Global Insights | Analytical Insights

Mapping Innovation

Innovation is everywhere. We compare the size, growth and areas of opportunities.

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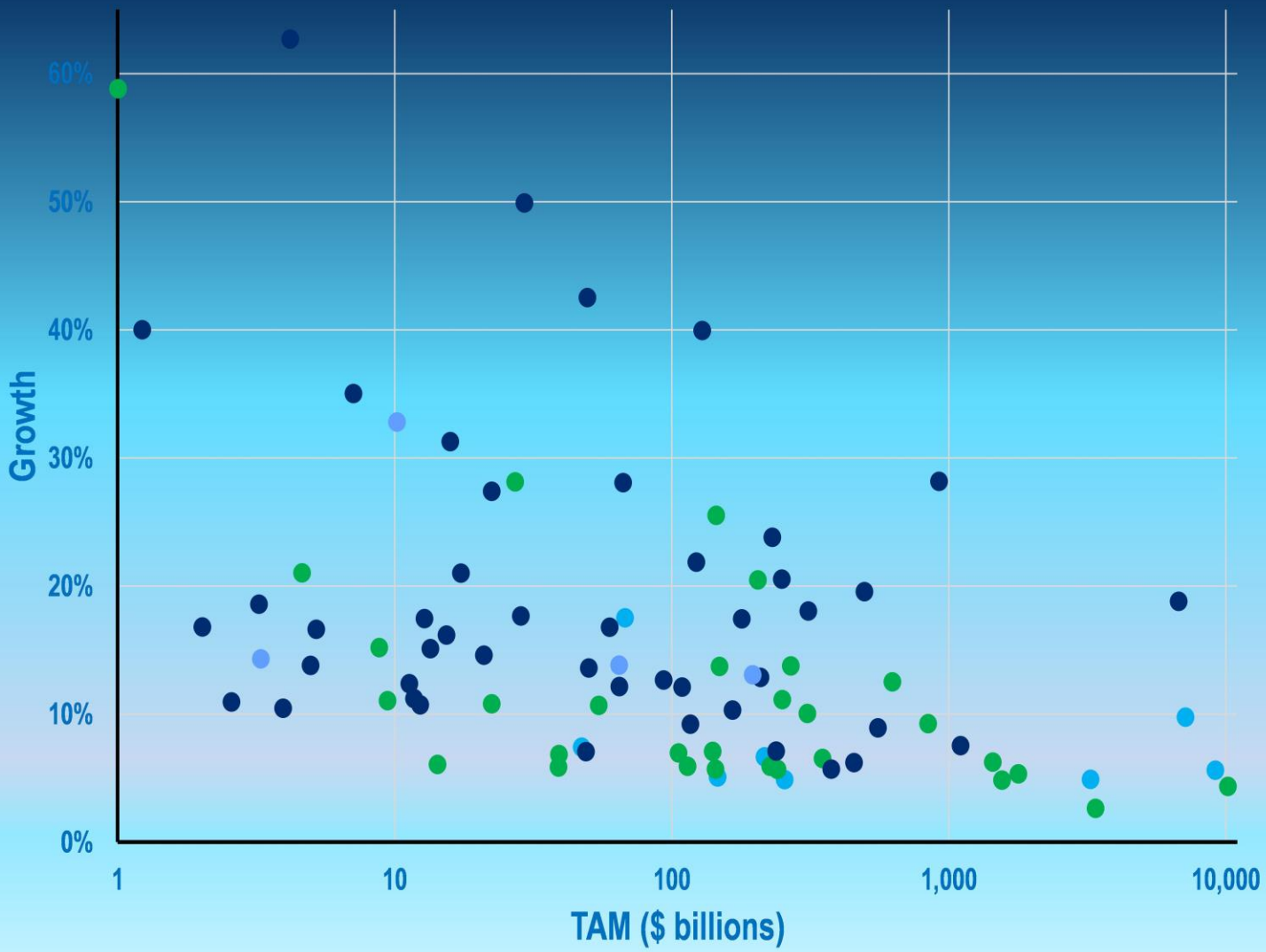

Executive Summary

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This unique report compares the size of opportunities across innovations. We have mapped 100 themes, showing third-party estimates of their size and growth. The biggest themes belong to big macro-related ideas whereas the smallest ones are nascent technologies. Many smaller innovation-driven themes are growing in the mid-teens. However there are a handful of already-big areas that are forecast to grow even more rapidly: these are where the trillion-dollar market cap companies play. We also compare these estimates to where VCs are investing: there are interesting mismatches between the stock market performance of certain themes and the expected sales growth. Relative to public markets, private investment is hugely overweight software and services, whether in FinTech, health or B2B. This report gives what we think is a solid base of comparison that can help to identify areas of opportunity, the size of the markets and the growth profiles.

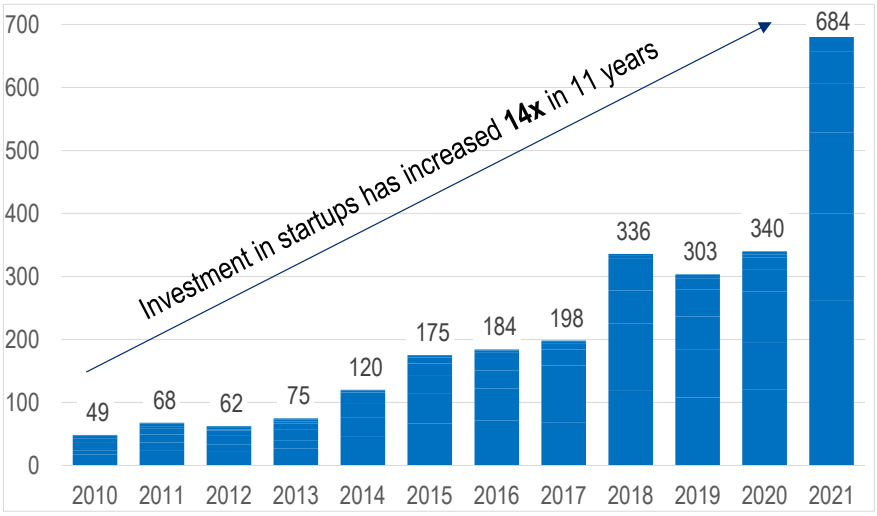
Contents

Top takeaways

- **Mapping Innovation –** This unique report compares the opportunities across innovations. We've mapped 100 areas – or themes as we call them -- showing estimates of their current size and likely growth, based on multiple third-party sources. We also compare these estimates to where VCs are investing. This report gives what we think is a solid base of comparison that can help to identify areas of opportunity, the size of the markets and the growth profiles.

- **There is a huge variation in the size of the TAMs[1]** – The biggest themes we examine tend to belong to big macro-related ideas – like the spend of aging populations – whereas the smallest ones are narrowly defined, nascent technologies like eSports. The TAMs (or potential sales) of the biggest themes we have chosen are more than 30,000x the size of the smallest ones.

Figure 1. Investment in Private Companies by VCs and Similar ($ billions)



Geography = Global. Includes Angel, Seed, and VC rounds.
Source: PitchBook Data Inc.

- **There is less correlation than expected between the expected percentage growth in the TAMs and their size** – Figure 10 shows many of the large macro-driven themes are growing in the single digits. But many smaller innovation-driven ones aren't growing much faster – most grow only in the high single digits or mid-teens. (For example, Waste-to-Energy is growing in mid-single digits only and Digital Leisure only in the mid-teens.) However there are a handful of already-big areas that are expected to grow very rapidly, including Mobile Payments, AI and Internet Business Models. These are areas where the trillion-dollar market cap companies play. The strongest growth is generally coming from innovations that rely on new business models rather than new technology – Architectural Innovations in the language of the Citi Innovation Cube. (Page 18 has a fuller explanation.)

[1] TAM: Total Addressable Market – the sales of all the companies operating in the area.

- **Despite the positive stories, many of the themes are struggling to grow –** Citi Research's Quant team have analyzed the performance of the publicly listed companies exposed to 61 of the themes. Figure 15 shows more than half had negative scores on the Quant team's *Composite Growth* metric[2], implying growing profit has proved hard despite the positive secular trends. (Software companies typically do best on this measure; non-digital themes worst.) Our Quant team also analyze the themes relative to macro factors. Given that bond yields are rising, we've included one chart (Figure 16) that shows which themes have seen valuations rise when bond yields increase, and which fall.

- **There are some interesting mismatches between the stock market performance of certain themes and the expected sales growth –** Figure 17 shows that certain themes – e.g., AI, Remote Working and Luxury – have higher market valuations than the estimates of their TAMs might suggest. Figure 18 shows that Novel Biothreats, Hydrogen and Contactless have seen larger 3-year returns than might be expected. On the other hand, EdTech, Mobile Payments and Experiential Commerce all appear to have underperformed.

- **VCs are investing most in Software and Architectural Innovations –** Figure 19 shows VCs have invested notably more in a handful of areas than the estimates of growth would suggest. Examples include Software and FinTech, AI and Ag/ FoodTech. Conversely they have been avoiding Luxury and Nanomedicine. Relative to the public market benchmark, private investment is hugely overweight software and services, whether in FinTech, health or B2B. (Figure 24.) Comparatively little investment is going into manufacturing. This is especially striking when you consider that software and services generally need less capital than either deep tech or manufacturing. VC funds, unlike public equity funds, are driven by a small minority of startups that return many tens or even hundreds of times the original investment, and this is much more likely to occur in highly scalable businesses, like software. Furthermore the typical enterprise software start-up trades on about 3x the sales multiple of a typical consumer goods startup, as Figure 25 shows. This means a consumer startup would have to grow about 3x as fast to achieve the same valuation.

[2] Calculated from the average of the six factors listed in Figure 14. Three of the six are related to earnings growth.

How do the opportunities from innovation compare?

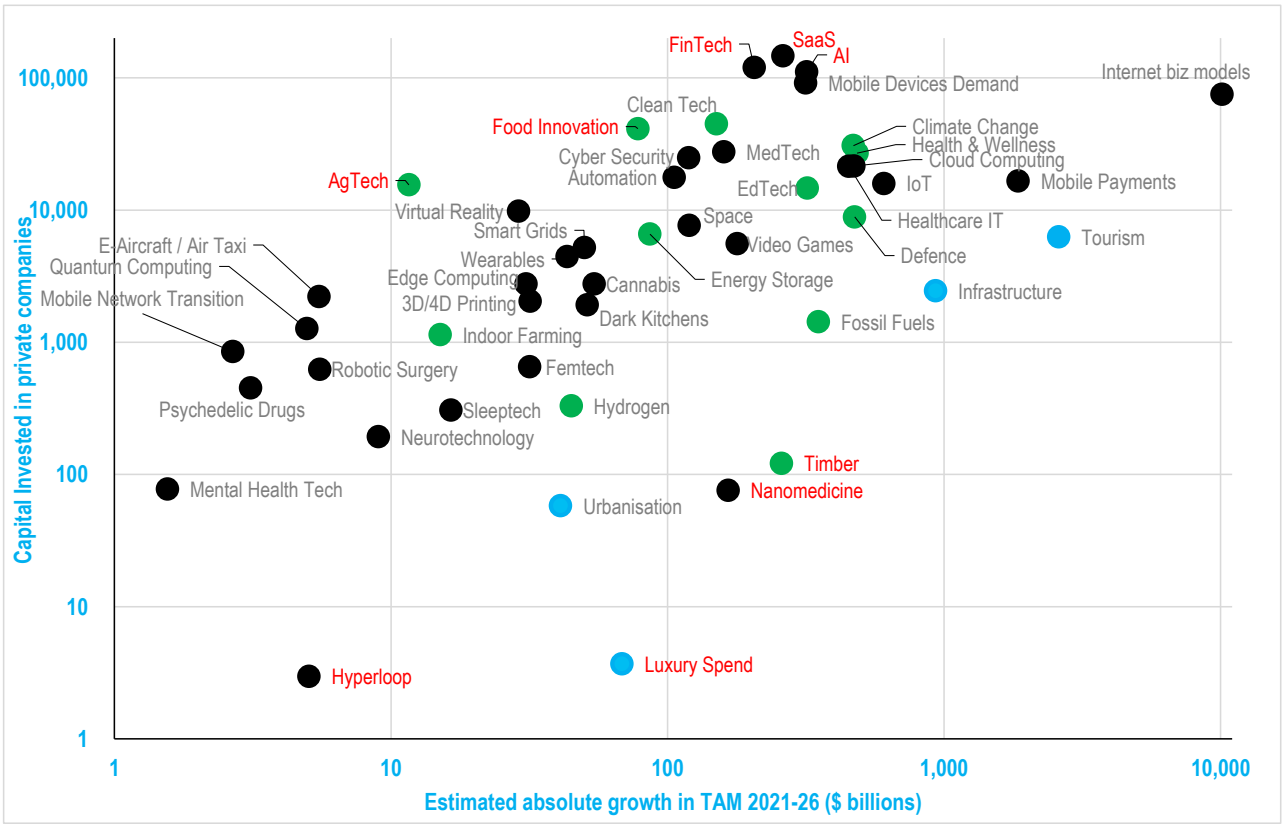
Investment in startups has been rocketing in the last decade, as Figure 1 shows, with disruptive innovations launched in everything from productivity software to artificial meat. But how do the opportunities compare? How, for example, does the opportunity in fuel cells compare to that in wearable tech?

These are BIG questions, and a single report like this can't possibly hope to provide all the answers. However we have *started* to map out the opportunities, by quantifying the outlook in 100 different areas, or themes as we call them. We have also looked at stock market performance in those areas. Of course there's no guarantee that the particular area you are interested in will appear on the lists – but mapping 100 themes and looking at other investments should help in considering the size of the opportunity, the projected growth rate and whether investors are already moving in.

Another way of judging where opportunities are being seen is simply following the money. In Figure 2 and from page 28 onward we show where VC firms are investing — and it's useful to see just how skewed their investments are toward certain areas like software, FinTech and AI, and toward companies with disruptive business models.

We have never seen any report quite like this one. We hope you find it both interesting and useful.

Figure 2. Capital Invested in Private Companies by Theme vs. Expected Growth in TAM



SaaS: Software as a Service. Blue dots = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4. Investments include Angel, Seed and VC rounds.
Source: PitchBook Data Inc. and the sources listed in Figure 6

Understanding themes

The core of this report is an analysis of the TAMs[3] of 100 themes – in other words the potential sales related to those themes.

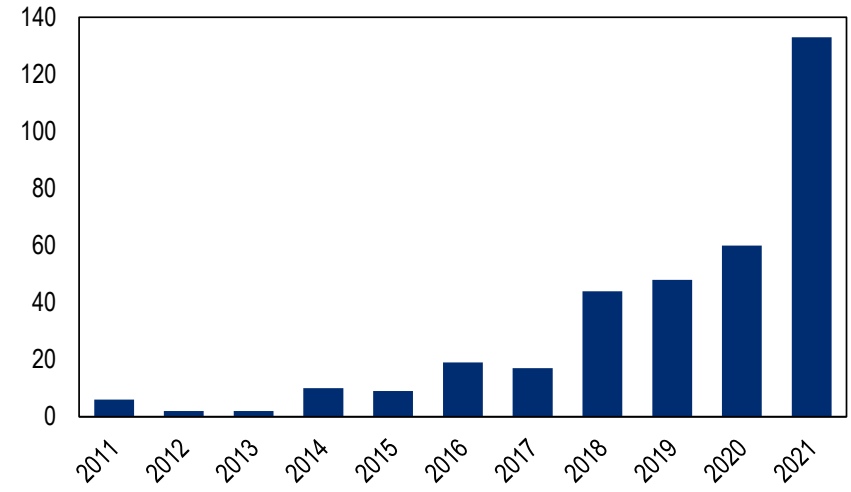
What is a theme?

The traditional way of thinking about and dividing up industries is by sector – where a sector relates to a certain type of activity – for example banks or software companies. For investors, themes are rather more subtle: they are secular trends that can help companies from many sectors.

If the Hydrogen theme does well, for example, this could help utilities generating green hydrogen; transport companies specialized in shipping it; real estate companies focused on hydrogen stations that allow cars and trucks to fill up; automakers that sell hydrogen cars; and suppliers that make the fuel cells and hydrogen tanks that would makes the cars work.

Investors in the public markets are increasingly focusing on themes. Last year the number of theme-based ETFs more than doubled to 133, as Figure 3 shows.

