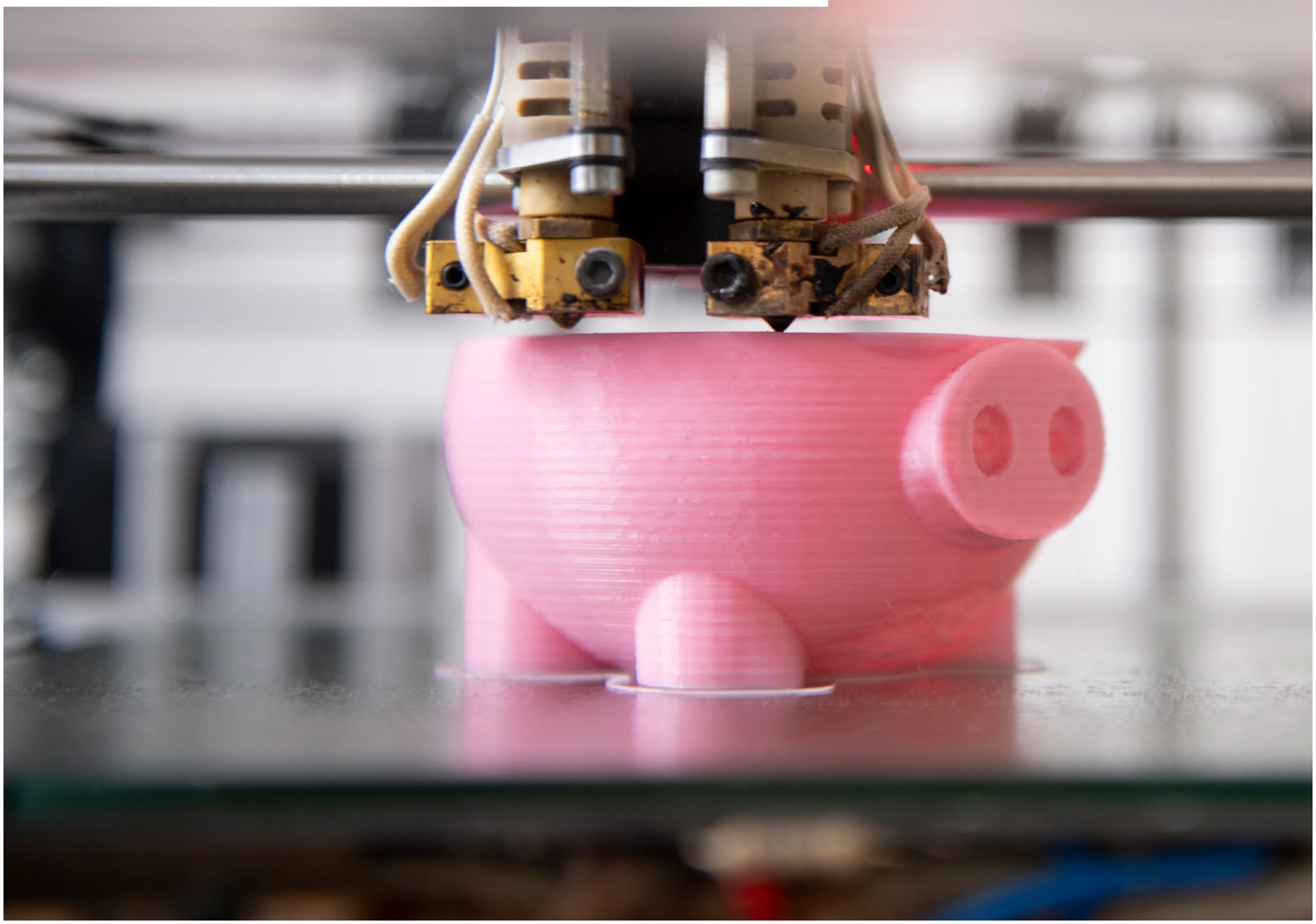
Report

Roland Berger

MUNICH / GERMANY



Additive manufacturing: The money story

A SPECIFIC VALUE PROPOSITION FOR A FAST-GROWING SEGMENT

Roland Berger

MANAGEMENT SUMMARY

Additive manufacturing and money go together. We have seen this in the past, and especially in 2021, with new peaks in public offerings, M&A deals and funding. The industry has been fired up by a combination of marketing and engineers' dreams suggesting that, with AM, nothing is impossible. As part of our Next Generation Manufacturing publication series, we therefore analyze the drivers behind the money. We look at where and how money is invested, and examining the key valuation levers in the AM industry.

