Silicon chips enabling modern day computing

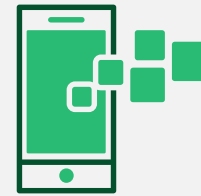
Desktop computers



Internet 1980s-90's

Processing power enabled new level of advancements

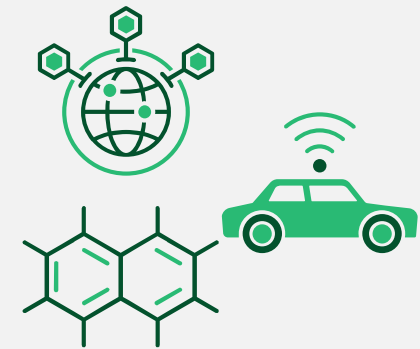
Global instantaneous connectivity



Digital & Mobile 2000's - Present

Available all the time, everywhere

Information spreads like wildfire

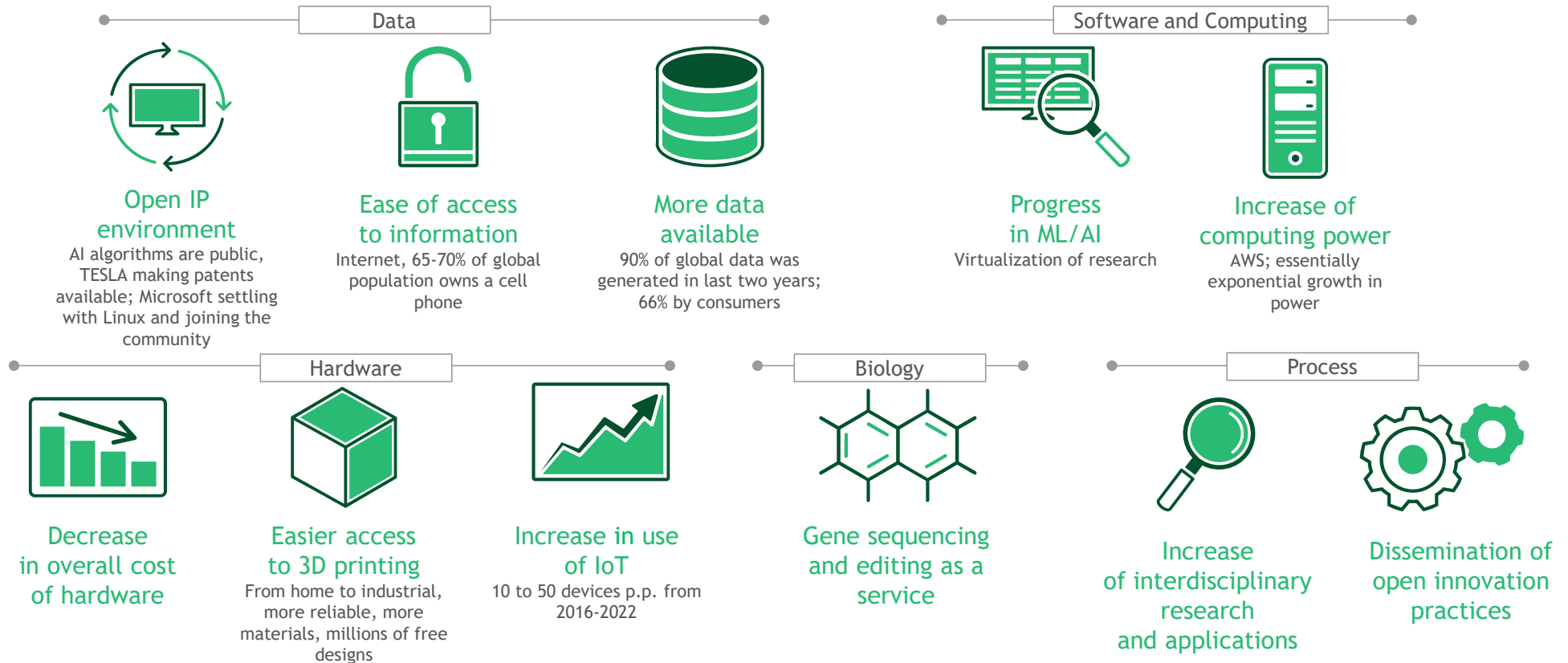


Deep Technologies 2010 - Future

Giving more and more autonomy to machines, and engineering life at a large scale

Impact on industries and society still hard to fathom

2/ Barriers to Entry have Significantly Decreased to Enter Cutting-edge Research

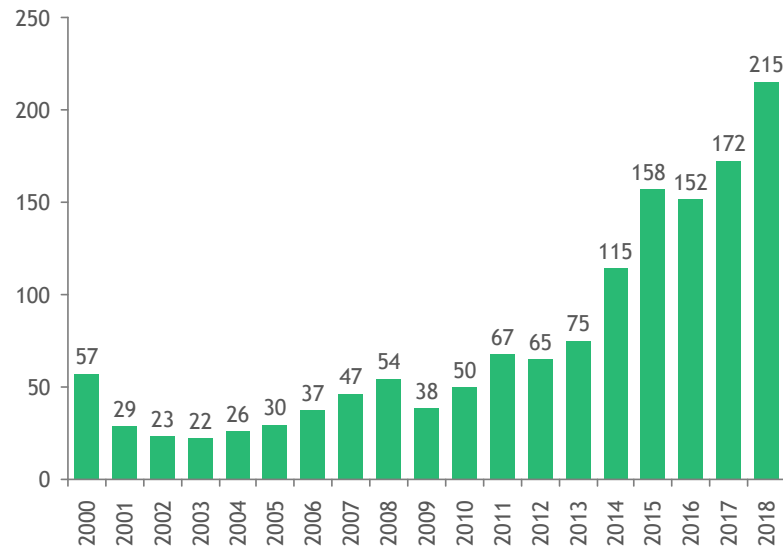