Figure 3. Annual Thematic ETF Launches



Source: Bloomberg and Citi Research

How we have chosen the themes

We have chosen the themes – in other words the opportunities we look at – in the most objective way we could, leveraging a decade's worth of analyses from Citi Research. The final selection is listed in Figure 4. Of the 100 themes, 70% come from a Citi Research product called the **Global Theme Machine**, or GTM, and most of the rest come from the **Citi GPS Disruptive Innovations** series.

[3] TAM: Total Addressable Market

About two-thirds are types of technical innovation (mainly colored black in Figure 4), but 40% also relate to sustainability themes (green in Figure 4), and 11% to growth/ prosperity (blue). This adds up to more than 100% because some of the innovation themes are also classified as related to sustainability and society, and are shown as green in Figure 4.

Figure 4. Themes

Category		Theme	Source
Growth & Prosperity	1	Aging Demo Spend	GTM
	2	Belt & Road	GTM
	3	EM Consumer	GTM
	4	Global Trade	GTM
	5	Infrastructure	GTM
	6	Luxury Spend	GTM
	7	Medical Tourism	DI
	8	Services Offshoring	GTM
	9	Tourism	GTM
	10	Urbanisation	GTM
	11	US Construction	GTM
Sustainability & Society	12	Agriculture Demand	GTM
	13	AgTech	GTM
	14	Alt Proteins	DI
	15	Biofuels	GTM
	16	Carbon Markets	DI
	17	Clean Tech	GTM
	18	Clean Water	GTM
	19	Climate Change	GTM
	20	Defence	GTM
	21	De-Polymerizing Plastics	DI
	22	E cigarettes	DI
	23	EdTech	GTM
	24	Energy Efficiency	GTM
	25	Energy Storage	GTM
	26	Food Innovation	GTM
	27	Fossil Fuels	GTM
	28	Fuel Cells	GTM
	29	Health & Wellness	GTM
	30	Hydro Energy	GTM
	31	Hydrogen	GTM
	32	Indoor Farming	DI
	33	Light-Weighting of Cars	DI
	34	Net Zero	GTM
Sustainability & Society	35	Novel Biothreats	GTM
	36	Obesity	GTM
	37	Sharing Economy	GTM
	38	Solar Energy	GTM
	39	Sustainable Materials	GTM
	40	Timber	GTM
	41	Waste-to-Energy	DI
	42	Wind	GTM
Technology & Innovation	43	3D/4D Printing	GTM
	44	5G Network	GTM
	45	AI	GTM
	46	Auto Electronics	GTM
	47	Automation	GTM
	48	Cannabis	DI
	49	Cloud Computing	GTM
	50	Contactless	GTM
	51	Cyber Security	GTM
	52	Dark Kitchens	DI
	53	Data Storage	GTM
	54	Deepwater	GTM
	55	Digital Identity	DI
	56	Digital Leisure	GTM
	57	DNA/Genetic	GTM
	58	E Vehicles	GTM
	59	E-Aircraft / Air Taxi	DI
	60	Edge Computing	DI
	61	Elder Care	DI
	62	eSports	DI
	63	Experiential Commerce	GTM
	64	Femtech	DI
	65	FinTech	GTM
	66	Generics & Biosimilars	GTM
	67	Healthcare IT	GTM
	68	Hyperloop	DI
	69	Immunotherapy	GTM
	70	Internet biz models	GTM
	71	IoT	GTM
	72	IP	GTM
	73	IT Services	GTM
	74	Last mile delivery	DI
	75	Liquid Biopsy	DI
	76	MedTech	GTM
	77	Mental Health Tech	DI
	78	Metaverse	GTM
	79	Mining Capex	GTM
	80	Mobile Devices Demand	GTM
	81	Mobile Network Transition	GTM
	82	Mobile Payments	GTM
	83	mRNA	DI
	84	Nanomedicine	DI
	85	Neurotechnology	DI
	86	NFTs	DI
	87	OnDemand Media	GTM
	88	Psychedelic Drugs	DI
	89	Quantum Computing	DI
	90	Remote Working	GTM
	91	Robotic Surgery	DI
	92	SaaS	GTM
	93	Sleeptech	DI
	94	Smart Grids	GTM
	95	Space	GTM
	96	Telemedicine	DI
	97	Video Games	GTM
	98	Virtual Reality	GTM
	99	Voice-activated systems	DI
	100	Wearables	GTM
		Total GTM	**70**
		Total DI	**30**

GTM: Global Theme Machine. DI: Citi GPS Disruptive Innovation series. GPS: Other Citi GPS reports. Add: Additional.
We provide definitions of each of the themes in Figure 29 in the Appendix, on page 42.

Source: Citi Global Insights

The base list comes from the Global Theme Machine

We started with all the themes in the Global Theme Machine because they have been chosen in a rigorous process, involving Citi Research sector heads, strategists and quantitative analysts. The team chose the first set of themes in 2012. Since then they have re-examined them each year, to ensure the list remains fresh, adding a handful most years, merging and renaming others, and occasionally deleting some (e.g. shale.) There has, however, been surprising little turnover.

There are 90 themes in the Global Theme Machine, but several are not suitable for our mapping as they focus on investment characteristics that are impossible to find a TAM for – for example "companies with major buyback programs" or "companies with large pension deficits." In total we found 70 themes from the Global Theme Machine where we also found useful third party estimates for TAMs.

The list is supplemented with themes from Citi's GPS Disruptive Innovations series

We look beyond the GTM because it is designed for investors in public markets, and as a result one of the criteria for choosing the themes is that there must be around 20 publically listed companies that offer exposure to the theme. This means that many potentially interesting themes – for example quantum computing – aren't listed in the GTM.

The Disruptive Innovation series of reports fills this gap perfectly. The series stretches back to 2013, and each report lists 10 carefully chosen early-stage innovations that the GPS authors believe may shake up established products markets. We have therefore supplemented our list with 30 themes we think are most relevant from the Disruptive Innovation series. Finally we have added a handful from other GPS reports, and elsewhere.

What is the Global Theme Machine?

The Global Theme Machine is a unique Citi Research product that combines the insights from Citi Research's fundamental analysts around the globe with a rigorous quantitative analytical framework to evaluate the relative attractiveness of themes on a number of financial metrics. We are not aware of any other product quite like it.

The themes have been matched to more than 5,000 listed companies

A committee of senior Citi Research staff use a systematic process to choose the themes, which must fit the criteria shown in Figure 5. Then Citi Research fundamental analysts match more than 5,000 public companies to the themes each year, saying whether the exposure was low, medium or high.[4]

This allows portfolio construction and analysis

Citi Research's Quant team have then created portfolios for each theme, with stocks weighted proportionally to their exposure to the theme, and the portfolios rebalanced monthly to maintain a correct weighting[5].

Finally the Quant team have kept track of the relative performance, and analysed them, asking questions like:

- Which themes are currently outperforming?
- Are the outperforming themes' relative valuations stretched?
- Is their earnings momentum moving up or down?
- How do themes rate on quality, growth or risk scores?

[4] High exposure is typically more than 50% revenue; low exposure is typically less than 10%.

[5] We believe this creates better balanced portfolios than most ETFs achieve, because most are market-cap weighted.

A Genuine Machine

The name *Global Theme Machine* is appropriate, we believe, because it examines almost 90 themes, cross referenced to more than 5,000 companies from all equity markets. Citi Research's Quant Team construct portfolios to reflect the themes, and calculates their attractiveness according to six different investment styles – Valuation, Growth, Risk, Quality, Price Momentum and Estimate Momentum – each based on a series of objective criteria. The team also calculate their exposure to ten different macro factors – like currency and bond movements. It would, we believe, be impossible to create a similar product by hand.

Figure 5. Criteria for Themes in the Global Theme Machine

Source: Citi Research

How big is the market for each theme?

After finalizing our list of 100 themes, we then sought estimates for global TAMs using just over 100 third party sources, as set out in Figure 6. For most themes we looked at several sources – up to nine in the case of Cloud Computing – but in a handful we have been able to find only one source. We have not used Citi estimates anywhere.

Figure 7 shows the average estimate for each of the TAMs, for 2021.

What is immediately apparent is the huge variation in the numbers: It shows that Emerging Market Consumer spending was about $23 trillion in 2021, whereas Quantum Computing had sales of $0.7 billion –- more than 30,000 times smaller.

Figure 6. Sources for data on TAMs

360 Research Report	Help Netsecurity	Persistence Market Research
Absolute Reports	Hosting Tribunal	Power Technology
Acumen Research and Consulting	Humanities & Social Sciences Communications	Precendence Research
Adroit Market Research	IDC	Psychedelic Spotlight
All The Research	imarc	PwC
Allied Market Research	Industry ARC	Quartz
American Enterprise Institute	Industry Europe	Quince Market Insights
Baker McKenzie	Infrastructure Outlook	Ranking The Brands
BCC Research	Insights Intelligence	Reports and Data
BioSpace	Institute for Mergers, Acqusitions & Alliances	Research and Markets
Bloomberg	Institute of International Finance	Research Dive
Brand Essence Research	International Energy Agency	Research Nester
Brookings	KBV Research	Restaurant Dive
CCS Insight	Knowledge Sourcing Intelligence	Reuters
Climate Policy Initiative	Market Data Forecast	S&P Global Market Intelligence
Data Bridge	Market Insight Solutions	Statista
Data Library Research	Market Reports World	STL Partners
Emergen Research	Market Research Future	Stockholm International Peace Research Institute
Esti Cast Research	Market Study Report	Stratview Research
European Commission	Market Watch	Swiss Re
Expert Market Research	Markets and Markets	Technavio
Facts & Factors	MarTechCube	The Brainy Insights
Femtech Analytics	Marticulous Research	The Business Research Company
Financial Times	McKinsey	The Geneva Association
Food and Agriculture Org'n (UN)	Medgadget	Transparency Market Research
Food Navigator	Million Insights	tvtechnology
Forbes	Mordor Intelligence	UK Parliament
Forrestor	National Retail Feferation	Valuates Reports
Fortune Business Insights	Nature	Verified Market Research
FurtureWise	NeuralTech Reports	Vision Research Reports
Future Market Insights	NeuroTech Business Report	World Code School
Gartner	Next Big Future	World Resources Institute
Global Industry Analysts	Oberlo	Zion Market Research
Global Market Insights	OECD	
Grand View Research		n=103

Source: Citi Global Insights

Figure 7. Sales in 2021 by Theme

Theme	2021 TAM ($ blns)	Theme	2021 TAM ($ blns)	Theme	2021 TAM ($ blns)
EM Consumer	23,000	EdTech	200	E cigarettes	27
Agriculture Demand	10,000	Video Games	200	NFTs	27
Aging Demo Spend	9,200	SaaS	180	Indoor Farming	22
Tourism	7,200	Cyber Security	170	Cannabis	22
Internet biz models	6,800	Solar Energy	150	Digital Identity	21
Climate Change	3,400	Urbanisation	150	Generics & Biosimilars	19
Infrastructure	3,300	Energy Storage	150	3D/4D Printing	17
Defence	1,800	Hydrogen	140	Virtual Reality	16
Health & Wellness	1,600	Biofuels	140	Sleeptech	15
Fossil Fuels	1,400	AI	130	Novel Biothreats	14
US Construction	1,300	FinTech	120	Digital Leisure	13
Elder Care	1,100	Automation	120	Voice-activated systems	13
IT Services	990	Light-Weighting of Cars	110	DNA/Genetic	12
Mobile Payments	920	Immunotherapy	110	Contactless	12
Net Zero	840	Wind	110	Neurotechnology	11
Energy Efficiency	630	Mining Capex	100	Experiential Commerce	10
Mobile Devices Demand	560	Last mile delivery	94	Alt Proteins	9.4
IoT	500	Medical Tourism	68	Obesity	8.8
MedTech	460	Telemedicine	67	Edge Computing	7.1
Sharing Economy	380	Data Storage	66	Robotic Surgery	5.2
Space	380	OnDemand Media	65	IP	5.0
Clean Water	350	Wearables	65	Fuel Cells	4.6
Cloud Computing	310	Smart Grids	60	E-Aircraft / Air Taxi	4.2
Sustainable Materials	310	Belt & Road	56	Mobile Network Transitior	4.0
Timber	270	AgTech	55	Psychedelic Drugs	3.3
Luxury Spend	260	Dark Kitchens	50	Liquid Biopsy	3.2
Clean Tech	250	Metaverse	50	Mental Health Tech	2.6
Healthcare IT	250	Deepwater	49	Remote Working	2.0
Food Innovation	240	mRNA	48	eSports	1.3
Auto Electronics	240	Global Trade	47	Hyperloop	1.2
E Vehicles	230	De-Polymerizing Plastics	39	Carbon Markets	1.0
Hydro Energy	230	Waste-to-Energy	39	Quantum Computing	0.7
Services Offshoring	220	5G Network	29		
Nanomedicine	210	Femtech	29		

Blue = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4.
Source: The sources listed in Figure 6

Broad vs narrow themes

The biggest TAMs belong to very large, very well-established macro themes like Agricultural demand, Aging Demographic Spend and Global Tourism, which is why the blue- and green-colored themes are clustered toward the top of Figure 7. By contrast some of our themes are both highly-focused and nascent – for example Quantum Computers and Hyperloop.

This contrast occurs because the designers of Global Theme Machine chose, as a deliberate policy, some themes that are quite narrowly defined and some that are very broad. The GTM is really designed for investors in the publically quoted equity markets, and therefore the product identifies different types of exposure.

For example in the Sustainability Area, the GTM deliberately identifies Clean Tech which is a broad theme, but also Fuel Cells, Hydro Energy and Hydrogen for investors who want a narrower focus. It also flags Fossil Fuel, both for investors who want to sell it, and for those who believe the sector may outperform because the move away from stocks on the wrong side of ESG has gone too far.

Differing ways of measuring themes

Another reason for a big range of TAMs is that there is often ambiguity in how to measure a theme.

For many technologies, there are two ways of looking at the market size: (1) sales of the technology itself (for example the sales of robots); and (2) the sales of the products made with the technology (for example all products made with robots).

One good example is in Contactless. Figure 8 shows some of the TAMs we could have chosen for the theme. It shows that the TAM for contactless payments is about $1.7 trillion whereas the TAM for point of sale equipment is around $12 billion, more than 1,000 times smaller. Equally there is a major Citi Research report[6] that says the Contactless Economy is a $300 billion opportunity – but this figure refers to 2024 (and all the other TAMs are for 2021), and combines figures for the smart home, service robots and Augmented Reality as well as payment equipment. It might have been reasonable to choose any of these figures, but the TAM we have used for Contactless in Figure 7 is $12 billion.

We could have shown a similar table for Wind. It's worth noting, though, that for Wind the TAM estimate we have used includes the sales of electricity made with Wind (very roughly $110 billion) not the sale of wind equipment (about $7 billion).

[6] The US$300bn Contactless Economy: Who Benefits?

Figure 8. Possible Estimates of the TAM for Contactless ($ billions)

	2021	2024
Contactless Payments		
Grand View Research	1,700	
Allied Market Research	1,800	
Contactless POS equipment, incl cards etc		
Markets and Markets	12	
Research Dive	12	
Citi Research Estimate		**300**
~Augmented Reality		20
~Service Robots		84
~Smart Home		174
~Retail Automation		20

Source: GVR, AMR, M&M, RD, and Citi Research

In summary, therefore, it is important to realize that it is possible to describe the economic opportunity in many ways. This isn't a problem – but it does need to be kept in mind.

Overall, however, it's much more interesting when we look at growth of the themes as well as their size – and that's precisely what we do in the next chapter.

What about the growth?

Figure 9 shows the average 5-year growth rates for the TAMs, both in percentage and absolute dollar terms, as forecast by the same third parties listed in Figure 6.