Learn more about Next Generation Manufacturing

DISCLAIMER

This study does not purport to be all-inclusive and is not investment advice. This study is not a recommendation to invest or not invest in any of the companies mentioned in this study.

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FAST FACTS & CONTENTS

→ **2021** was a record AM year

→ **47** M&A deals

10 IPOs

1 / Drivers of money in the AM industry

Additive manufacturing (AM) is a fascinating industry in which anything seems possible. High expected growth rates point to a bright future, with some AM marketing publications creating the impression that the sky is the limit. In keeping with the euphoria of these glossy articles, recent heavy investment in the industry has been driven mainly by six key trends identified by Roland Berger: digitalization, high growth rates & expectations, media and marketing, low barriers to market entry, low-interest rates and the industry's proximity to potent funds. On the back of these trends, AM companies have lately been able to raise copious funds. → A

While the trends toward digitalization are not new, the AM industry is a stand-out example of digital production: Parts are digitally designed, 3D computer-assisted designs are printed and digital inventories are assembled, all of which adds up to digital supply chains. Various reports and market studies claim growth rates in excess of 20% p.a. but, in so doing, fuel business plans and expectations that often go beyond reality. Hand in hand with these reports, media coverage and marketing blurb speak of endless possibilities. Yet few mention the still very high cost of AM materials, machinery and parts, or the fact that AM is still mostly used in niche applications/industries and prototyping. That said, the number of new entrants in the materials, machinery, software and AM parts printing service spaces illustrates how low the barriers to market entry really are, as well as reflecting the efforts undertaken by these companies to secure sufficient funds to gain a foothold on the AM market. Low interest rates are likewise buoying up the market by making capital more readily accessible. And large aerospace, medical technology or turbomachinery companies who choose AM for their production technology will always find major investors ready and waiting close by. This trend will likely continue for all drivers – with the exception of entry barriers, which are expected to remain low as the market and its technologies become ever more complex, offering novel niches for startups. Accordingly, Roland Berger expects to see further activity in the AM market in 2022. Given that this industry is highly flexible in terms of production sites and locations, it is believed that the Russia-Ukraine war will not stop current developments. On the contrary, the conflict may actually encourage precisely the flexible production and supply chains to which AM can make a major contribution.

"A large amount of money was raised on the market in 2021 – a record IPO year for AM. Some investors will make their returns, but definitely not all of them."

Bernhard Langefeld
Senior Partner

A / The drivers behind the money

Key trends for investments in the AM market

1	2	3	4	5	6
Digitalization & high-tech	**Growth rates & expectations**	**Media & marketing**	**Low market entry barriers**	**Interest rates**	**Proximity to potent capital**
Digital applications are key for high-cost and high-tech countries	Double digit growth in most AM segments and value chain parts – However expectations go even beyond reality	• Media/press hype about size, growth and technology • Little public insight into high costs structure and real profitability	• Ever increasing number of players in materials, machines and services • Significant patents have expired	Low interest rates make alternative investments less attractive	Market participants are close to investors with large funds available in aerospace, medical technology and automotive
Driver relevance & future development					

Low current relevance of driver · High current relevance of driver · Increasing expected future development · Decreasing expected future development