Source: Expert interviews; BCG and Hello Tomorrow analysis

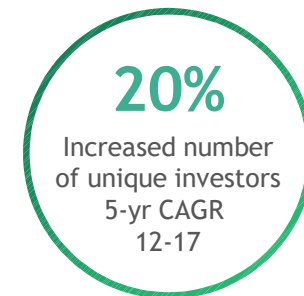
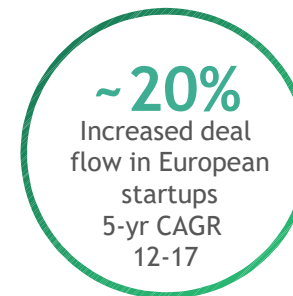
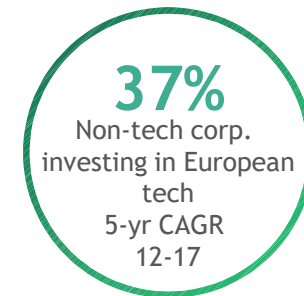
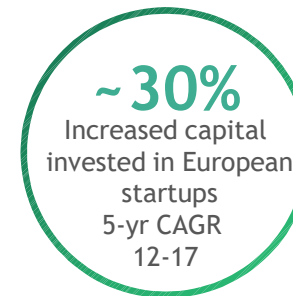
3/ Capital Investment in Startups Continuously Expanding

Historic investment in tech startups

Capital invested in tech startups globally (USD B)



Current trends of increased capital deployment in tech fields



With such growth in AuM expected, anticipation of continued and expanded investment in "other types of investments" (i.e. startups)

2. R&D is changing

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"Is the shape of technology R&D changing?