Figure 9. Estimated Growth by Theme, 2021-26

Theme	CAGR (%)	($bln)	Theme	CAGR (%)	($bln)	Theme	CAGR (%)	($bln)
E-Aircraft / Air Taxi	63%	5.5	Smart Grids	17%	50	Net Zero	9%	469
Carbon Markets	59%	10	Robotic Surgery	17%	5.5	Automation	9%	106
Quantum Computing	51%	5.0	Sleeptech	16%	16	Mobile Devices Demand	9%	316
5G Network	50%	204	Obesity	15%	8.8	Elder Care	8%	521
Metaverse	43%	245	Digital Leisure	15%	14	Global Trade	7%	20
Hyperloop	40%	5.1	Digital Identity	15%	20	Auto Electronics	7%	97
AI	40%	319	Psychedelic Drugs	14%	3.1	Biofuels	7%	58
Edge Computing	35%	31	IP	14%	0.9	Deepwater	7%	20
Experiential Commerce	33%	32	Wearables	14%	43	Wind	7%	38
Virtual Reality	31%	29	Timber	14%	258	De-Polymerizing Plastics	7%	16
Mobile Payments	28%	1,856	Solar Energy	14%	109	Services Offshoring	7%	85
E cigarettes	28%	47	Dark Kitchens	14%	51	Clean Water	7%	125
Telemedicine	28%	198	Video Games	13%	179	Fossil Fuels	6%	351
Cannabis	27%	54	Nanomedicine	13%	166	MedTech	6%	160
Energy Storage	25%	86	Last mile delivery	13%	40	Novel Biothreats	6%	4.7
E Vehicles	24%	441	Energy Efficiency	12%	623	Light-Weighting of Cars	6%	47
FinTech	22%	206	Neurotechnology	12%	9.0	Hydro Energy	6%	75
Fuel Cells	21%	6.9	OnDemand Media	12%	52	Waste-to-Energy	6%	13
3D/4D Printing	21%	32	Immunotherapy	12%	79	Space	6%	120
Healthcare IT	21%	453	Contactless	11%	8.4	Hydrogen	6%	45
EdTech	20%	320	Clean Tech	11%	150	Food Innovation	6%	78
IoT	20%	606	Alt Proteins	11%	10	Aging Demo Spend	6%	2,876
Internet biz models	19%	10,136	Mental Health Tech	11%	1.6	Defence	5%	475
Liquid Biopsy	19%	4.0	Indoor Farming	11%	15	Urbanisation	5%	41
Cloud Computing	18%	473	DNA/Genetic	11%	8.3	Infrastructure	5%	932
Femtech	18%	32	AgTech	11%	12	Luxury Spend	5%	68
Medical Tourism	17%	79	Mobile Network Transition	10%	2.7	Health & Wellness	5%	485
Voice-activated systems	17%	13	Cyber Security	10%	119	Agriculture Demand	4%	2,406
SaaS	17%	262	Sustainable Materials	10%	189	Climate Change	3%	470
Remote Working	17%	2.4	Tourism	10%	2,598			

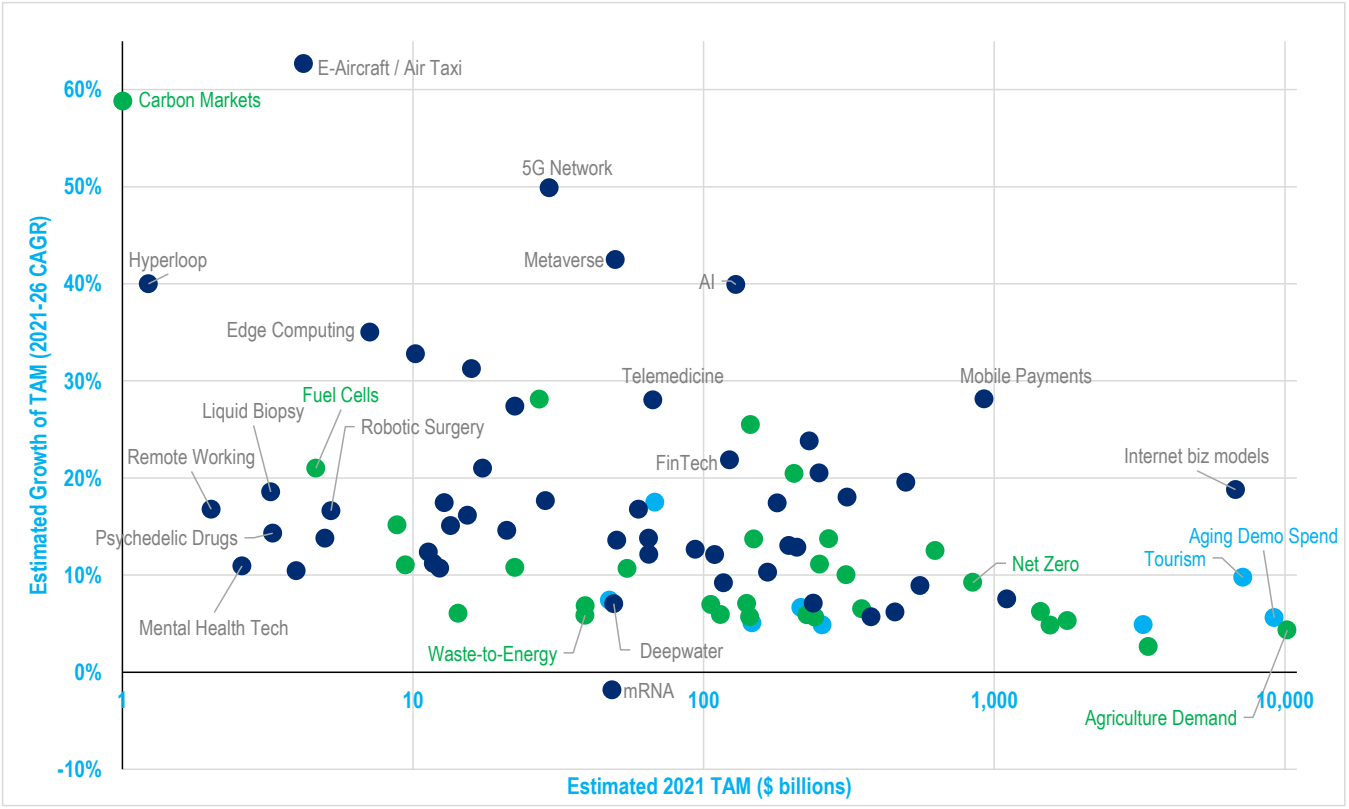
Blue = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4.
Source: The sources shown in Figure 6

As with the size of the TAMs, there is a wide range of expected growth rates – varying from 50-60% (compound) for some of the nascent industries – e.g. Quantum and E-aircraft and Air Taxis – to low single digits for some of the big macro themes. Perhaps it's no surprise that the big, macro driven themes in blue and green are at the bottom of the growth table.

However, when we plot the growth and size of the themes on the same chart – as we do in in Figure 10 – it turns out that the relationship is surprisingly quite weak.

- A large number of themes are projected to grow in the single digits -- this is true for several macro themes that are already very large (like Global Tourism and Net Zero) but also for many that are mid-size (like Deepwater technology and Waste-To-Energy plants).
- Many of the themes with small TAMs (those in the single-digit and double-digit billions) are projected to grow only in the teens: Examples include Robotic Surgery, (legal) Psychedelic Drugs, and Remote Working. Consistent growth above 30% is rare.
- By contrast there are a handful of already-big innovations that are expected to grow very rapidly in the next five years: 5G Networks, the Metaverse, AI, Mobile Payments and Internet Business Models. These are the areas where the trillion-dollar market cap companies already play.

Figure 10. Predicted growth for the themes (in %) vs current size

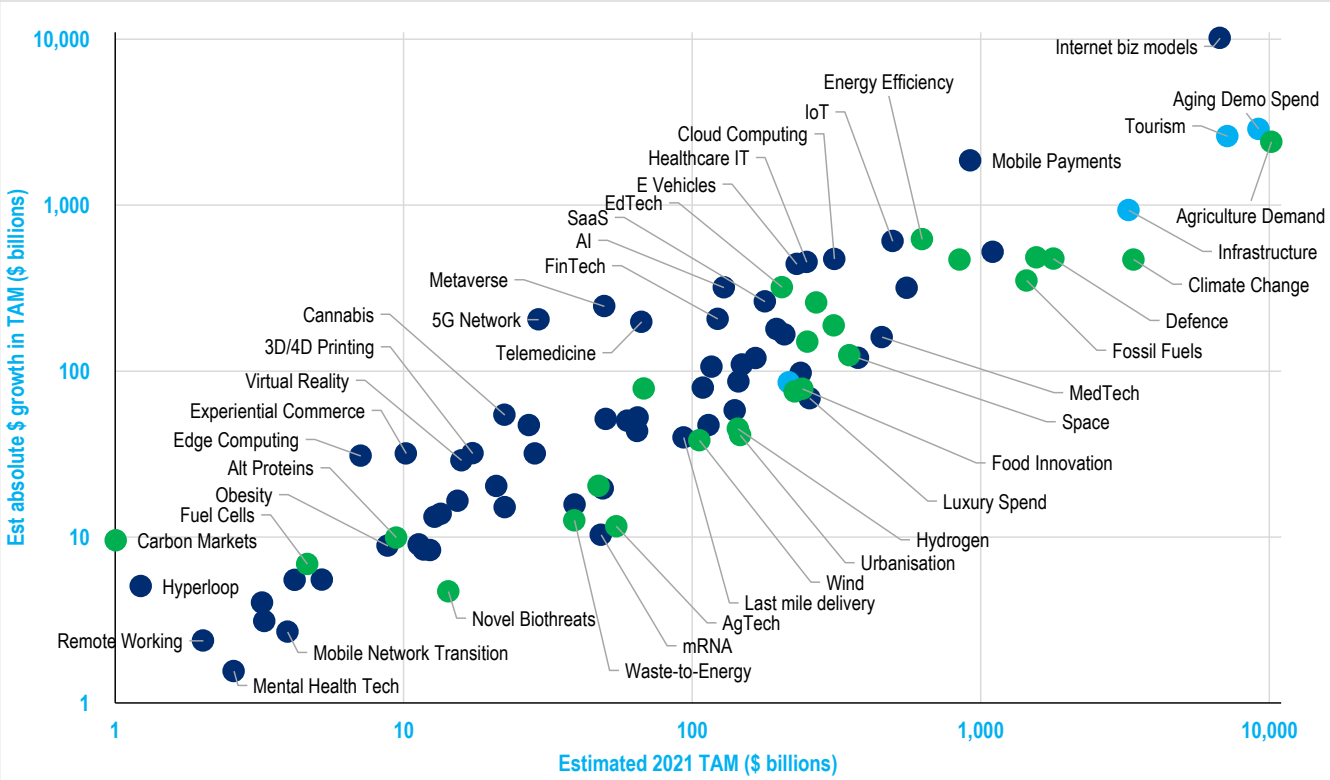


The labels on all the dots can be seen in Figure 30 and Figure 31 in the Appendix, on page 44. Blue dots = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4.

Source: The sources shown in Figure 6

Figure 11 shows the same data but in a different way: The y axis shows growth in absolute dollars not per cent. This chart emphasizes that in absolute dollars the biggest growth is expected to come from the already-big sectors – which means some of the macro themes like Aging Demographic Spend and Global Tourism.

Figure 11. Predicted growth for the themes in absolute dollars vs current size



Blue dots = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4 for more details.
Source: The sources shown in Figure 6.

We learned a lot by going through the process of finding multiple estimates for the TAMs of 100 themes. We came away quite sceptical about the likely accuracy of individual forecasts, but we also concluded there were important learnings from the pattern made by the group as a whole.

It is reasonable to question the precision of the individual TAMs . . .

It is easy to criticize the estimates for the individual TAMs and their growth, saying they are not 100% reliable.

- For many themes there are different ways of describing the economic opportunity (as we discussed earlier).
- Few growth forecasts are really done bottom up. This means that forecasts for future TAMs are critically dependent on (1) an accurate estimate of today's TAM, and (2) an accurate prediction of a percentage growth rate. Clearly this is exceptionally hard for yet-to-be-proven technologies.
- Few of the forecasts go out more than five years, which is hardly enough for some technologies to mature.

- Different forecasters seem more or less optimistic both on current market sizes and also on the growth rates.

We try to mitigate these points by using an average of forecasts wherever possible. Nonetheless we think it would be reasonable to question the precise forecast for any of the TAMs. As Daniel Kahneman points out in the book "NOISE: A Flaw in Human Judgement", it is inevitable there will be variability in these type of judgments, and this has important consequences for anyone trying to use them to value business opportunities.

. . . but the overall picture is still very useful

However we think that criticizing the precision of individual TAMs would miss the broader point entirely. The tables and charts on TAMs show several things that it would be hard to see so clearly in any other way.

In particular Figure 7, Figure 10 and Figure 11 provide good benchmarks for assessing TAMs. Whenever you hear a TAM (or indeed any other figure) mentioned, it is important to think "is this a large number? Is it small?" The tables and charts are sufficiently accurate to put these sorts of estimates into context.

They also show in broad terms what sort of themes are most important, in terms of current size and expected growth.

Growth and the Citi Innovation Cube

It's interesting to analyse the themes in the light of the Citi Innovation Cube[7]. This is a tool for analysing and categorizing innovations, depending on whether an innovation requires:

- Genuinely new technology;
- A new business model; and/ or
- A new ecosystem.

Where an innovation sits within the Cube often determines what it is likely to need in order to succeed, and how fast it is likely to scale.

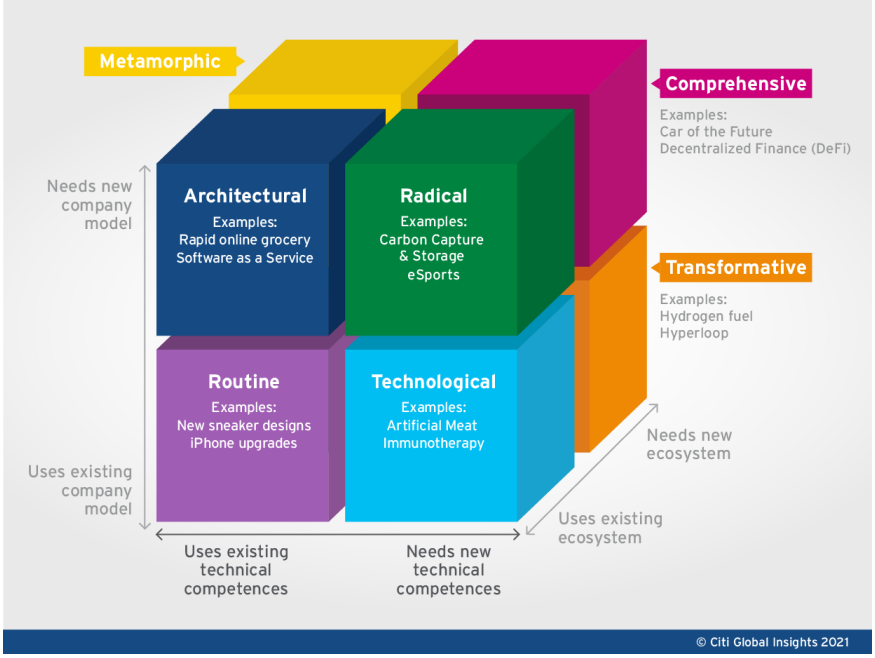
[7] For a detailed explanations, see The Citi Innovation Cube - A new tool for analyzing innovations.

Architectural Innovations – those that need a new business model but don't use genuinely new technology (like online grocery delivery) – tend to scale very rapidly, or "blitzscale" to use a term invented by Reid Hoffman and Chris Yeh. They wrote:

> When a market is up for grabs, the risk isn't inefficiency — the risk is playing it too safe. If you win, efficiency isn't that important; if you lose, efficiency is completely irrelevant. . . . Blitzscaling means that you're willing to sacrifice efficiency for speed, without waiting to achieve certainty on whether the sacrifice will pay off. If classic startup growth is about slowing your rate of descent as you try to assemble your plane, blitzscaling is about assembling that plane faster, then strapping on and igniting a set of jet engines (and possibly their afterburners) while you're still building the wings.[8]

By contrast innovations that require genuinely new technology – for example quantum computing – can only move at the pace at which they develop their technology. And innovations that require a new ecosystem – like hydrogen-fuelled transport – rely on a whole series of other innovations and businesses evolving together.

Figure 12. The Citi Innovation Cube



Source: Citi Global Insights

Many of the largest increases in dollar terms (shown in Figure 11) are indeed Architectural or Radical Innovations – in other words ones that are applying a new business model. Examples include Internet Business Models. Mobile Payments and Cloud Computing. As we will see later these are also the themes receiving the most investment from VC firms.