Source: Roland Berger

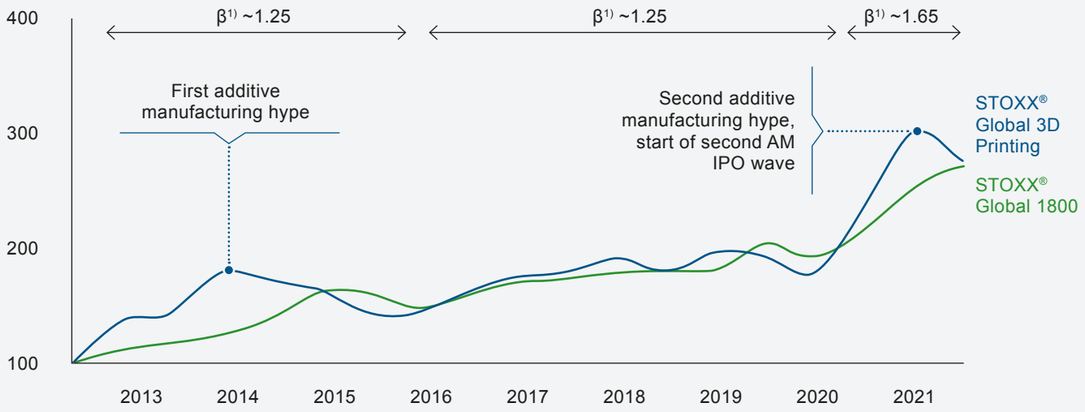
2 / New IPOs, M&As and funding indicate an active market

A glance at the stock market and how AM companies have performed compared to the market in general clearly reveals the additive manufacturing hype that blossomed around 2015. AM stocks then hit another peak in the latter half of 2021, outperforming the stock market as a whole. In part, this trend seems to have been caused by media attention on the numerous IPOs in 2020 and 2021, starting with Desktop Metal and culminating around the public offering of Velo3D. Many other companies took advantage of this high point in 2021 to also raise money through special purpose acquisition company (SPAC) IPOs. This form of public offering follows an accelerated timeline and is preferred by "younger" companies with substantial capital needs. In 2022, further IPOs have already been announced on the AM market, and there is as yet no visible sign that the influx of money might be ebbing. → B

2021 was also an outstanding year for deal-making in the AM industry, with a record 47 deals closed. The total disclosed deal value of above EUR 2 billion and an average deal value of over EUR 100 million suggest that the AM market

B / Stock development of additive manufacturing companies against general market development

1st and 2nd additive manufacturing hype [indexed to 100 in 2012]

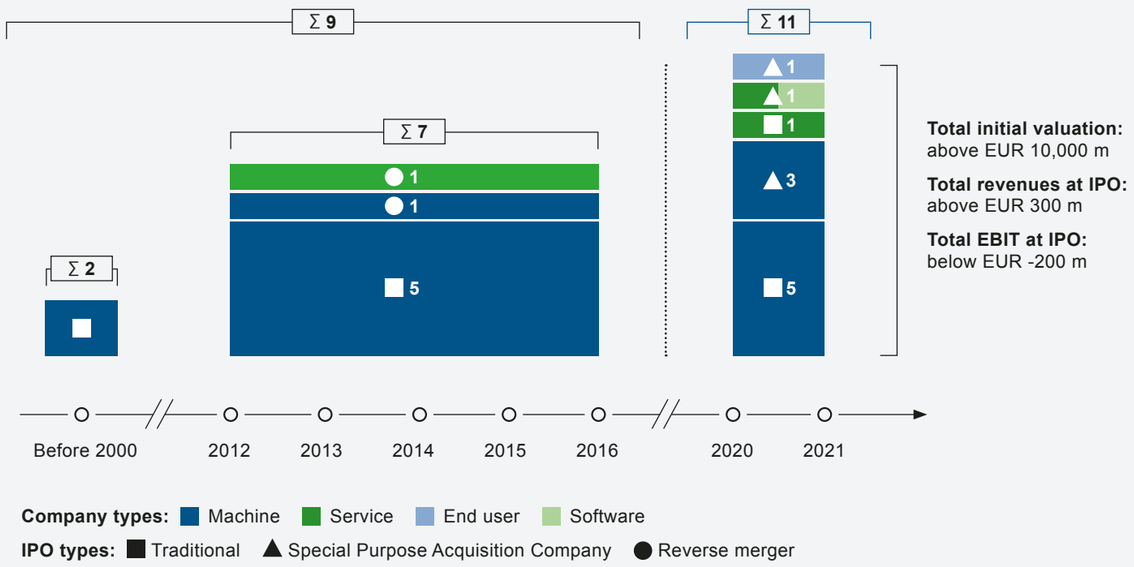


1) Raw beta of Stoxx Global 3D printing vs. Stoxx Global 1800

Source: Stoxx, Roland Berger

C / In 2020/2021, significant number of IPOs were announced with a large amount of capital raised for the AM companies