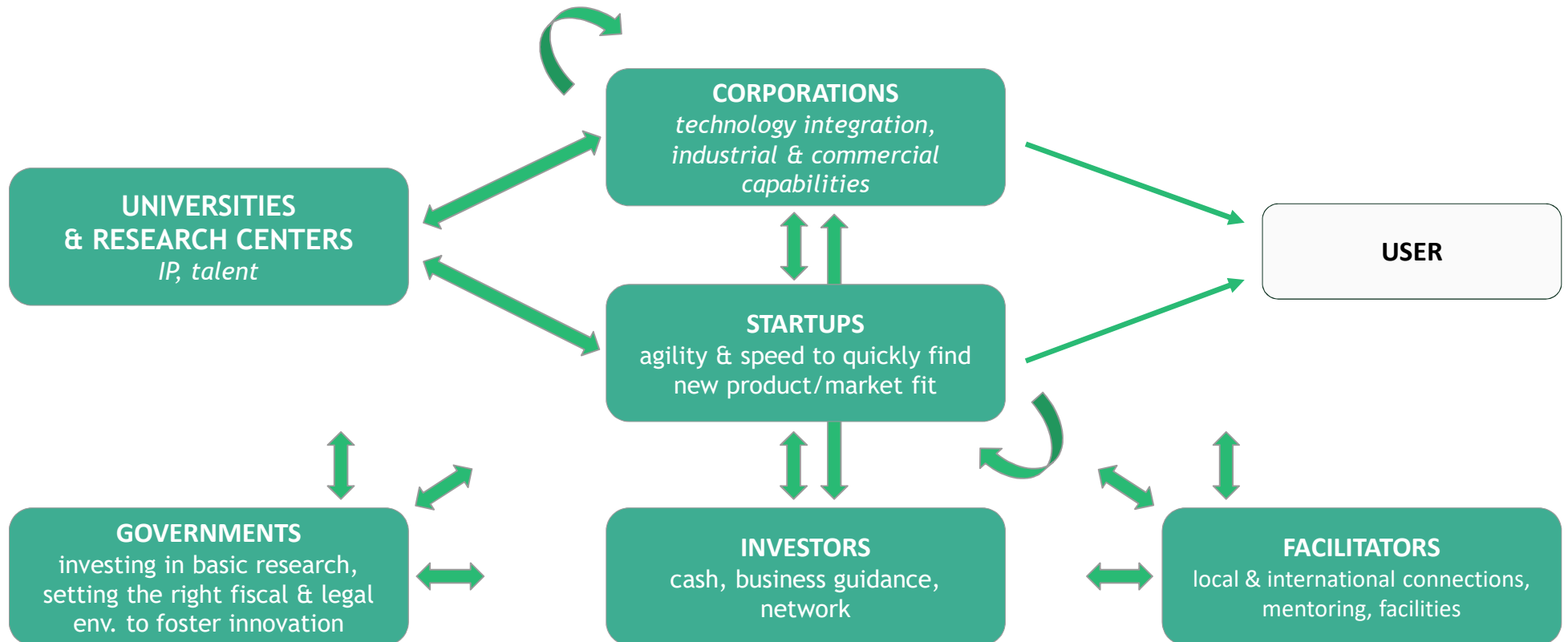
Is a new model emerging for developing and commercializing deep technologies — novel technologies that still require some advances to be market ready but from which enormous impact is expected?

Are the central roles with respect to the development of new scientific discoveries and their transfer to commercial applications traditionally played by large entities and institutions—corporations, governments, universities and others—being increasingly augmented, and in some instance replaced, by startups?

Do the many stakeholders with a basic interest in technology R&D need to rethink how they play the game?

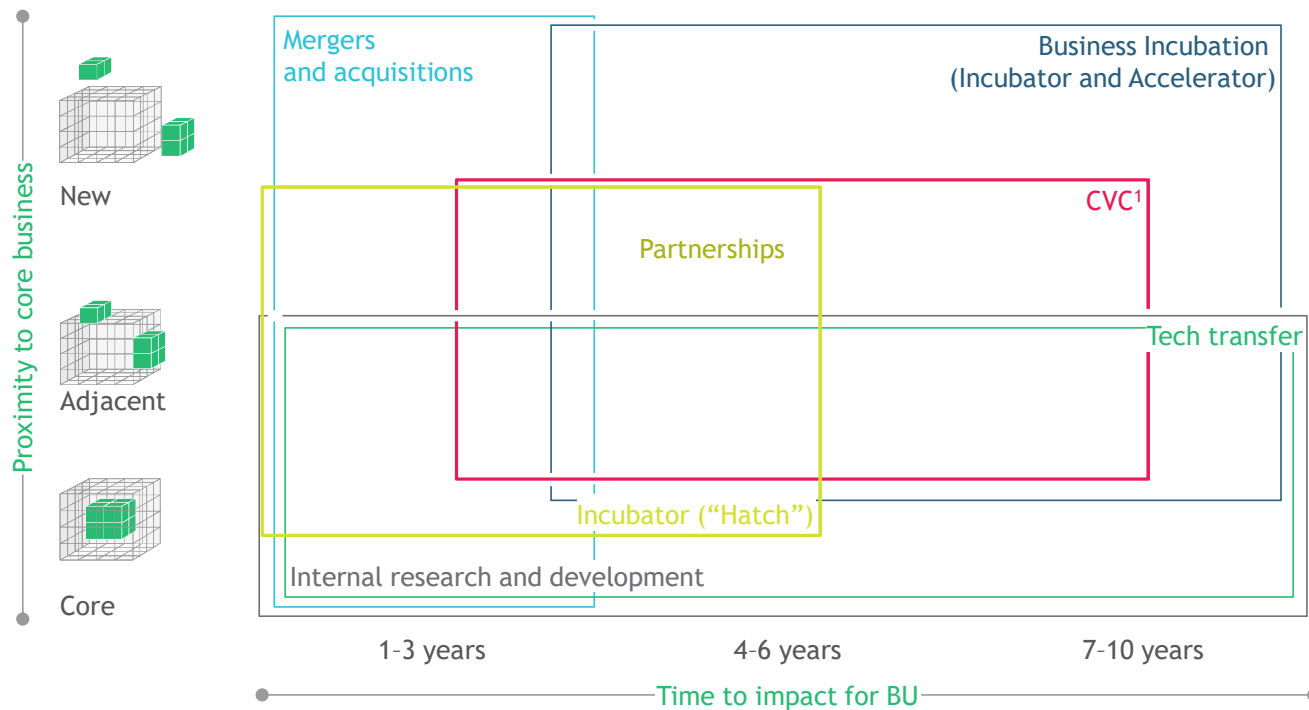
The overarching answer to all these questions is, yes."