[8] https://www.strategy-business.com/article/The-Blitzscaling-Basics

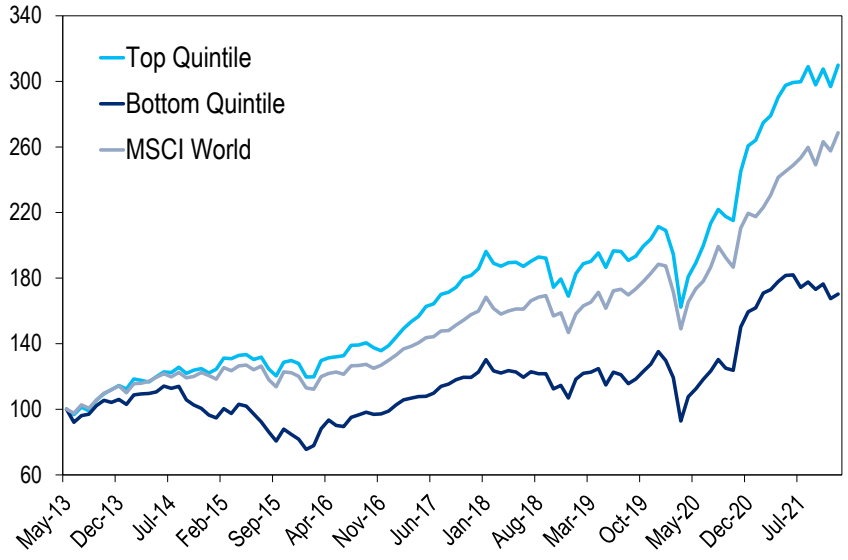
However it is also striking that many of the themes with the best projected growth in percentage terms – in other words those small themes at the top left of Figure 10 (like E-Aircraft/ Air Taxis) – are Technological Innovations. The third-party forecasters must be assuming that these technologies are about to achieve real breakthroughs, and they don't need new ecosystems[9].

Biggest opportunities ≠ best investments

It's important to say in passing that the biggest and fastest growing opportunities don't necessarily make the best investments. Of course returns depend on the size of the opportunity, but they also depend on the price of the investment – and this report makes no attempt to consider valuations or what specific skills and insights a particular investor might bring. It's possible that a skilled investor may generate much better returns by entering a small, low-growth area with a minimal outlay than by investing in a large, fast growing one that's also crowded.

That said, for investors in public equity markets, the Global Theme Machine has proven to be a genuinely useful tool. Since the GTM was created in 2013, back-testing shows that a portfolio containing the most attractive themes on a fundamental basis – as determined by Citi Research's Quant Team – would have consistently outperformed the global equity market, as the chart below shows.

Figure 13. Total Return of Most and Least Attractive Themes on Fundamental Measures



See Global Theme Machine - Imagination & Discipline: a Thematic lens to Markets for more details.

Source: Citi Research

[9] We think this point is particularly relevant for air taxis. Even if the technology arrives soon for air-taxis, we wonder whether the ecosystem will allow the industry to scale. Will the regulatory regime arrive quickly? Will the launch-and-landing pads become available? E-aircraft are different, however, as they can travel between existing airports, with minor modifications. It's worth repeating that all the forecasts in this report come from third parties, not Citi.

How are the themes with quoted companies doing?

As we've said, 70% of the themes that have been chosen here come from the Global Theme Machine. One of the advantages is that those themes have been linked to over 5,000 individual stocks, which means Citi Research's Quant team can analyze them in many different ways.

One of their measures is the *Composite Growth* score, which is designed to show how the themes are growing in practice. It is calculated using the six factors shown in Figure 14.

Figure 14. Factors in the Composite Growth Score

Sales growth – one year, historic
Earnings growth – one-year, historic
Earnings growth – one-year, prospective
Earnings growth – long term = 3 years backward + 2 years forward
Dividend growth – one-year, historic
S&P Growth-Value Score

The composite Growth score uses an equally weighted average of these six factors

Source: Citi Research Quant team

How the themes rank on the *Composite Growth* score

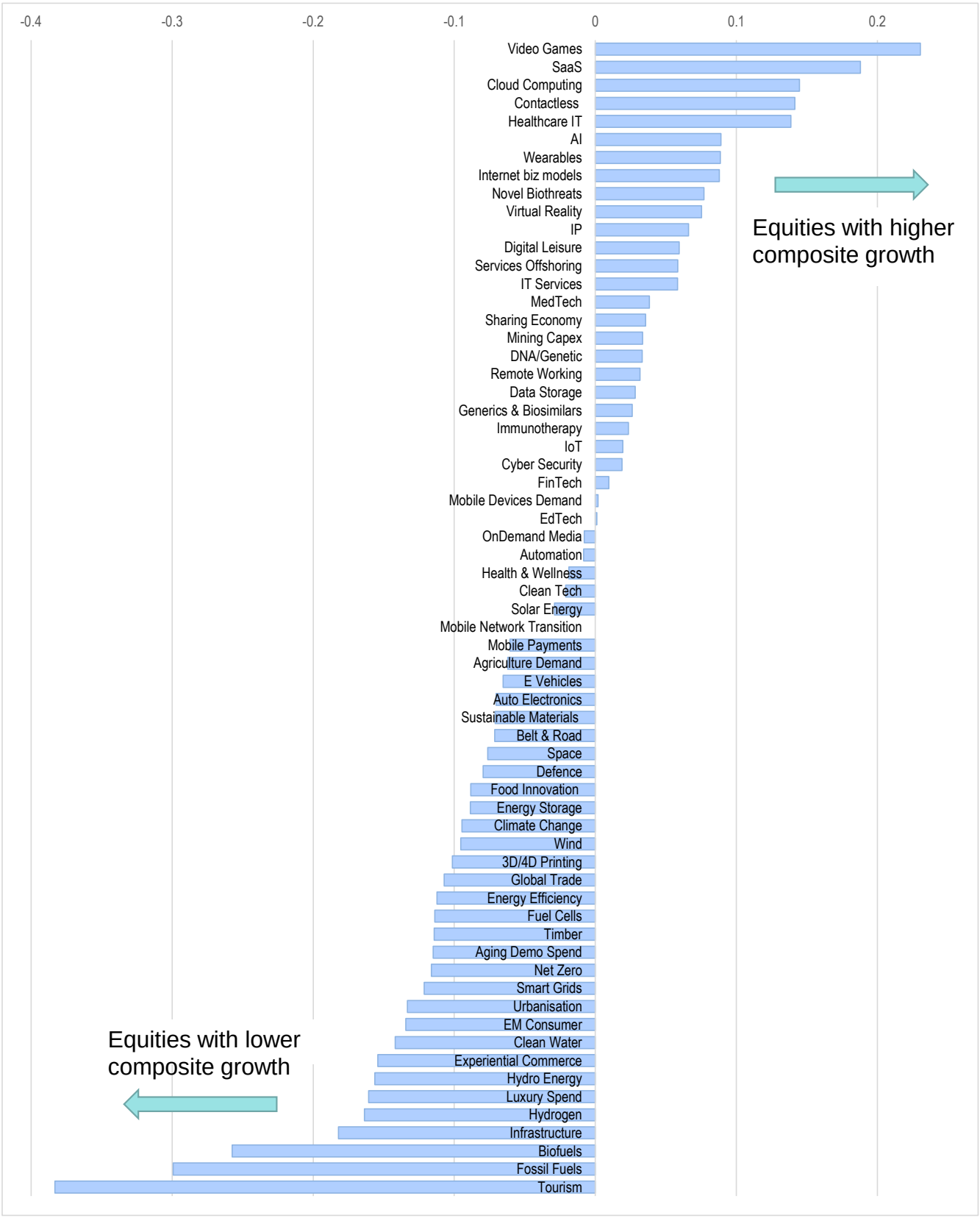
Figure 15 shows how the relevant themes actually rank on C*omposite Growth* score. Slightly over half ended up with negative *Composite Growth* scores, suggesting the day-to-day reality for quoted companies exposed to these themes has been less rosy than the stories of secular growth trends may suggest.

To be clear, this doesn't mean the growth in these sectors is negative on a long-term basis: it can mean that (1) short-term profit is falling – perhaps because of investment; or (2) they've suffered in the pandemic. The C*omposite Growth* score puts a greater weight on actual achieved growth (or lack of it) than on forward projections. It also focuses much more on profit than on sales.

Nonetheless the themes with better *Composite Growth* scores are definitely on a smoother runway.

- The best growth scores all come from digital and software related themes: Video Games, SaaS, Cloud Computing, Contactless. The top physical product is No7 in the list – Wearables.
- By contrast the worst performing themes are non-digital: Tourism, Fossil Fuels, Biofuels, Infrastructure, Hydrogen and Luxury.
- Many new economy themes have roughly zero composite growth scores or worse. Examples of roughly zero growth include FinTech, EdTech, Mobile Devices Demand and CleanTech. Examples of the negative composite growth scores for new economy areas include Biofuels, Hydrogen and Hydro Energy.

Figure 15. GTM themes ranked by Composite Growth score



Source: Citi Research

Sensitivity to rising interest rates

The Quant team also analyze the portfolios in terms of their sensitivity to various macro factors. One example is the sensitivity of the share prices to changes in U.S. 10-year Treasury yields. Interest rates are rising currently, so we show this in Figure 16.

The effect of higher yields on valuation is somewhat complicated as they generate opposing forces:

- On the one hand they are associated with faster economic growth, which should boost valuations, depending on the extent to which higher GDP is likely to boost the profits in a particular area.
- But on the other hand they imply higher discount rates, which reduces valuations, partly depending on the expected shape of cash flows in the future for each sector.

Of course an investor might argue that in a particular area – say wind or virtual reality – rising long-term interest rates do NOT affect the ultimate sales potential. But if higher interest rates mean lower valuations these sectors *are* becoming less economically attractive.

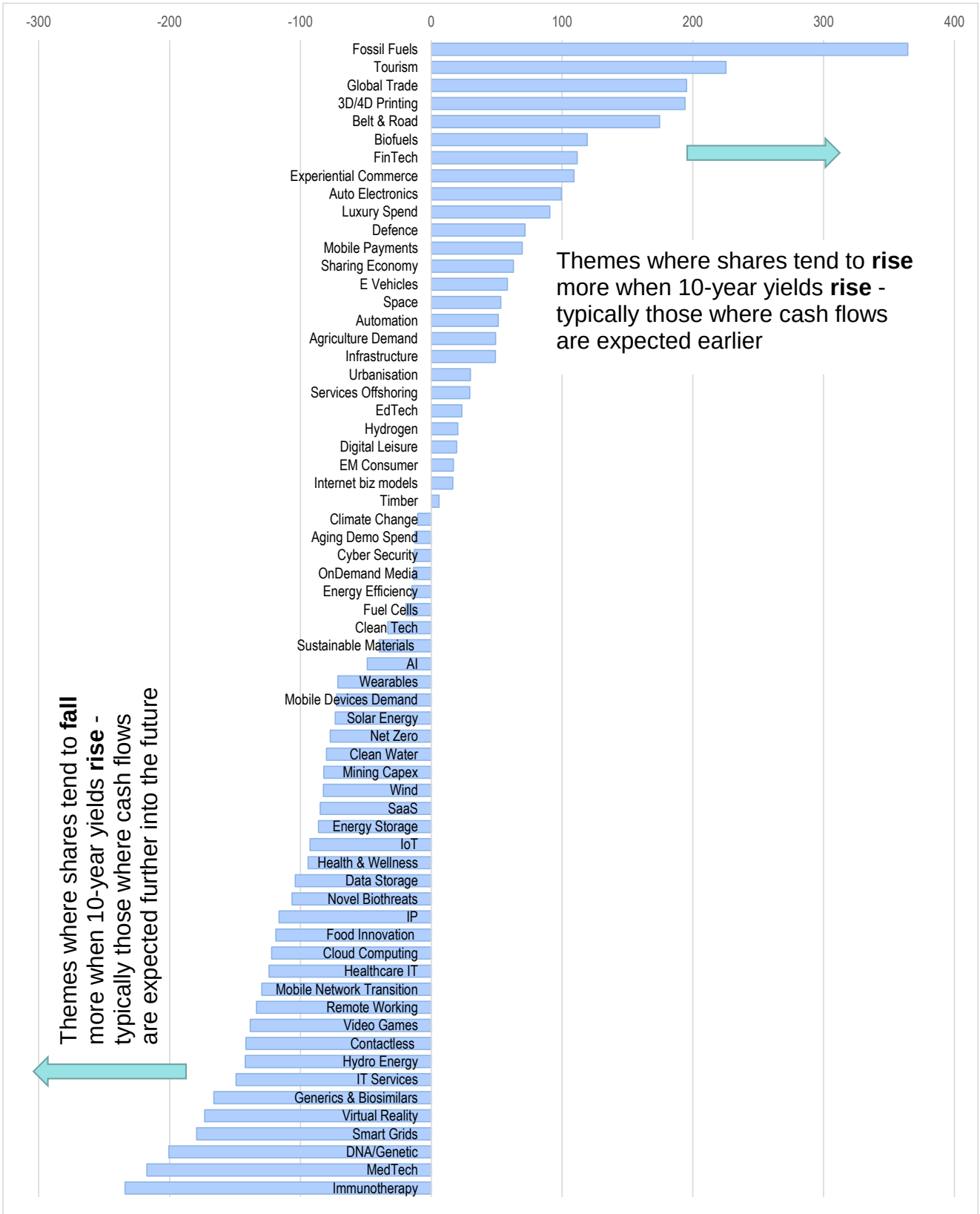
The same point can be made in a less academic way: if higher Treasury yields are driving down valuations in a particular area, IPO valuations are likely to fall – possibly so that the IPO window closes and private investors can't exit.

Observations on the interest rate sensitivities

There's a clear pattern in Figure 16. When 10-year yields rise:

- Valuations of more established industries – like Fossil Fuels and Tourism – tend to rise. Rising yields are associated with greater confidence about the economy, and these industries are (supposed to be) profitable in the here-and-now.
- Meanwhile pharma related ones and some of the software and future related themes tend to fall.
- Again, there is a group of themes in the middle, roughly similar to the ones in the middle of Figure 15, including EdTech, Mobile Devices Demand and CleanTech.

Figure 16. GTM themes ranked by sensitivity to rises in 10-year Treasury yields



Source: Citi Research

Stock market performance vs. size and growth of TAMs

The quant analysis of the GTM themes also allows us to compare third-party estimates of their TAMs and growth with their stock market performance.

- **Market value vs. TAM.** Figure 17 shows the relationship between the stock market values of the themes and the size of their TAMs in 2026 (as estimated by the third party providers listed in Figure 6).
- **Share price rises vs. forecast growth.** Figure 18 shows the relationship between the increase in share prices and the estimated growth in the TAMs.

In both charts one would tend to expect a fairly linear relationship – when the economic opportunity is larger, one would expect larger market caps. The interesting points on the charts are therefore the anomalies.

Of course there could be several explanations for them:

- The data could be presenting a fair picture of the economic reality, and the anomalies in Figure 17 and Figure 18 simply show mismatches between the expectations in the stock market and the third party estimates.
  - The stock market may be mispricing assets, thereby creating investment opportunities. Figure 17 raises the question of whether the valuations of equities related to Tourism and 3D Printing, for example, are simply too low currently, relative to their potential, thereby creating investment opportunities. Equally Figure 17 raises the question of whether the market is over-valuing assets related to Remote Working, relative to the forecasts made by third parties.
  - The stock market may be “right”, in which case the third party estimates would be misleading, implying it would be a mistake to rely on them. It could be that the outlook for Tourism now is permanently worse than it was when the third party estimates were made, and for Remote Working it’s better.
- But there are various ways in which the data could be comparing apples and oranges.
  - The themes may be dominated by private businesses, not large publicly quoted companies. Tourism is an obvious example – it’s a huge industry, which is why it appears on the right of Figure 17 but it’s dominated by smaller, non-quoted companies.
  - The theme may be dominated by publicly quoted companies, but many of the relevant companies may get less than 50% of their sales from the theme, in which case their market cap wouldn’t contribute to Figure 17, because it shows only the market cap of High Exposure companies.

Market values vs TAMs

Figure 17 below shows the market caps of all the stocks with high exposure to the relevant themes, plotted against the estimated TAMs in 2026.

Figure 17. TAMs vs the Market Cap of Stocks with High Exposure to the Theme

High exposure companies are those that get more than 50% of their revenue from a particular theme. Data as of Jan 20, 2022.
Blue dots = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4.