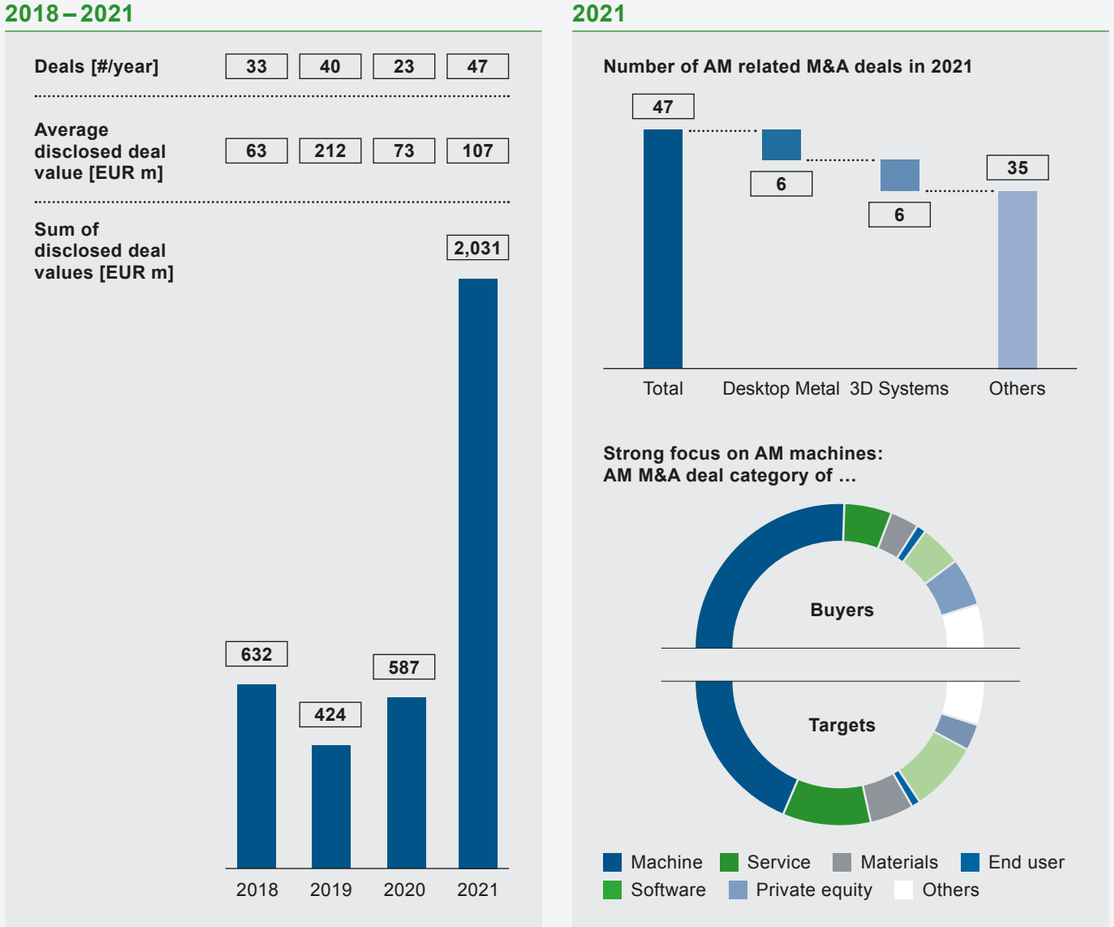
AM related IPO history and near future



Source: Capital IQ, company information, Roland Berger

D / 2021 was an outstanding year for additive manufacturing related M&A deals, with 47 deals