The Deep Tech Ecosystem encompasses diverse types of actors



Increased Sophistication Towards Innovation from corporations

Strategic objectives of internal and external innovation units



Description

- **CVC¹**
Equity investments to assess and access new growth opportunities
- **Incubator ("Hatch")**
Create new and sustainable business models along a structured approach
- **Business Incubation (Incubator and Accelerator)**
Support of and cooperation with start-up companies in early stages
- **Tech Transfer**
Scouting/identification and transfer of innovation/technology by external sources into corporate (e.g., IP licensing)
- **Strategic partnerships**
Partnerships/joint ventures that drive incremental revenue for BU
- **Mergers & Acquisitions (M&A)**
Acquisition of developed companies with existing business
- **Internal Research and Development**
Internal product development

1. CVC=Corporate Venture Capital
Source: BCG analysis

Ecosystems' 4 Main Dynamics

Multi-entity

- More types of players (startups, corporations, investors, universities & research centers, governments, facilitators)
- More diverse sources of players (public and private sector)

Dynamic Structures and Relationships

- Often informal relationships
- Emerging relationships & changing roles of players based on changing needs

Horizontal and Decentralized

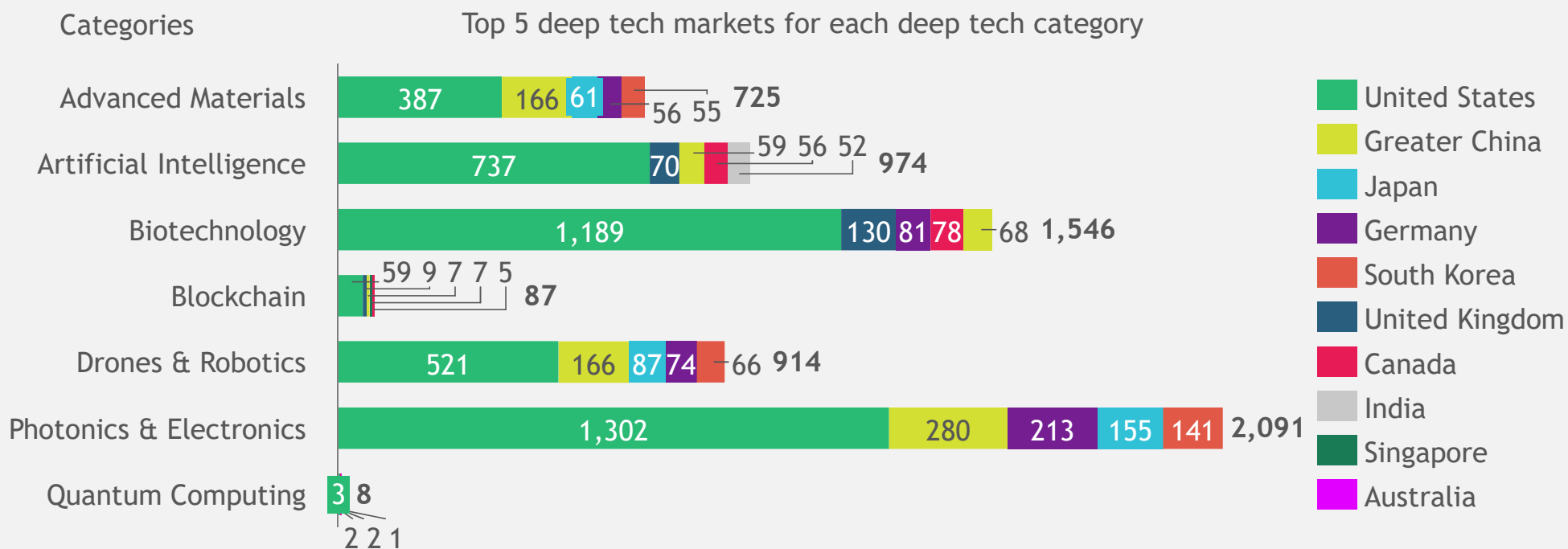
- Rarely a controlling party
- Each party can influence the direction of the whole
- Orchestrator more like a magnet than a manager
- Ecosystem development is driven by aligning visions, knowledge and goals