Source: The sources listed in Figure 6

Observations

There are a group of sectors that seem to have a disproportionately high market cap relative to their TAMs, including Mobile Network Transformation; Digital Leisure; Novel Biothreats; Luxury and AI. This suggests the stock market investors are more bullish for these themes than the third parties listed in Figure 6.

Equally some sectors seem to be under-represented in the stock market – e.g. 3D printing, Heatlhcare IT, TImber and Tourism. This could mean stock market investors are being more conservative about the outlook in these sectors than third parties, potentially implying investment opportunities.

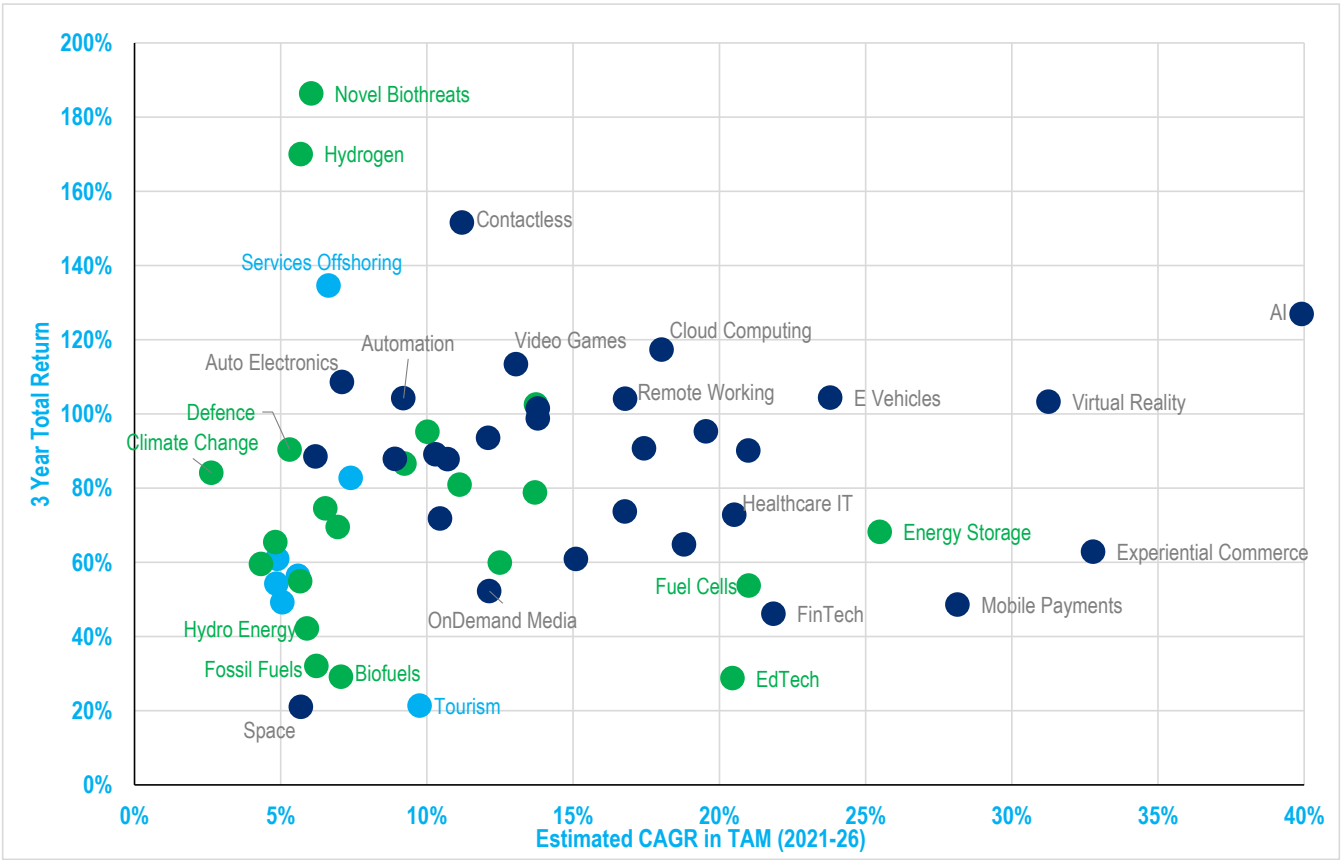
Share price rises vs forecast growth

In Figure 18 we show total return for the various sectors in the GTM over the 3 years from January 2019 to December 2021, relative to the estimated growth in TAMs. We find this particularly interesting because there is no real pattern in it.

Rather it shows that most themes returned about 50% to 90% in the stock market in the period, but some did significantly better or worse – without any relationship with the third party estimates.

This may be because the trend toward growth assets in the stock market was so powerful during the period that it ended up being rather indiscriminate. If this is right, a clearer relationship may evolve over time.

Figure 18. 3-Year Total Return by Theme, vs Est TAM growth rate



3-year return of high exposure companies, Jan 2019 to Dec 2021.
Blue dots = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4.
Source: The sources shown in Figure 6

Outperformers

The best performing theme in the chart is Novel Biothreats, an obvious beneficiary of the pandemic. However another beneficiary – EdTech – is amongst the losers, and HealthCare IT is in the middle of the pack.

A certain number of themes related to digital areas also have done well, for example Contactless, Cloud, and Video Games.

And the several themes related to the Car of the Future - for example Hydrogen, Auto Electronics and EV vehicles – have done well, even though the Hydrogen and Fuel Cell themes had negative *Composite Growth* scores in Figure 15 and the prospect for about autonomous vehicles became more distant in the period.

Underperformers

For us, the most interesting part of Figure 18 are the themes in the bottom right – including EdTech, Mobile Payments, Experiential Commerce, and also FinTech[10] and Energy Storage. These are the areas where the third party forecasters are most optimistic about growth, but where the shares performed comparatively poorly.

Probably the most surprising underperformer is EdTech, which we would have expected to be a beneficiary of the pandemic. It is possible the decline was driven by the clampdown on tutoring in China last year. Citi GPS recently published a comprehensive analysis of EdTech in the post-pandemic world[11], however, and the conclusions were bullish. Based on a detailed survey of more than 700 institutions globally, the authors expect worldwide EdTech spend will more than double to around $360 billion by 2024 from almost $160 billion in 2019, implying an average growth rate of 17% per year.

[10] For an explanation of expectations vs reality in FinTech, see Global Payments/Processors/IT Services: 2022 Payments Preview: Patience Is Not A Virtue!

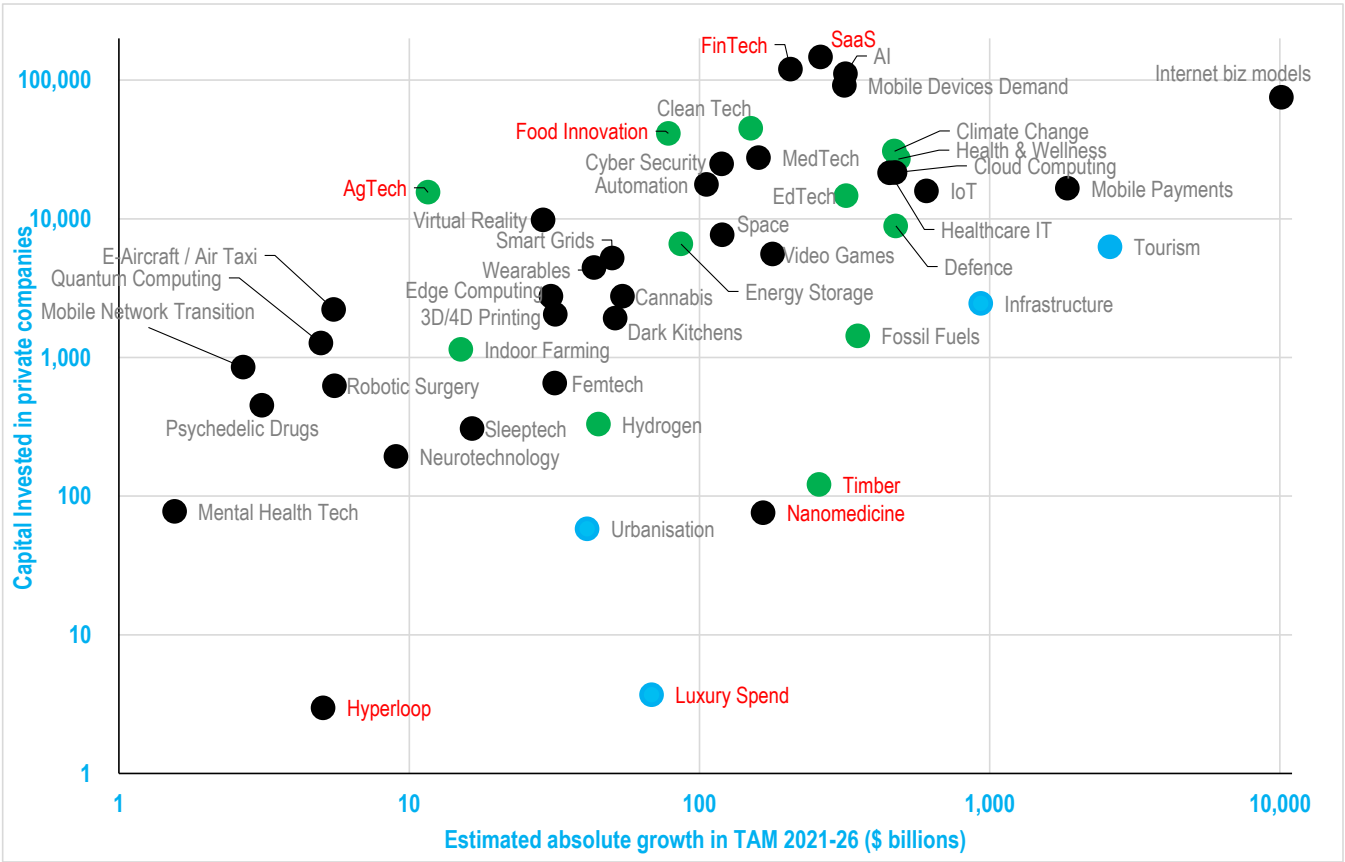
[11] Citi GPS: Education -- Fast Forward to the Future

Where do venture capitalists see opportunity?

Another way of judging where opportunities are being seen is by looking at where capital is being invested. Figure 19 shows all the capital invested in private companies by VCs, allocated to the themes for which we can find relevant data, plotted again the expected growth in TAMs.

Figure 31 – in the Appendix on page 45 – is a similar chart showing the capital invested but against the absolute size of the TAM, not the growth.

Figure 19. Capital Invested in Private Companies by Theme



Blue dots = Growth & Prosperity; Green= Sustainability; Black = Technology. See Figure 4. Red labels are referred to in the text.
Investments include Angel, Seed and VC rounds. Geography = Global.
Source: PitchBook Data Inc and the sources listed in Figure 6.

Once again one would expect a fairly linear relationship between the growth opportunity and the capital invested by VCs. In fact there are some significant outliers:

- VCs have invested notably more in a handful of innovations than the estimates of growth would suggest. Examples include SaaS and FinTech, AI; Ag and FoodTech. These are what we call Architectural and Radical Innovations in the Citi Innovation Cube – in other words innovations that require new business models (see Figure 12).

- Equally, there appears to have been less investment than one might expect in some themes – most noticeably in Luxury but also in Nanomedicine and Timber and Hyperloop.
  - We suspect that Luxury is simply unappealing for VCs, because it relies on brand values (and often heritage) that isn't easily amenable to tech/ digital investment. Similarly we suspect Timber is not that amenable to technology, and the core product – trees – grows too slowly.
  - On the other hand we suspect that Nanomedicine is simply too hard, with too much regulatory risk, to attract much investment at the moment, despite its theoretical promise.

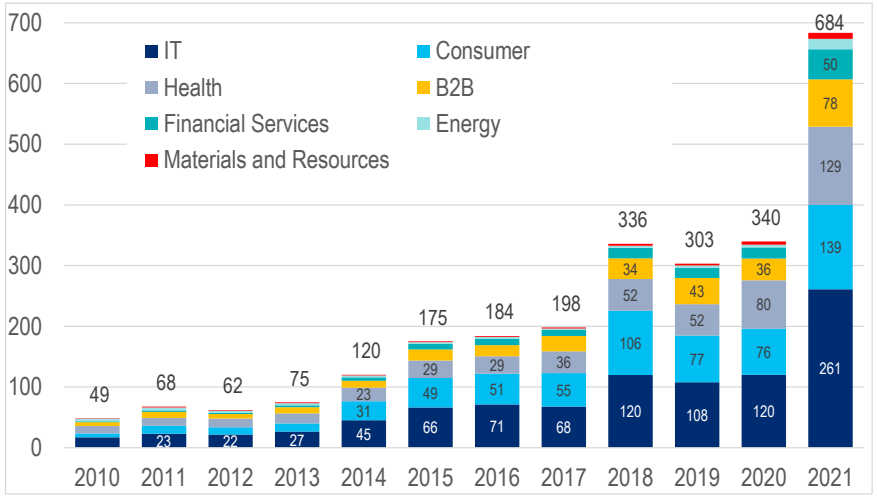
Analysing VC investments across all areas

Of course Figure 19 looks only at the themes that we selected right at the beginning of this report, and it includes data only for 2021 investments. What about the entire opportunity set, across all industries? And what about previous years?

Figure 20 includes all the capital invested in private companies since 2010 that PitchBook has gathered. It shows the capital deployed by startups grew almost seven times in the decade after 2010, from $49 billion to $340 billion in 2020, before doubling last year, to $684 billion.

Figure 20. The growth of capital invested in private companies

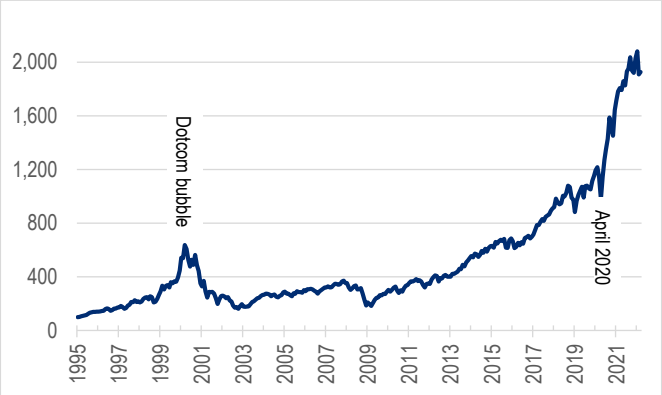
Includes Angel, Seed and VC investing rounds ($ in billions)



Source: PitchBook Data, Inc.

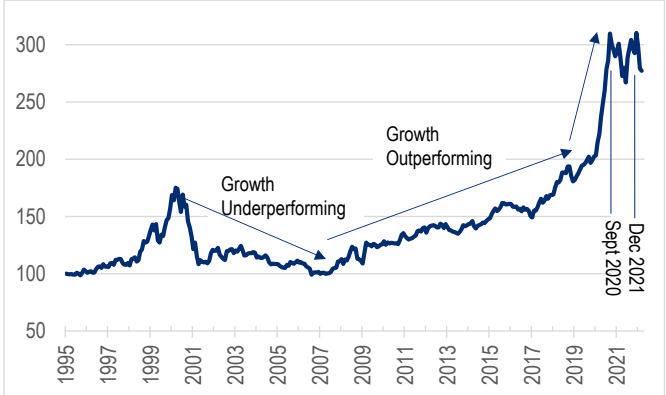
We think one of the drivers of this extraordinary growth has been the unusual financial conditions: from late 2020 financial markets have been favoring growth investments, relative to value, to a greater extent than ever before. Figure 21 shows how rapidly the Nasdaq Composite index accelerated last year. But Figure 22 is perhaps more important, because it shows the relative performance of growth vs value. When the line in Figure 22 is heading up growth stocks are outperforming, and when it's heading down they're underperforming. The chart shows that since 2007 growth has outperformed, but there was a sharp acceleration in February 2020.

Figure 21. Nasdaq Composite Index – 1995 to Present



Source: dataCentral
dataCentral is a Citi Research proprietary database, which includes the Firm's estimates, data from company reports and feeds from Thomson Reuters.