Overview of AM related M&A deals, without IPOs



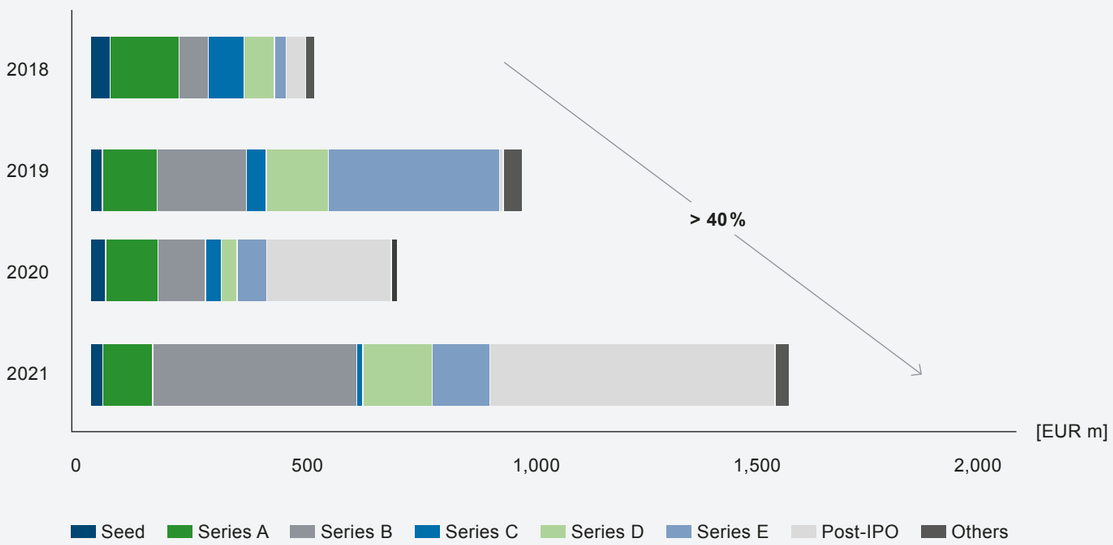
Source: Capital IQ, company information, Roland Berger

landscape is changing continuously as more money is invested. AM machinery companies in particular were the most active on both the buyers' side and as the targets of recorded deals. Initial signs of consolidation are emerging, with big AM companies such as Desktop Metal acquiring six other firms and 3D Systems acquiring four and selling two in 2021, while most revenue multiples may not exactly be bargain buys, at around one to a maximum of 25. To set this in context, a company operating at 10% EBIT margin that is valued at a revenue multiple of one means its EBIT multiple is 10. Double-digit growth rate expectations will nevertheless likely lead to numerous deals in 2022. → C, D

It is interesting to note that, if post-IPO funding is excluded, yearly injections of capital fell back to the 2019 level of roughly EUR 1 billion in 2021. However, when post-IPO funding is included, funds raised in 2021 surge past EUR 1.5 billion, which translates into an annual growth rate of more than 40% from 2018 through 2021. As early-stage funding, too, is increasing, more and more startups are expected to hit the market with fresh innovations, products, software and services in the years ahead. In other words, more market players are expected to enter the AM market with commercial offerings. → E

> *"The AM landscape is changing with every deal completed in the industry, and the pace of technological development is high, too. Investors need to understand the entire market to make their investments work."*
>
> **Tim Femmer**
> Project Manager

E / Funding in the additive manufacturing
Investments by category, incl. post-IPO funding, 2018-2021 [EUR m]