Non-financial Linkages

- Financial gains (ROI) are important but often not the focus of the relationships
- Including also: knowledge, data, skills, expertise, contacts, market access (and cash)
- Assessing value is different than traditional relationships: ROI takes a back seat to larger goals

3. China and the US are leading the deep tech race

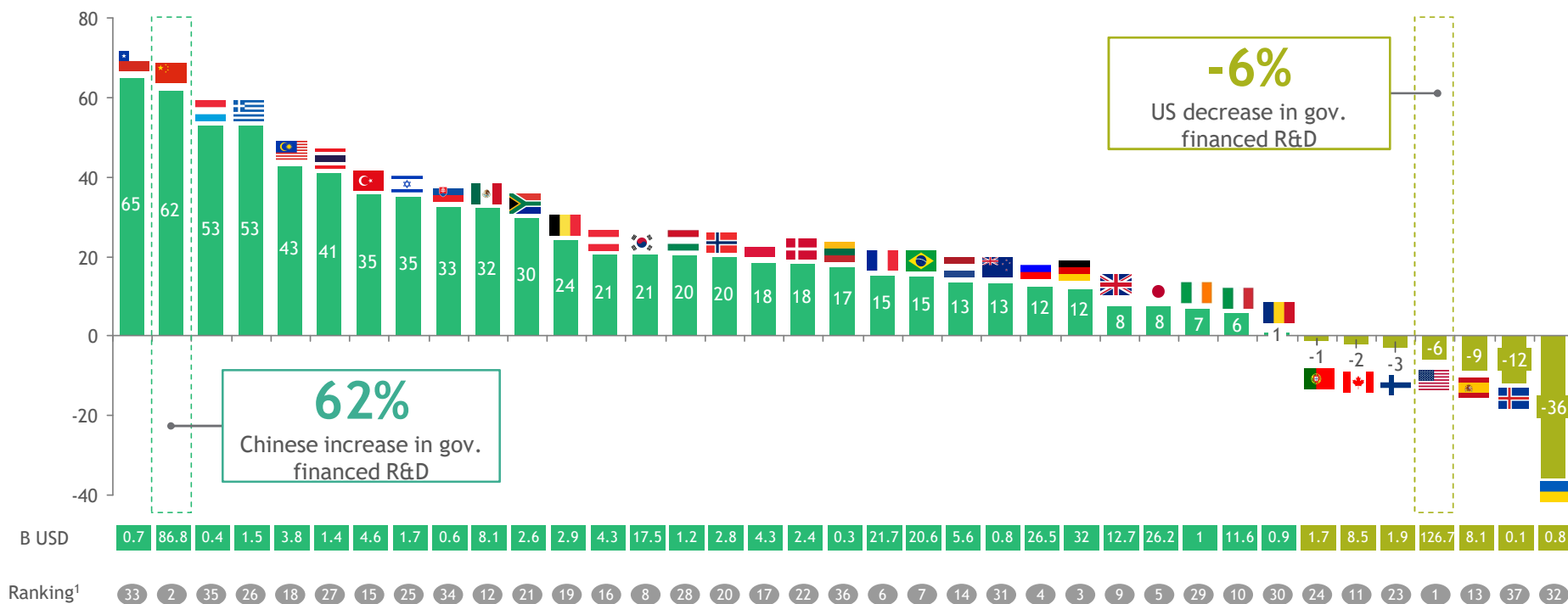
The US Leads as a Deep Tech Hub, but Considerable Activity Is Occurring Elsewhere



Sources: Capital IQ; Quid; BCG Center for Innovation Analytics.
 Note: Greater China includes mainland China, Hong Kong, Macau, and Taiwan.