Figure 22. U.S. Growth Stocks Relative to Value – 1995 to Present

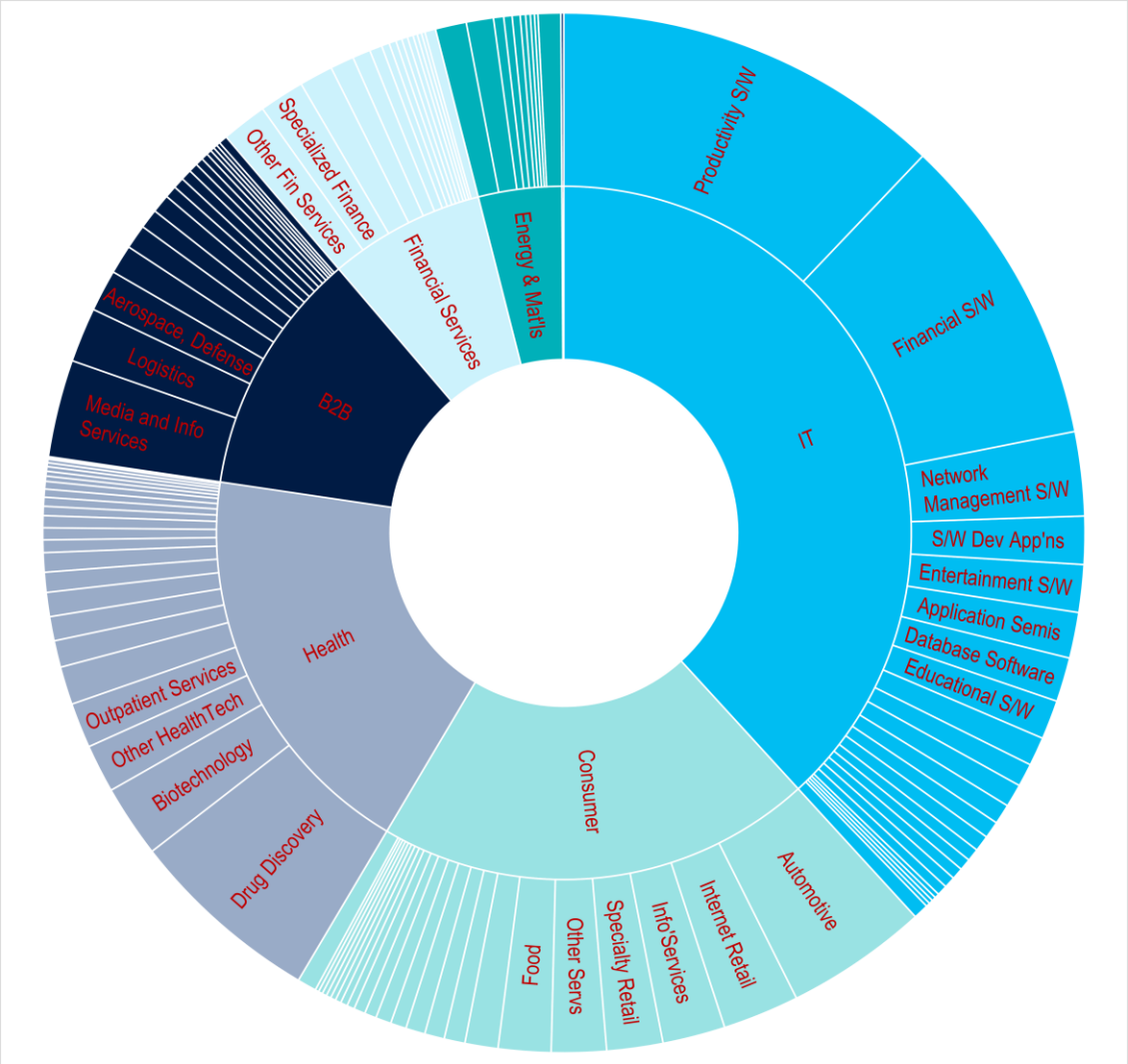


Source: dataCentral

The level of quoted shares doesn't affect the real economy directly – but the knock-on effects on startups *are* important. This is because higher valuations in the public (secondary) markets for growth stocks drive investors to invest more cash in private (primary) markets, and this ends up being used by companies to make real investments on the ground.

Figure 23 shows how PitchBook breaks the investment down by sectors and subsectors (he precise numbers are shown in Figure 32 in the Appendix). What is really striking is how much investment is driven by software, with drug discovery and automotive subsectors trailing a very long way behind.

Figure 23. Primary Capital Invested by Sector, 2021



See Figure 32 in the Appendix for the actual data. Includes Angel, Seed and VC rounds. Geography = Global.
Source: PitchBook Data Inc.

VCs investments are skewed to IT and services, unlike the public equity markets

Figure 24 compares the investment in private companies with the split of the market cap in the global equity market. It shows that, relative to the public market benchmark, private investment is hugely overweight software and services, whether that's in health, B2B, or consumer. Comparatively little investment is going into manufacturing. This is even more striking when you consider that software and services generally need less capital than either deep tech or manufacturing.

Figure 24. Investment in Private Companies vs Market Cap of Listed Companies

		Investment in Private Companies, 2021	Mkt Cap of Quoted Companies
IT	Software & IT Servic	34.0%	10.0%
	Hardware	2.0%	7.0%
	Semi & Semi Equip	1.9%	5.5%
Health	Health Care Equip	4.2%	4.2%
	Pharma & Biotech	8.8%	7.2%
	Health Services	5.9%	n/a
Consumer Discretionary	Autos	4.4%	2.9%
	Consumer Durables	1.1%	2.1%
	Consumer Services	6.2%	1.7%
	Retailing	4.9%	5.3%
Consumer Staples	Food & Staples Retail	n/a	1.4%
	Food Bev & Tobac.	2.1%	3.9%
	Household Products	0.8%	1.6%
Financials	Banks	0.5%	7.5%
	Div Financials	5.6%	4.5%
	Insurance	1.1%	3.1%
Industrials	Capital Goods	3.3%	6.2%
	Commercial Services	5.7%	1.1%
	Transport	2.4%	2.0%
Communications	Telecom	0.3%	1.9%
	Media & Entertainment	0.8%	6.5%
Energy		2.4%	4.2%
Materials		1.5%	4.8%
Utilities		0.02%	2.7%
Real Estate		0.02%	2.6%
		100%	**100%**

The sectors highlighted in green are those sectors where the proportion of investment is higher for private companies than it is for the stock market.
Geography = global.
Source: PitchBook Data Inc. and Factset

The contrast in the balance of investment between private companies and the public equity market has important implications for policy makers who want to adapt their geographies to the changes innovation brings[12].

[12] This is discussed more in Chapter 4 of Citi GPS: Technology at Work 6.

This is partly explained by difference between conventional equity investing and VCs

At one level the different balance in investments can be attributed to the different ways that public equity market portfolios and VC funds work.

- **In the public equity market** investors are looking for a balance of returns, and for most portfolios, each stock matters. It's unusual for a stock to more than treble in a couple of years, but equally a 50% loss is rare.
- **VC investing** is utterly different: successful funds rely on a very small percentage of investments going up by many tens or even hundreds of times, so it doesn't matter if 80% or even 90% go bankrupt[13]. Y-Combinator, for example, once calculated that three-quarters of its returns came from just two of the 280 businesses it had invested in[14]. "The best investment in a successful fund equals or outperforms the entire rest of the fund," according to Peter Thiel – the man who bought a 10% stake in Facebook when it was starting out for $500,000.

VCs are therefore inevitably drawn to software and services because these business can be scaled rapidly with relatively little capital, helped by network effects – unlike, say, semi-conductor fabs, which require billions to set up.

"Software is eating the world"

Figure 24 reminds us of the great headline that was put on an article that Marc Andreessen wrote back in 2011: Why Software is Eating the World. However the thesis of the article is even more important, as it explains how value is accruing to software.

> More and more major businesses and industries are being run on software and delivered as online services — from movies to agriculture to national defense. Many of the winners are Silicon Valley-style entrepreneurial technology companies that are invading and overturning established industry structures. Over the next 10 years, I expect many more industries to be disrupted by software, with new world-beating Silicon Valley companies doing the disruption in more cases than not[15].

And reinforced by differences in valuations

On top of all this, higher valuations compound the attractions of certain subsectors – most notably on enterprise software – the biggest single subsector in Figure 23 – and FinTech.

Figure 25 shows, for example, that the typical Enterprise Software company is valued at about 9-12x sales, which is three times more than the typical Consumer or Healthcare company. As a result successful startups in these areas can become unicorns with relatively little revenue – say $100-150 million – and get there rapidly. By contrast, a company making consumer products would probably have to grow three times as fast to achieve the same valuation. In short, backing the right enterprise software company can be very, very profitable.

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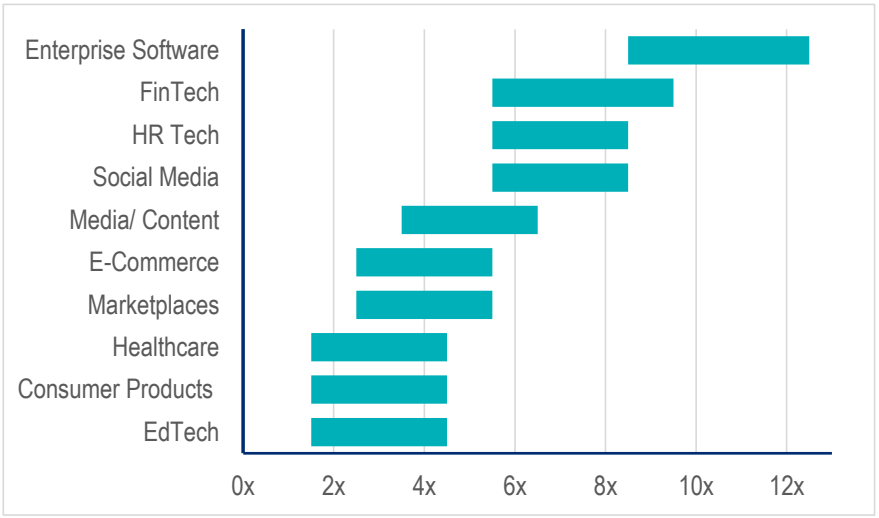
[13] See Sebastian Mallaby's book The Power Law – Venture Capital and the Art of Disruption

[14] Tren Griffin: A Dozen Lessons for Entrepreneurs.

[15] WSJ in 2011: Why Software is Eating the World

Figure 25. Typical Sales Multiples for Startups Seeking VC Funding, 2020



Source: Harlem Capital

Which industries are really seeing the most investment?

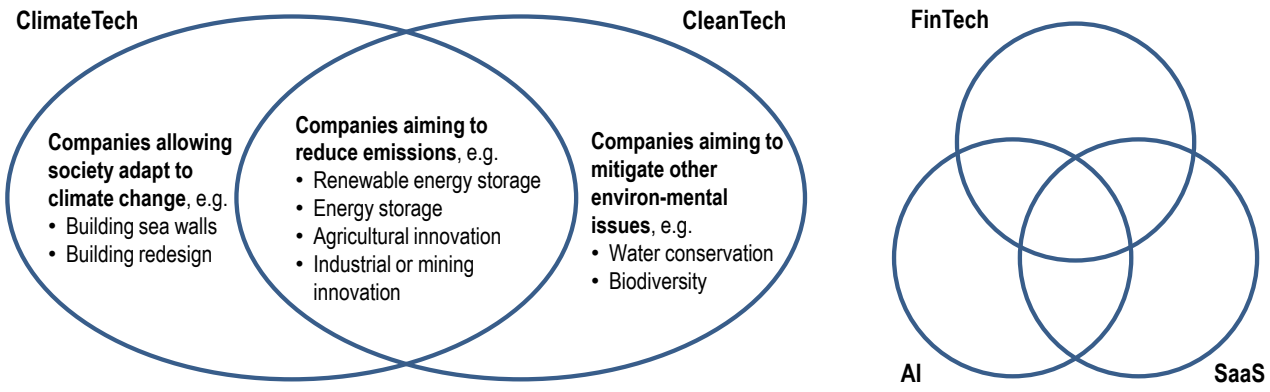
Although Figure 23 shows the capital invested in private companies by Sector and Subsector, we think it is much more useful to look at what PitchBook calls “Industry Verticals” and “Emerging Spaces”, as we do in Figure 29.

The Sectors and Subsectors shown in Figure 23 divide companies in non-intuitive ways – for example a company offering software to analyse financial products is listing under the IT sector, not Financial Services. They do this because the subsectors don’t overlap, and together they add to the total invested in private companies – which is why the percentages in Figure 24 add up to exactly 100%.

By contrast the Industry Verticals are much more intuitive, but the disadvantage is that they do overlap, and they leave out certain startups altogether.

For example, a company in the ClimateTech vertical is also likely to appear in the CleanTech vertical, as Figure 26 explains. Equally, FinTech, AI and SaaS are overlapping verticals; and Micro Mobility is a subset of Mobility. As a result the percentages in Figure 29 add up to 157%.

Figure 26. ClimateTech vs CleanTech Verticals; FinTech AI & SaaS



Source: Citi Global Insights bsed on PitchBook definitions

The overall pattern shown in both Figure 24 and Figure 29 is very striking, however, as it is dominated by the IT, and especially software. It is clear that by far the largest amount of money is being invested in what the Citi Innovation Cube describes as Architectural and Radical Innovations. Much less is being invested in Technological or Transformative ones.

Figure 27. Investment in Private Companies by Industry Vertical

Verticals	$ bln	% of Total	Verticals	$ bln	% of Total
SaaS	146	21%	Wearables & Quantified Self	4.4	1%
FinTech	119	17%	NFTs	4.1	1%
AI and ML	111	16%	Construction Technology	4.0	1%
Mobile	91	13%	Oncology	3.3	0%
E-Commerce	75	11%	Edge computing	2.8	0%
Mobility Tech	65	10%	Cannabis	2.7	0%
CleanTech	45	7%	Infrastructure	2.5	0%
Drug Discovery & Pharma*	44	6%	3D Printing	2.0	0%
FoodTech	41	6%	Ghost Kitchens	1.9	0%
Climate Tech	31	4%	Beauty	1.7	0%
Cryptocurrency/Blockchain	27	4%	Legal Tech	1.7	0%
Health, Sustainability, Wellness Lifestyles	27	4%	Air Taxi	1.4	0%
Cybersecurity	25	4%	Oil & Gas	1.4	0%
CloudTech & DevOps	22	3%	Quantum computing	1.3	0%
Autonomous cars	20	3%	Indoor Farming	1.1	0%
HealthTech	19	3%	Electric Flight	0.78	0%
Robotics and Drones	18	3%	Car-Sharing	0.71	0%
Mobile Commerce	17	2%	FemTech	0.65	0%
Internet of Things	16	2%	Medical Robotics	0.62	0%
Biotech*	15	2%	Psychedelics	0.45	0%
Life Sciences	11	2%	Hydrogen energy	0.33	0%
AgTech	10	2%	Sleep Tech	0.31	0%
Space Technology	7.6	1%	Neurotechnology	0.19	0%
Ridesharing	7.0	1%	Mental Health Tech	0.08	0%
Gaming	5.5	1%	Nanomedicine	0.08	0%
Augmented Reality	5.2	1%	Mining Tech	0.07	0%
eSports	5.0	1%	Urban Planning tech	0.06	0%
Virtual Reality	4.6	1%	Hyperloop	0.003	0%
Micro-Mobility	4.5	1%	**Sum**		**157%**

Note: Not all industry verticals are shown. Includes some emerging spaces. *Industry sectors.
Source: PitchBook Data Inc.

Climate issues are mainly being addressed by other sources

According to the PitchBook data, last year $31 billion of VC capital went to ClimateTech companies – including those focused on renewables and agricultural innovation, among other things. Figure 29 shows this is this is a bit more than the investment in cryptocurrency and blockchain companies ($27 billion), but a lot less than VC investments in many other verticals, including SaaS ($146 billion), FinTech ($119 billion), E-Commerce ($75 billion), and Mobility ($65 billion).

However it is important to note that that there *is* a lot of finance going into energy transition, even if it's coming from elsewhere: A total of $755 billion[16] was committed globally by governments, companies and households to decarbonize the energy system last year, according to Bloomberg NEF, up 27% from 2020. And the investment may increase considerably. "To reach net zero emissions by 2050, annual clean energy investment worldwide will need to more than triple by 2030 to around $4 trillion," according to the IEA[17].