Source: Tracxn, Crunchbase, Roland Berger

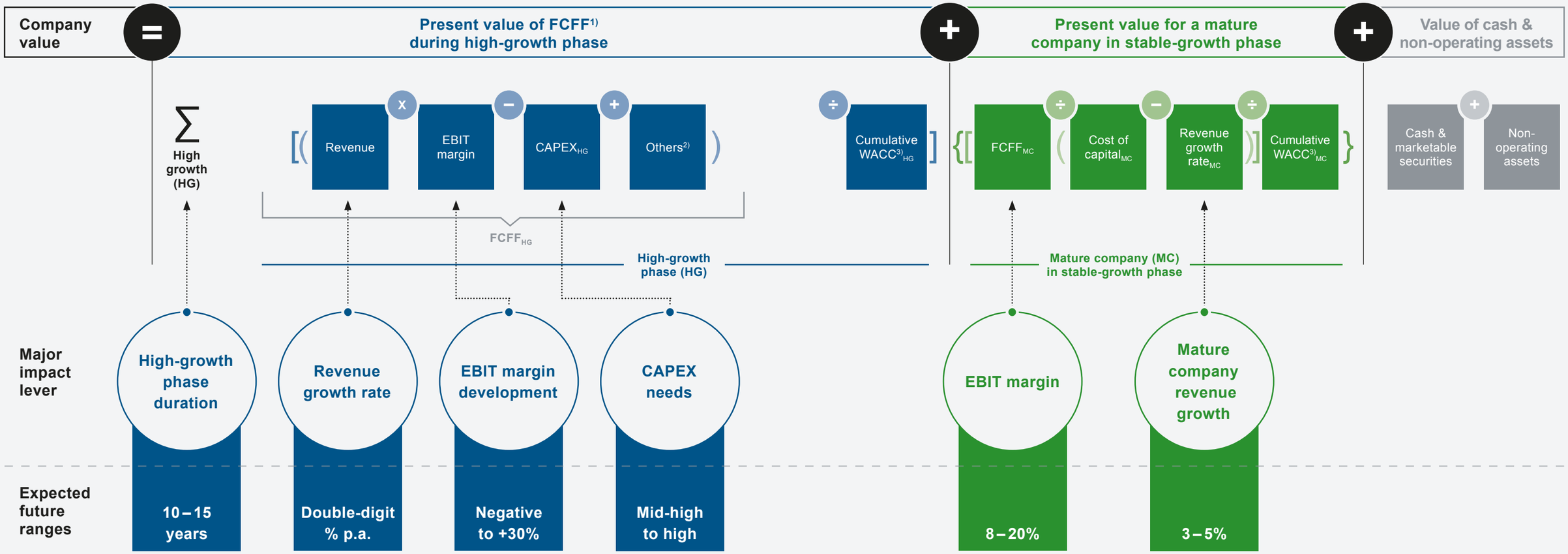
3/ Current and future expectations based on a discounted cash flow model

All investors must ask themselves one question: Does the price tag on the target company reflect its fair value, or has it been overblown by a hot market? Analysis of discounted cash flow values permits the main valuation levers to be identified during the high-growth phase and, for mature companies, in the stable-growth phase. We believe that the valuation of AM companies – when the expected ranges are based on public markets reports – will be flawed or distorted. There is no question that expected future ranges in the free cash flows to firms (FCFFs) formula correlate closely to the positioning of the company within the AM value chain, i.e. whether it is a materials provider, a machinery OEM, an AM service company or a software firm. Given that there are more than 15 different additive manufacturing technologies in metal and polymer printing alone, the AM market is enormously complex. A clear understanding of the AM company's business model and its competitive positioning is thus crucial to drive the company's success today and in the future. Analysis of pure-play AM companies with public disclosure shows that 50% of them grew at double-digit rates from 2019 through 2020. Overall, the market today is dominated not by highly profitable companies – only one in three reports positive EBIT – but by companies with ambitious business plans that describe sizable future profits. Capital requirements are steep for AM companies, as are investment ratios: Short product variant lifecycles prevail in the AM machinery space, i.e., each new machine generation has to cover its own R&D expenses, marketing and customer acquisition costs. Given the current dynamics of the market, this trend will continue in the years to come, so there is obviously a clear risk that companies may bleed red ink for a prolonged period. In addition, signs that part of the market is at the forefront of commoditization have limited projected EBIT margins for stable companies in mature AM industries. These are expected to be around 8 to 20% – comparable to the mechanical engineering sector. On the other hand, some AM companies are evidently showing the way forward, addressing the right customer needs in the right market segments and realizing highly profitable use cases. → F