Chinese government is putting considerable efforts into R&D to catch up

% growth of GERD financed by government in USD (2011 - 2015)



1. Ranking relative to current list of countries
 Note: Gross domestic expenditure on R&D (GERD)
 Source: UNESCO GERD data collection; BCG analysis

4. Meet the new breed of deep tech startups

Deep Tech definition and characteristics

Novelty

Deep technologies are novel and offer significant advances over technologies currently in use.

They require significant R&D to develop practical business or consumer applications and bring them from the lab to the market

Impact

Many of these technologies address big societal and environmental challenges and will likely shape the way we solve some of the most pressing global problems.

These technologies have the power to create their own markets or disrupt existing industries

Time & Scale

Deep tech takes time to move from basic science to a technology that can be applied to actual use cases.

The amount of time varies substantially by technology but it is almost always longer than an innovation based on a widely available technology would take, and can be more than 10 years.

Investment

Continuous investment from ideation through commercialization and intensive capital requirements, complicated by the technology risk adding to the market risk.

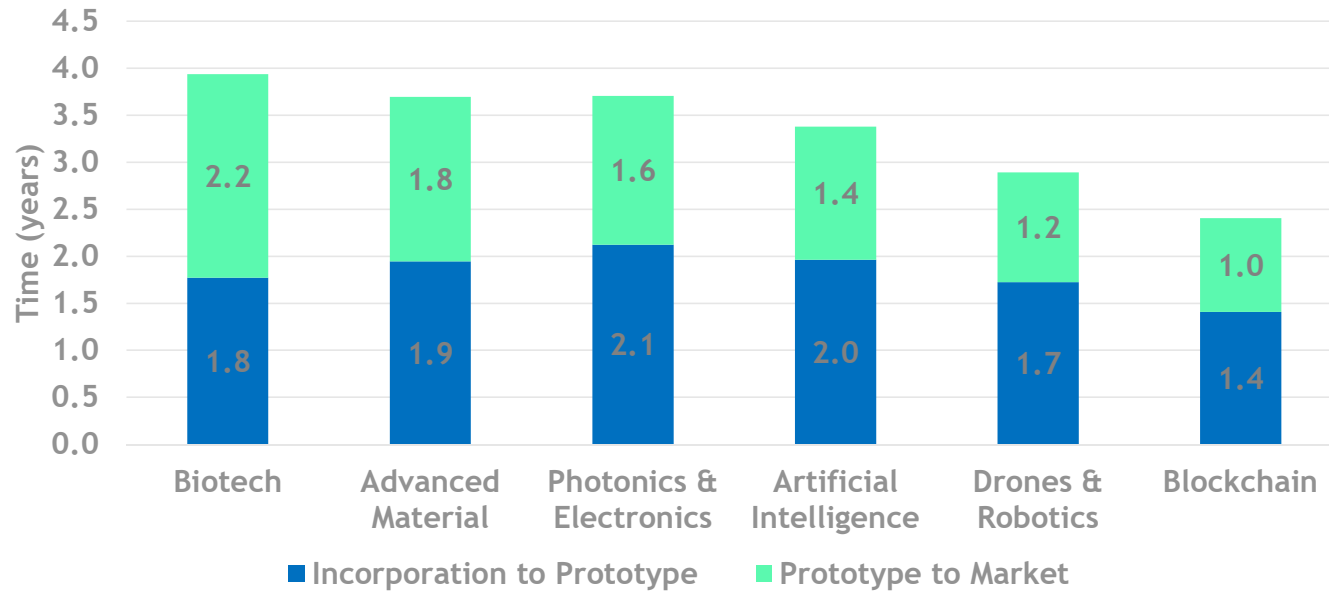
Generally requires both public and private funds & resources for full development

Deep Tech "Impact": Share of Deep Tech Startups Targeting Each UN Sustainable Development Goal

SDG	Number	Share
Good health and wellbeing	837	51%
Industry, innovation and infrastructure	827	50%
Sustainable cities and communities	469	28%
Responsible consumption and production	413	25%
Climate action	369	22%
Decent work and economic growth	340	21%
Affordable and clean energy	289	18%
Reduced inequalities	231	14%
Clean water and sanitation	165	10%
Life on land	160	10%
Quality education	160	10%
Zero hunger	156	9%
No poverty	137	8%
Gender equality	100	6%
Peace, justice and strong institutions	95	6%
Life below water	79	5%
Total Number of Qualified Startups	1646	100%