As we have said, VC funds look to buy equity in businesses that could return tens or even hundreds of times their initial investments even if there is high risk of failure – which is why VCs back startups trying to find cheap ways of harnessing fusion, or developing new types of battery. By contrast the bread and butter business of installing and managing renewable power plants like solar and wind farms is a long-term, low-risk business with unlevered returns in the single digit percentages – suitable for infrastructure funds but not VCs[18]. These types of project require investment, but not innovation, which is what this note has focused on.

[16] Source: BloombergNEF: Investment Trends Jan 2022. Within the $755 billion, the biggest categories were renewables (48%) and electric vehicles and charging infrastructure (36%). By geography the biggest region was Asia-Pacific (48%), followed by EMEA (31%).

[17] https://www.iea.org/reports/net-zero-by-2050

[18] A lot of the financing for renewables infrastructure comes in the form of debt, so the returns to equity can be higher than this

Conclusions

- **This is a unique report –** We've mapped 100 themes, showing third party estimates of their current size and likely growth. We also compare these estimates to where VCs are investing. This gives what we think is a solid base of comparison that can help to identify areas of opportunity, the size of the markets and the growth profiles?

- **There is a huge variation in the size of the TAMs** – The biggest themes we examine tend to belong to big macro-related ideas – like the spend of aging populations – whereas the smallest ones are narrowly defined, nascent technologies. The TAMs of the biggest themes we have chosen are more than 30,000x the size of the smallest ones.

- **There is less correlation between the expected percentage growth in the TAMs and size than expected** – Figure 10 showed many of the large macro-driven themes are growing in the single digits but many smaller innovation-driven ones aren't growing much faster – most grow only in the high single digits or mid-teens. However there are a handful of already-big areas that are expected to grow very rapidly, including Mobile Payments, AI and Internet Business Models. The best growth is generally coming from Architectural and Radical Innovations.

- **Despite the positive stories, many of the themes are struggling to grow –** Figure 15 showed that more than half the themes had negative scores on the Citi Research Quant team's *Composite Growth* metric, implying that driving profit growth has proved hard in reality. Software themes generally came out best from Figure 15 and certain non-digital themes worst. Figure 16 showed that many of the fastest growing themes see valuations fall when bond yields rise – and they *are* expected to rise further.

- **There are some interesting mismatches between the stock market performance of certain themes, and the expected sales growth** – Figure 17 showed that certain themes – e.g., AI, Remote Working and Luxury – have higher market valuations than the estimates of their TAMs might suggest. Figure 18 showed that Novel Biothreats, Hydrogen and Contactless have seen a larger 3-year returns than might be expected.

- **VCs are investing most in Software and Architectural Innovations –** Figure 19 showed VCs have invested notably more in a handful of areas than the estimates of growth would suggest. Examples include Software and FinTech, AI and Ag/ FoodTech. Conversely they have been avoiding Luxury and Nanomedicine. Figure 24 showed that relative to the public market benchmark, private investment is hugely overweight software and services, whether in FinTech, health or B2B. Comparatively little investment is going into manufacturing. This reflects the differences between conventional investors and VCs: VCs are looking to invest in companies that may return many, many times the initial investment, even if there is a high chance of failure.

Where to go next

Theme-based investing is on the rise, both in the public markets and thanks to VCs. This report adds to Citi's existing and well developed offering on thematic investing.

- **Citi** provides detailed analysis of nearly all the individual themes. In Figure 28 in the Appendix we provide links to some of Citi's most important reports on them.
- **The Global Theme Machine** is a unique product that combines the insights from Citi Research's fundamental analysts around the globe with a rigorous quantitative analytical framework to evaluate the relative attractiveness of themes on a number of financial metrics.
- The **Theme Basket Incubator** is a new tool for analyzing both private and public companies. Citi Data Insights are able to provide lists of private and public companies exposed to particular themes, based on a proprietary analysis of alternative data sources, including job postings, news items and patents.

Appendix

Figure 28. Key reports

	Category	Short Name	Source	2021 TAM	5 Yr Growth	Mkt Cap	PB Investment	Report
1	Growth & Prosperity	Aging Demo Spend	GTM	9,200	6%	4,700		
2		Belt & Road	GTM	56		710		Link to report
3		EM Consumer	GTM	23,000		7,000		Link to report
4		Global Trade	GTM	47	7%	2,100		Link to report
5		Infrastructure	GTM	3,300	5%	3,200	2,500	Link to report
6		Luxury Spend	GTM	260	5%	6,800	4	Link to report
7		Medical Tourism	Add	68	17%			
8		Services Offshoring	GTM	220	7%	880		
9		Tourism	GTM	7,200	10%	550	6,300	Link to report
10		Urbanisation	GTM	150	5%	2,000	58	
11		US Construction	GTM	1,300				
12	Sustainability & Society	Agriculture Demand	GTM	10,000	4%	510		Link to report
13		AgTech	GTM	55	11%		16,000	Link to report
14		Alt Proteins	DI	9	11%			Link to report
15		Biofuels	GTM	140	7%	120		Link to report
16		Carbon Markets	DI	1	59%			Link to report
17		Clean Tech	GTM	250	11%	1,700	45,000	Link to report
18		Clean Water	GTM	350	7%	790		Link to report
19		Climate Change	GTM	3,400	3%	1,700	31,000	Link to report
20		Defence	GTM	1,800	5%	510	8,900	Link to report
21		De-Polymerizing Plastics	DI	39	7%			Link to report
22		E cigarettes	DI	27	28%			Link to report
23		EdTech	GTM	200	20%	210	15,000	Link to report
24		Energy Efficiency	GTM	630	12%	1,600		Link to report
25		Energy Storage	GTM	150	25%	710	6,600	Link to report
26		Food Innovation	GTM	240	6%	570	41,000	Link to report
27		Fossil Fuels	GTM	1,400	6%	3,800	1,400	Link to report
28		Fuel Cells	GTM	5	21%	22		
29		Health & Wellness	GTM	1,600	5%	3,100	27,000	Link to report
30		Hydro Energy	GTM	230	6%	330		
31		Hydrogen	GTM	140	6%	410	330	Link to report
32		Indoor Farming	DI	22	11%		1,100	
33		Light-Weighting of Cars	GPS	110	6%			Link to report
34		Net Zero	GTM	840	9%	9,900		Link to report
35		Novel Biothreats	GTM	14	6%	810		
36		Obesity	GTM	9	15%			Link to report
37		Sharing Economy	GTM	380	0%	2,800	7,700	Link to report
38		Solar Energy	GTM	150	14%	370		Link to report
39		Sustainable Materials	GTM	310	10%	250		Link to report
40		Timber	GTM	270	14%	140	120	Link to report
41		Waste-to-Energy	DI	39	6%			
42		Wind	GTM	110	7%	270		Link to report
43	Technology & Innovation	3D/4D Printing	GTM	17	21%	7	2,000	Link to report
44		5G Network	DI	29	50%			Link to report
45		AI	GTM	130	40%	5,900	110,000	Link to report
46		Auto Electronics	GTM	240	7%	1,200		Link to report
47		Automation	GTM	120	9%	1,900	18,000	Link to report
48		Cannabis	Add	22	27%		2,700	Link to report
49		Cloud Computing	GTM	310	18%	4,200	22,000	Link to report
50		Contactless	GTM	12	11%	230		Link to report
51		Cyber Security	GTM	170	10%	1,800	25,000	Link to report
52		Dark Kitchens	Add	50	14%		1,900	Link to report
53		Data Storage	GTM	66	0%	1,700	360	Link to report
54		Deepwater	GTM	49	7%			
55		Digital Identity	GPS	21	15%			Link to report
56		Digital Leisure	GTM	13	15%	1,700		Link to report
57		DNA/Genetic	GTM	12	11%	1,300		Link to report
58		E Vehicles	GTM	230	24%	2,600		Link to report
59		E-Aircraft / Air Taxi	GPS	4	63%		2,200	Link to report
60		Edge Computing	DI	7	35%		2,800	Link to report

61	Elder Care	Add	1,100	8%			
62	eSports	DI	1	0%		5,000	Link to report
63	Experiential Commerce	GTM	10	33%	630		Link to report
64	Femtech	Add	29	18%		650	
65	FinTech	GTM	120	22%	1,600	120,000	Link to report
66	Generics & Biosimilars	GTM	19	0%	680		Link to report
67	Healthcare IT	GTM	250	21%	210	21,000	Link to report
68	Hyperloop	DI	1	40%		3	Link to report
69	Immunotherapy	GTM	110	12%	1,200		Link to report
70	Internet biz models	GTM	6,800	19%	8,900	75,000	Link to report
71	IoT	GTM	500	20%	690	16,000	Link to report
72	IP	GTM	5	14%	2,100		
73	IT Services	GTM	990	0%	2,800	2,700	Link to report
74	Last mile delivery	Add	94	13%			
75	Liquid Biopsy	DI	3	19%			Link to report
76	MedTech	GTM	460	6%	2,000	27,000	Link to report
77	Mental Health Tech	Add	3	11%		77	
78	Metaverse	GTM	50	43%			Link to report
79	Mining Capex	GTM	100	0%	950	69	Link to report
80	Mobile Devices Demand	GTM	560	9%	5,200	91,000	Link to report
81	Mobile Network Transition	GTM	4	10%	2,100	850	Link to report
82	Mobile Payments	GTM	920	28%	1,300	17,000	
83	mRNA	DI	48	-2%			Link to report
84	Nanomedicine	Add	210	13%		76	
85	Neurotechnology	DI	11	12%		190	
86	NFTs	DI	27	0%		4,100	Link to report
87	OnDemand Media	GTM	65	12%	570		
88	Psychedelic Drugs	DI	3	14%		450	Link to report
89	Quantum Computing	DI	1	51%		1,300	Link to report
90	Remote Working	GTM	2	17%	790		Link to report
91	Robotic Surgery	DI	5	17%		620	Link to report
92	SaaS	GTM	180	17%	1,300	150,000	Link to report
93	Sleeptech	Add	15	16%		310	
94	Smart Grids	GTM	60	17%	210	5,200	
95	Space	GTM	380	6%	250	7,600	
96	Telemedicine	Add	67	28%			Link to report
97	Video Games	GTM	200	13%	2,100	5,500	Link to report
98	Virtual Reality	GTM	16	31%	61	9,800	Link to report
99	Voice-activated systems	DI	13	17%			Link to report
100	Wearables	GTM	65	14%	130	4,400	Link to report

Mkt Cap: Market Cap of Companies with High Exposure for GTM Themes. PB Investment = Investment in 2021 from Angel, Seed and VC rounds.
Source: The sources listed in Figure 6, PitchBook Data, and CGI

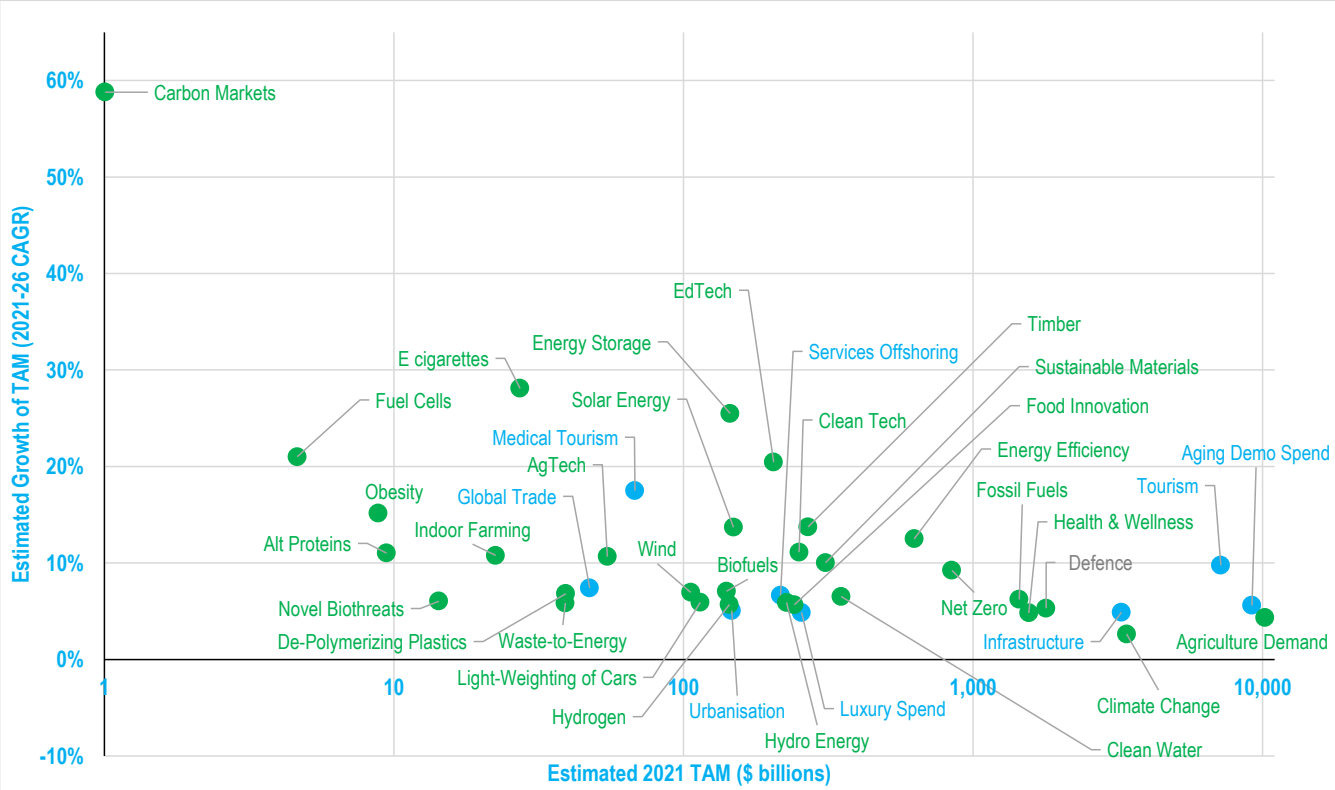
Figure 29. Definition of Themes

Theme	Definition
3/4D Printing/Additive Manufacturing	The growth in 3D printing, or additive manufacturing. 4D printing includes products that are designed to change over time
5G Network	Driven by the growth of 5G networks
Aging Demographics Spend	Consumption trends caused by aging populations
Agricultural Tech	Modern tech applied to agriculture
Agriculture Demand	The rising demand for food, driven by the increasing global population, and increasing ability to afford protein.
Alternative Proteins	Replacements for meat, dairy and other animal (or fish) products.
Artificial Intelligence	Computing technology that perform tasks typically requiring human intelligence, such as speech recognition
Auto Electronics	Car electronics, especially due to the growth of autonomous vehicles.
Automation/Robotics	Robots and automation within manufacturing
Belt & Road	Businesses that benefit from China's One Belt, One Road initiative
Biofuels	Fuels derived from plants to replace traditional fuels.
Cannabis	Legal cannabis
Clean Tech	Businesses that aim to help the environment, both by reducing emissions and helping other issues, e.g., biodiversity and water scarcity
Clean Water	Companies benefiting from moves to improve water supplies
Climate Change	Companies that will benefit from the drive to slow (or adapt to) climate change.
Cloud Computing	The growth in both consumer and enterprise cloud services
Consumer Health and Wellness	Companies that benefit from changing consumer preferences
Contactless Economy	Companies that benefit from contactless technology -- often the interface between the physical and digital worlds.
Cyber Security	The growth of cybersecurity
Dark Kitchens	Restaurants that only serve delivery companies, where consumers can't eat
Data Storage	Businesses that benefit from the requirement to store more data
Deepwater	Offshore oil & gas that operates in deep water
Defence	Businesses that benefit from defense spending
De-Polymerizing Plastics	A way of recycling plastics by breaking them down into monomers -- basic molecular building blocks
Digital Identity	Businesses that benefit from the growth of digital ID systems
Digital Leisure	The increasing consumption online of leisure activities, including streaming services, online gambling and eSports
DNA/Genetic	The use of genetics to improve healthcare
E cigarettes	New technologies to deliver nicotine, without burning tobacco
Edge Computing	Edge computing uses new semiconductors to bring computation and data storage closer to the sources of data, which should improve response times
Education	Education (non-profit and for-profit) is one of the largest sectors globally
Elder Care	Care for the elderly -- both health and social care.
Electric Aircraft / Air Taxi	Combines aircraft driven by electric engines and air-taxis.
Electric Vehicles	Vehicles driven by electric motors, not internal combustion (or steam) engines, or horses or camels.
EM Consumer	Trends driven by improving disposable income, demographics, and a growing middle class within Emerging Markets
Energy Efficiency	Businesses that aim to improve energy efficiency, for example LED lighting
Energy Storage	Companies that benefit from the need to store energy more effectively
eSports	Tournaments where spectators watch competitors play video games
Experiential Commerce	The trend for consumers to spending more on experiences than physical goods.
Femtech	Businesses that serve the particular needs of women in health and other areas -- often around menstrual and fertility issues.
FinTech	New approaches to financial services
Food Innovation	Businesses innovating around foods for humans
Fossil Fuels	Companies that benefit from the supply of hydrocarbons
Fuel Cells	Devices that convert chemical energy into electricity. Hydrogen is the most common fuel.
Generics & Biosimilars	A generic drug is identical to a branded drug, and becomes available when the branded drug loses patent protection. Biosimilars are drugs that have no clinically meaningful differences, but aren't identical.
Global Carbon markets	Markets where allowances to emit CO2 are traded -- part of the cap-and-trade approach to limiting emissions
Global Tourism	Increased spending driven by rising tourism, globally
Global Trade	Business that benefit from growth in global trade
Healthcare IT	Spending on IT to improve healthcare, usually in terms of quality, safety or economic efficiency
Hydro Energy	Business exposed to energy derived from water, usually via dams or wave power
Hydrogen	Businesses that benefit from the use of hydrogen to power vehicles.
Hyperloop	A proposed high-speed transport technology where passengers or goods move in pods through low-pressure tubes
Immunotherapy	Using the immune system to destroy cancer cells
Indoor Farming	Farming that uses artificial and other technologies to grow food inside
Infrastructure	Companies that benefit from spending on infrastructure
Internet of Things (IoT)	The Internet of Things (IOT) is the interconnection of uniquely embedded computing devices within the existing internet infrastructure., allowing everyday objects to send and receive data
Internet-driven business models	The growth of businesses that serve customers via the Internet
IT Services	IT Services mostly involve helping organizations implement IT-related projects
Last mile delivery	Businesses that benefit from the final step in delivering products to consumers or businesses