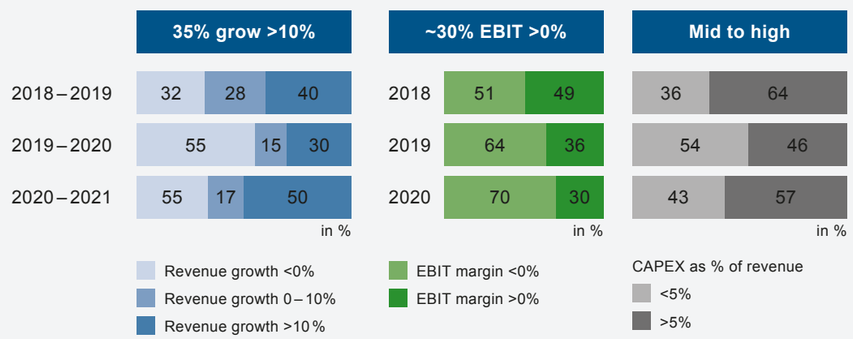
> *"A lot of AM companies are already on the market and new companies are joining the fray. Chinese companies are advancing, and companies need a clear USP to succeed."*
>
> **Max Schaukellis**
> Senior Consultant

F / Levers in the DCF valuation

Main levers in the discounted cash flow model valuation



Current market situation of pure AM companies[4]



1) FCFF: Free cash flow to firm; 2) +Depreciation & Amortization -Taxes -ΔNet Working Capital; 3) WACC: Weighted average cost of capital;
4) AM company sample size ~50 companies with dominant business in AM, incl. 10 publicly listed companies and 40 publicly disclosed financial statements

Source: Capital IQ, company information, Roland Berger

4/ What future innovations can disrupt this industry?

The additive manufacturing market landscape is changing constantly and at a rapid pace. Every move, every deal, every new IPO, market entry or successful funding round makes the market an increasingly complex ecosystem. The industry is experiencing forceful innovation across the board, from materials to machinery to software and services. Large-scale metal AM production systems and metal binder jetting machines are hitting the market right now, and a look at the AM innovation roadmap reveals further potential ahead. Continuous fiber composite systems, for example, produce parts that are lighter than aluminum but stronger than metal. This fact, combined with affordable machine prices, make this a very interesting technology for medium-sized to large parts – such as bicycle frames – that need to be extremely strong and lightweight. A further concept that should be on people's watchlist is changes in the laser exposure concept. Currently, all lasers generate focused dots, rather like a pen. Movement of the laser gives exposure to a line, and the consecutive exposure of many lines covers an entire area. However, this is time consuming compared to the diode laser concept, which uses multiple lasers to expose an entire area simultaneously. Faster exposure speeds are expected to bring costs down, opening the door to applications for which AM is still too expensive today. An even greater increase in printing speeds is realized by enhanced continuous liquid polymer resin printers from Azul and Nexa3D. These printers give exposure to entire areas and jump even more quickly from layer to layer, thanks to an intelligent and continuously flowing interface between the solidified part and the liquid resin at the point of exposure. Additional concepts, such as holographic printing from the likes of Spectroplast for silicon materials, combine new materials with enhanced exposure concepts, especially for medical applications. Beyond that, new software developments in the AM space are optimizing processes and

> *"The number of innovations in the AM space is tremendous. Each innovation opens a new window of opportunity to change the AM market."*
>
> **Miguel López**
> Consultant

> *"There is no one-size-fits-all solution on the AM market. Each application is different and requires a unique skill set and combination of design, material, machine, software and post-processing."*
>
> **Jonas Quarder**
> Consultant

increasing the number of industrial 3D printing adopters. Parts hatching and toolpath optimization are the focus of work for a good number of startups whose goal is to speed up print times and boost machine productivity for multiple AM technologies. Quality assurance for metal laser powder-bed fusion is another developing field that has evolved from melt pool data acquisition to actual melt pool monitoring. It allows engineers and operators to detect and fix problems with build jobs – or simply make the decision to stop printing, which saves time and slashes the number of scrapped build jobs. → G