Source: 1,646 deep tech startups of the Hello Tomorrow Challenge in 2018, Hello Tomorrow analysis

Deep Tech "Time & Scale": The Average Time Required from Incorporation to Market Varies for Each Deep Tech Category



Note: does not take into account the time for research before incorporation

Source: 1,500 startups (500 best startups from the Hello Tomorrow Challenge in 2016, 2017, and 2018), Hello Tomorrow analysis

Deep Tech "Time & Scale": Example of Facebook VS Lilium Aviation - winner of the Hello Tomorrow Challenge in 2016

Facebook : 20 months

January
2004

IDEA

February
LAUNCH OF
"THE FACEBOOK"
AT HARVARD

March
EXPANDS TO STANFORD,
COLUMBIA & YALE

August
INCORPORATION

Sep. 2005
SPREADING
WORLDWIDE

Lilium Aviation : 12 years

2013
IDEA IN GLASGOW

2015
FLIGHT OF THE FALCON

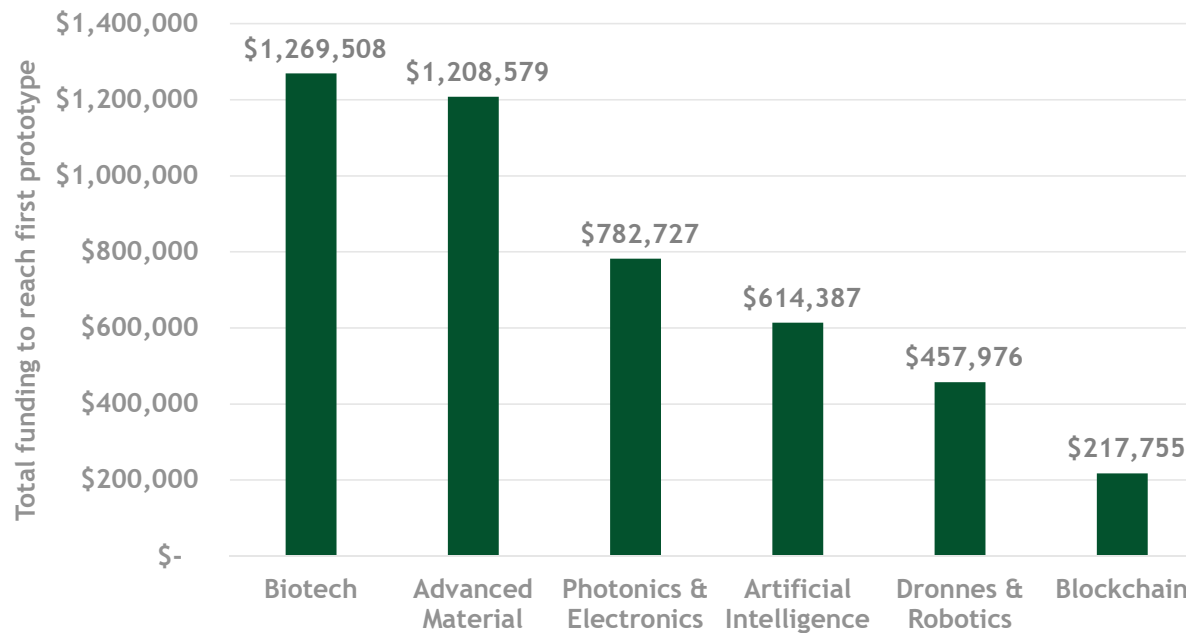
2017
TEST FLIGHT OF FULL-
SIZED PROTOTYPE