Light-Weighting of Cars	The aim is to make vehicles achieve better fuel efficiency and handling
Liquid Biopsy	Analyzing blood to find evidence for various types of cancer other diseases
Luxury Spend	The growth in aspiration consumption
Medical Tech	Using technology to diagnose and treat medical conditions, usually within a clinical setting
Medical Tourism	Medical tourism occurs when people travel in order to obtain medical treatments, often at a lower price than in their home country
Mental Health Tech	The use of technology to help with mental health
Metaverse	The metaverse is a proposed version of the Internet where you feel you are "inside" it, as opposed to merely looking at it
Mining Capex	Businesses that benefit from increased spending by mining companies
Mobile Network Transition	Companies that benefit from improvement to mobile networks, especially moving up the Gs, from 4G to 5G, and potentially onto 6 and 7G
Mobile Payments	Payments using mobile phones and similar technologies
mRNA	mRNA tells cells how to create proteins, allowing the creation of vaccines among other things
Nanomedicine	Using "things" on the scale of molecules to prevent and treat diseases
Net Zero	Companies that have committed to the Science-Based Targets Initiative for reducing greenhouse gas emissions.
Neurotechnology	Electronics that interfaces directly with the nervous system or brain
NFTs	Unique digital tokens that can prove ownership or authenticity, often of digital assets
Novel Biothreats	Companies that benefit from societies' attempts to deal with new biological threats, including infectious diseases, resistance to antibiotics and biological weapons
Obesity	Companies that benefit from the increase numbers of very fat people
Online/OnDemand Media	The growth of online media content
Patents/IP	Companies that benefit from innovation protected by patents
Psychedelic Drugs	Legal drugs that can treat several disorders, including types of depression
Quantum Computing	A new approach to computing that in theory allows much, much more complicated calculations than before
Remote Working	Companies that benefit from the growth of working remotely
Robotic Surgery	Robotic surgery often allows surgery that is more precise and controlled than conventional surgery
Services Offshoring	Offshoring services to low cost regions
Sharing Economy	Firms that match buyers and sellers, and thus facilitate the use of an asset or a service, without owning it. Examples include travel agencies, and home- and car-sharing websites
Sleeptech	Technology that helps users monitor or improve their sleep
Smart Grids	Renewables and energy storage require electricity grids to cope with more variable power sources, and the potential for re-sale back into the grid.
Smart Mobile Devices Demand	Companies that benefit from the growth of smartphones and similar mobile Internet devices.
Software as A Service	Software as a Service transforms what used to be a capital expenditure into an operating expense.
Solar Energy	Companies that benefit from the growth of solar energy
Space	The growing space economy
Sustainable Materials	The shift away from single-use plastics benefits companies focusing on light-weighing their products, investing in recycling or bio-polymers.
Telemedicine	Providing health services at a distance -- including consultations, monitoring, diagnosis and therapeutics
Timber	This theme is driven by the growth in demand for timber, from construction, pulp or paper. Timber supply takes time, but also has longevity.
Urbanisation	Trends driven by the continued increase of the proportion of people living in cities
US Construction	Businesses benefiting from construction of buildings and infrastructure within the U.S.
Video Games	Companies benefiting from the growth of video games
Virtual Reality	Virtual Reality covers the field of view to give an immersive experience. Augmented reality uses computer-generated images superimposed over a view of the real world, allowing for mobility
Voice-activated systems	Systems that can decode the human voice, for controlling devices, dictation, or other purposes
Waste-to-Energy	Generating electricity or heat from the primary treatment of waste -- a form of energy recovery.
Wearable Technology	Companies that benefit from smart wearable devices include not only the hardware companies but also those that analyze the data, for example insurers and telehealth companies
Wind	The use of wind to generate electricity

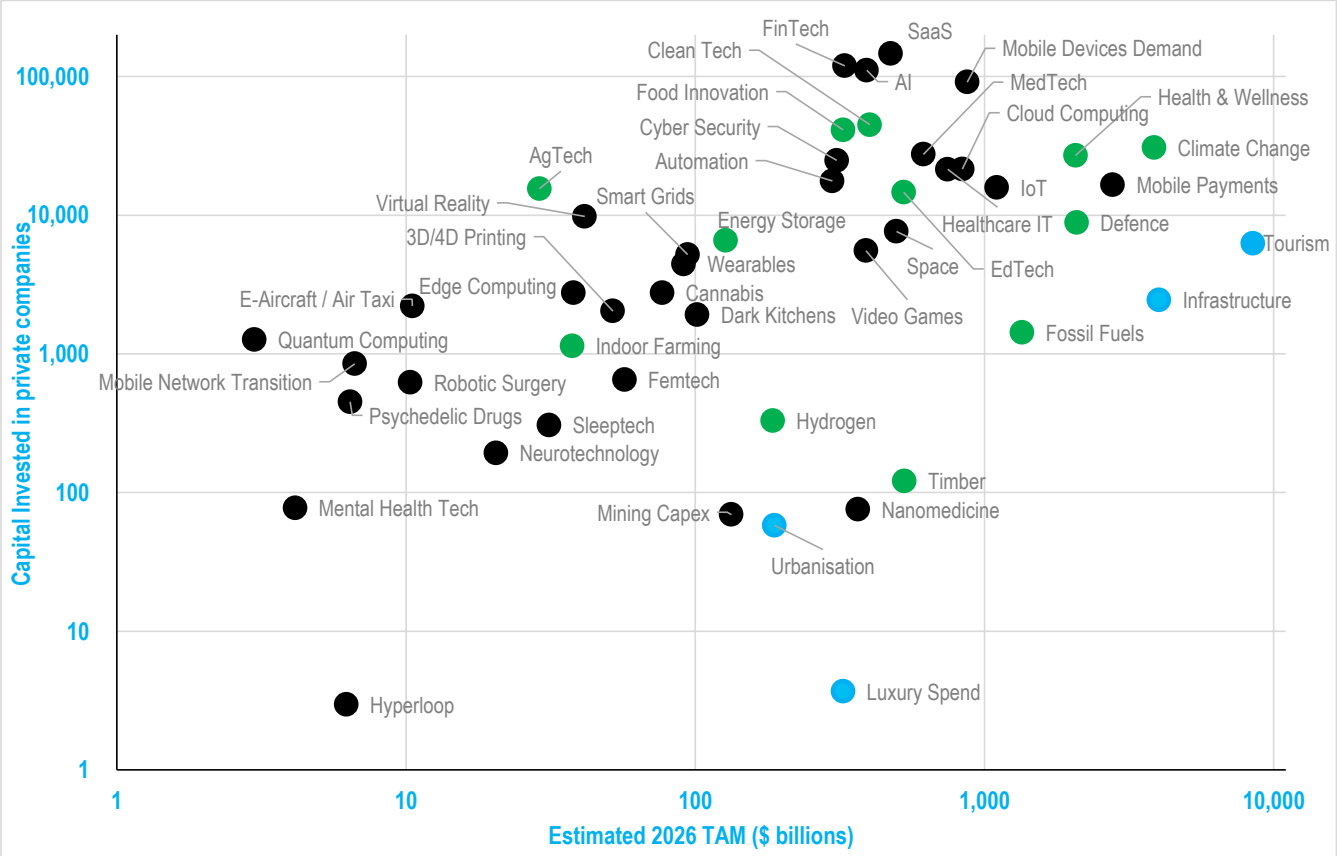
Source: Citi Global Insights

Figure 30. TAM vs Growth – Growth & Prosperity and Sustainability & Society Themes



Source: The sources listed in Figure 6

Figure 31. Capital Invested in Private Companies by Theme vs. Expected TAM of Theme (2026)



Source: PitchBook Data Inc. and the sources listed in Figure 6

Figure 32. Primary Capital Invested by Sector and Subsector, 2021

IT		Consumer		Healthcare		B2B		Financial Services		Energy Storage		Materials and Resources	
Productivity Software	83	Automotive	30	Drug Discovery	41	Media and Information Services	21	Other Financial Services	9.6	Energy Storage	6.6	Other Agriculture	2.2
Financial Software	67	Internet Retail	16	Biotechnology	15	Logistics	12	Specialized Finance	9.6	Alternative Energy Equipment	5.8	Cultivation	1.7
Network Management Software	18	Info' Services B2C	13	Other Healthcare Tech Systems	10	Aerospace and Defense	8.9	Consumer Finance	7.1	Energy Production	1.8	Specialty Chemicals	1.0
Software Development Applications	10	Specialty Retail	12	Clinics/Outpatient Services	10	Human Capital Services	6.1	Brokerage	5.0	Other Energy Services	1.1	Agricultural Chemicals	0.9
Entertainment Software	10	Other Non-Fin'l Servs	12	Diagnostic Equipment	8.1	Electrical Equipment	5.1	Holding Companies	3.8	Energy Transportation	0.7	Synthetic Textiles	0.6
Application Specific Semiconductors	10	Food	11	Discovery Tools (Healthcare)	5.7	Road	4.2	Other Commercial Banks	2.7	Other Equipment	0.4	Other Metals, Minerals and Mining	0.6
Database Software	9.4	Real Estate Servs	7.0	Therapeutic Devices	5.1	Other Commercial Services	3.9	Other Insurance	1.7	Energy Infrastructure	0.3	Other Materials	0.6
Educational Software	8.3	Educational and Training Servs	4.4	Enterprise Systems (Healthcare)	5.1	Machinery B2B	2.6	Life and Health Insurance	1.5	Energy Traders and Brokers	0.2	Aquaculture	0.4
Electronic Equipment	6.1	Other Restaurants, Hotels, Leisun	4.2	Surgical Devices	4.3	Other Commercial Products	2.3	Private Equity	1.3	Oil and Gas Equipment	0.1	Multi-line Chemicals	0.3
Application Software	4.9	Electronics B2C	4.1	Other Healthcare Services	4.1	Industrial Supplies and Parts	2.3	Asset Management	1.3	Energy Exploration	0.1	Horticulture	0.3
Social/Platform Software	4.9	Personal Products	3.4	Pharmaceuticals	2.7	Education and Training Services I	1.9	Automotive Insurance	1.2	Electric Utilities	0.1	Industrial Chemicals	0.3
Multimedia and Design Software	4.3	Beverages	3.3	Managed Care	2.6	Environmental Services B2B	1.7	Commercial/Prof'l Insurance	0.9	Energy Marketing	0.1	Iron and Steel Mining	0.14
Communication Software	3.6	Publishing	2.5	Decision/Risk Analysis	2.5	Distributors/Wholesale	1.4	Multi-line Insurance	0.9	Water Utilities	0.05	Multi-line Mining	0.13
Computers, Parts and Peripherals	3.4	Clothing	2.4	Laboratory Services (Healthcare)	2.0	Construction and Engineering	1.1	Insurance Brokers	0.8	Energy Refining	0.02	Other Chemicals and Gases	0.12
IT Consulting and Outsourcing	2.7	Recreational Goods	1.6	Monitoring Equipment	1.9	Consulting Services B2B	0.8	National Banks	0.7	Other Energy	0.01	Commodity Chemicals	0.12
Automation/Workflow Software	2.5	Restaurants and Bars	1.5	Practice Management (Health)	1.7	Buildings and Property	0.8	Other Capital Markets/Institutions	0.6			Paper Containers and Packaging	0.09
Systems and Information Manage	2.5	Household Appliances	1.2	Drug Delivery	1.6	BPO/Outsource Services	0.8	Property and Casualty Insurance	0.4			Other Containers and Packaging	0.09
Other Hardware	2.4	Accessories	1.1	Elder and Disabled Care	1.1	Building Products	0.4	Thrifts and Mortgage Finance	0.2			Raw Materials (Non-Wood)	0.08
General Purpose Semis	2.2	Other Consumer Non-Durables	1.0	Medical Records Systems	1.0	Air	0.3	SPACs	0.2			Animal Textiles	0.06
Telecoms Service Providers	1.0	Home Furnishings	1.0	Other Pharmaceuticals and Biotech	1.0	Accounting, Audit and Tax Servs	0.2	REITs	0.1			Forestry Processing	0.05
Internet Service Providers	0.9	Movies, Music and Entertainment	0.9	Other Devices and Supplies	0.8	Legal Services B2B	0.2	Regional Banks	0.06			Plant Textiles	0.04
Wireless Coms Equipment	0.8	Other Transportation	0.8	Outcome Management (Health)	0.8	Marine	0.2	Re-Insurance	0.04			Metal Containers and Packaging	0.04
Internet Software	0.8	Hotels and Resorts	0.6	Medical Supplies	0.3	Government	0.1	International Banks	0.03			Forestry Development/Harvesting	0.04
Connectivity Products	0.6	Leisure Facilities	0.4	Hospitals/Inpatient Services	0.1	Conglomerates	0.1					Animal Husbandry	0.03
Other Coms and Networking	0.6	Broadcasting, Radio and TV	0.4	Distributors (Healthcare)	0.1	Security Services B2B	0.1					Plastic Containers and Packaging	0.03
Production (Semiconductors)	0.5	Other Consumer Durables	0.4			Office Services B2B	0.1					Precious Metals/ Minerals Mining	0.02
Operating Systems Software	0.5	Air	0.4			Printing Services B2B	0.05					Other Forestry	0.02
Other Semiconductors	0.4	Footwear	0.4			Other Transportation	0.04					Other Textiles	0.02
Storage (IT)	0.4	Legal Services B2C	0.3			Other Business Products and Servs	0.02					Gold Mining	0.008
Fiberoptic Equipment	0.3	Social Content	0.3			Rail	0.005					Wood/Hard Products	0.007
Office Electronics	0.03	Department Stores	0.2									Wood Containers and Packaging	0.004
Vertical Market Software	0.01	Other Media	0.1										
Electronic Components	0.01	Other Consumer Prod's and Servs	0.1										
Other Software	0.00	Household Products	0.1										
		Marine	0.1										
		Catalog Retail	0.1										
		General Merchandise Stores	0.03										
		Other Apparel	0.02										
		Distributors/Wholesale B2C	0.02										
		Business Equipment and Supplies	0.01										
		Accounting, Audit and Tax Services	0.005										
		Luxury Goods	0.004										
Total IT	**261**	**Total Consumer**	**139**	**Total Health**	**129**	**Total B2B**	**78**	**Total Financial Services**	**50**	**Total Energy**	**17**	**Total Materials/ Resources**	**10**

Source: PitchBook Data Inc

Disclosures