Sales platforms are gradually moving from prototyping to the industrial space by offering higher quality standards. This is the case for Makerverse, a new platform released in early 2022. Industrial-quality sales platforms have the potential to provide an alternative to direct setup of contract manufacturing. The parts feasibility assessments conducted for B2C marketplaces are mature enough to emulate the judgment of an experienced AM engineer. We are also seeing innovation in post-processing: The removal of support structures from metal AM parts has always been a process that requires considerable manual effort. Nowadays, the availability of solutions such as electrochemical processing facilitates the automated removal of support structures and the simultaneous smoothing of surfaces in an electrochemical process. Similarly, minimizing manual part interaction in the post-processing chain increases both repeatability and the consistency of part quality. Bearing in mind that these examples touch on only a tiny selection of future developments, there is definitely more to come in the future. The key to future success in the AM industry, however, will be the ability to combine those skill sets that address customers' specific needs. Only players that know how to do this and can thus position themselves in the "sweet spot" will ultimately win the race.

G / Potential new technological developments that could change the AM landscape

Metal, polymer, software and post-processing AM innovations

	Metal		Polymers			Software		Post-processing
	Large, multi-laser L-PBF machines	**Binder jetting developments**	**Diode laser systems**	**Continuous fiber composites systems**	**New continuous liquid systems**	**Advanced laser path generation and melt-pool monitoring**	**Industrial quality sales platforms**	**Hirtization**
Key advancement	• Increase build size of metal AM parts up to approx. 1 m³ • Increase of build speed enabled by increased number of lasers (up to 12)	• Increase of metal AM build speed (but at lower part performance) • Significant reduction of costs compared to other metal AM technologies	• Innovative exposure concept with diode laser array of up to 1 m laser spots • Significant increase of build speed and reduction of costs	AM of fiber reinforced materials with superior mechanical properties compared to other polymer and metal materials	• Innovative continuous-exposure concept enabled by liquid interface between solidified resin and resin tank • Significant increase of build speed compared to SLA/DLP	• Optimization of laser paths during slicing and hatching • Simulation, monitoring and control of melt pools • Increasing number of established players and startups entering the field	New B2C platforms that include AI-based tools for part identification and feasibility assessments, as well as verification of production quality to meet industrial standards	Electrochemical process for the removal of support structures and the reduction of the surface roughness of 3D-printed metal parts
Assumed impact	Expansion of addressable metal AM part portfolio to large-scale parts in the automotive, turbomachinery and space industry	Expansion of addressable metal AM part portfolio to more price sensitive applications in the automotive industry	Significant expansion of addressable polymer AM part portfolio to complex and high-value injection molding parts	Expansion of addressable polymer AM part portfolio to applications with need for high-strength and low-weight materials	Possibility to push many serial applications for 3D printing, opening a new cost window for 3D printing close to conventional techniques	• Reduced printing times and increase of productivity • Reduction of scrapped build jobs	Simpler and quicker AM adoption for players without own printing capacities	Automation of post-processing to lower manual work and increase repeatability as well as quality
Time to impact								

Industrialized — 4–5 years to industrialization

Source: Company information, Roland Berger

CONCLUSION

Clearly, additive manufacturing can become a booming market in the future. It is poised to go beyond prototyping and stake its claim in industrial production. However, it is not yet clear when its breakthrough will come. Innovation is coming thick and fast in so many key areas, transforming AM into a dynamic and increasingly complex ecosystem. And as a cutting edge digital manufacturing technology, it has caught the imagination of industry and investors alike. Crucially, then, the money is there. Besides soberly separating hype from reality, smart investors must now keep a close watch on the many potentially disruptive innovations that can very quickly give completely new shape and direction to the entire AM space. If they do so, the smart money will continue to drive a fast-growing and seemingly crisis-resistant segment that, even now, is developing an attractive new value proposition in the near future.

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