2019
FIRST MANNED
FLIGHT

2025
YOU CAN BOOK A
LILIUM JET

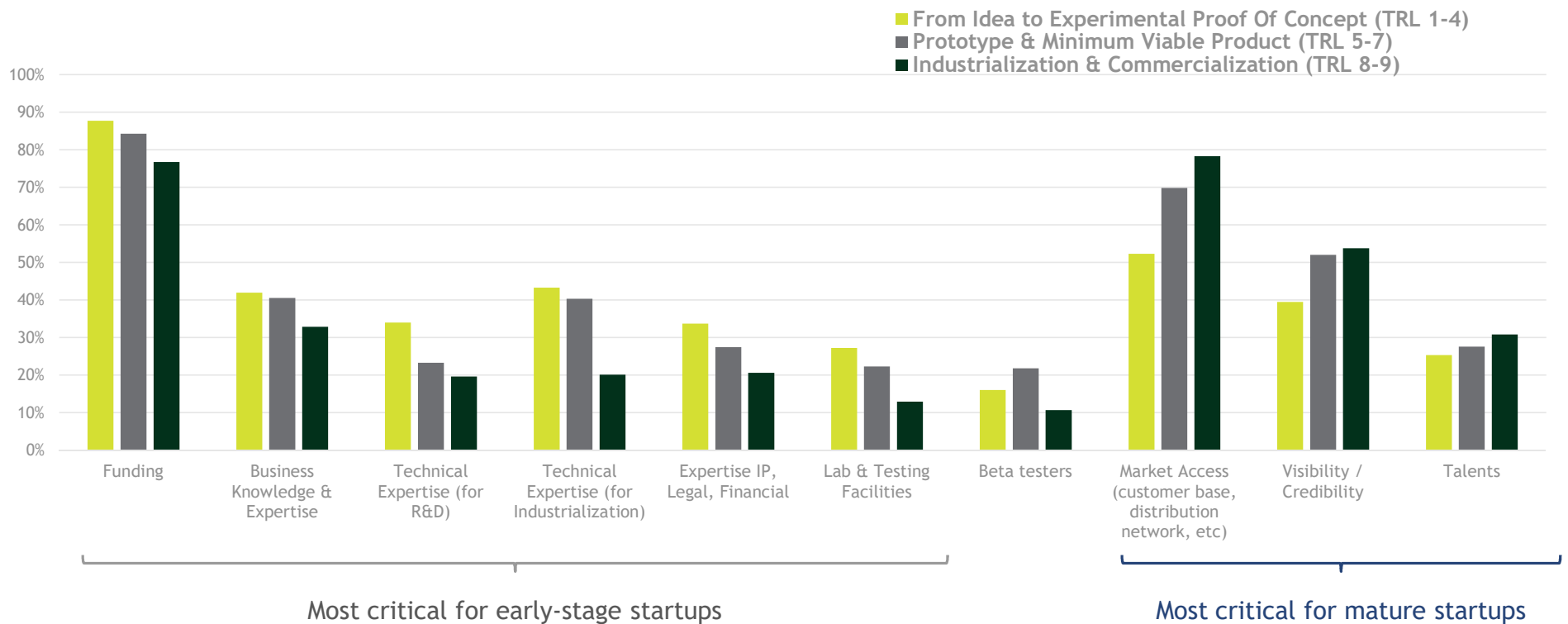


Deep Tech "Investment": The Average Total Funding (Equity and Non-Equity) Required To Build the First Prototype (TRL 5) Varies by Technology



Note: TRL 5 = technology readiness level 5 on NASA-originated scale of 1 to 9. At TRL 5, the technology has been validated in a simulated or real-world environment.
Source: 1,500 startups (500 best startups from the Hello Tomorrow Challenge in 2016, 2017, and 2018), Hello Tomorrow analysis

Deep Tech Startups' Most-Needed Resources Evolve with the Company's Maturity



TRL= technology readiness on NASA-originated scale of 1 to 9.

Source: 1,646 deep tech startups qualified for the second round of the Hello Tomorrow Challenge in 2018 (from 4,500 applications), Hello Tomorrow analysis

DISCOVERING DIAMONDS IN THE ROUGH

4

Hello Tomorrow Challenge winners

AND 21 BRILLIANT
FINALISTS FROM OUR
PREVIOUS EDITIONS WHO
HAVE ALREADY RAISED OVER

\$240M



GTX Medical

2014 - Switzerland

GTX Medical develops implants for the spinal chord which enable paraplegic people to walk again.

Met their CEO at the Summit, who raised \$36m for GTX two years after the event.

MIT Tech Review 10
Breakthrough Technologies
2017



Biocarbon Engineering

2015 - United Kingdom

Biocarbon Engineering uses drones to plant billions of trees for mass reforestation.

Met the CEO of Parrot at the Summit who is today their most important industrial partner.

Featured at the 2017
World Economic Forum



Lilium Aviation

2016 - Germany

Lilium Aviation is on track to make their electric flying taxi a reality by 2025.

Winning the Challenge helped them gain worldwide credibility.

Raised \$10m after the event, and \$90m two years later.



Saathi

2017 - India

Saathi makes biodegradable sanitary pads from banana fibre, aiming to help billions of women across the globe.

Gained global exposure, attracting potential industrial partners.

Named in Forbes 30 under 30
Asia in Healthcare.



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