HTGF Deep-Tech Matrix

A Framework for Equity Story Planning and Fundraising Success

Authors: Gernot Berger, Olaf Joeressen, Yann Fiebig

Introduction of the HTGF Deep-Tech-Matrix
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In this article, we present the HTGF Deep-Tech-Matrix, a new model for better understanding and planning the equity story of deep tech startups. It is based on two key dimensions: technology readiness and certainty for a huge market. The article explains which dominant factors these two dimensions comprise and why they require special attention for successful company development. The HTGF Deep-Tech-Matrix aids in better planning of company development and identifying value inflection points. The matrix and a consistent taxonomy for deep tech startups enable harmonization of expectations between startups and investors and facilitate a common understanding of equity stories that promote the growth of large and successful companies.

1. Introduction

Investments in deep tech startups provide significant benefits both financially and societally. Many venture capital firms find these startups attractive as they have achieved a higher internal rate of return (IRR) compared to traditional tech investments. Deep tech startups also have a higher likelihood of becoming unicorns and offer greater scalability and resilience against market fluctuations. In addition, these companies often can establish IP barriers that ensure long-term competitiveness. Europe continues to have great potential to expand its position and become the global center for deep tech due to the intensive research land-scape and the strong concentration of talent. This environment can serve as fertile ground for the creation of new deep tech startups, which have the potential, if successful, to create new industries, offer attractive employment opportunities, promote innovation and help solving global challenges.

However, despite these enormous advantages, deep tech startups often struggle with fund-raising. Although there are more and more funds with a deep tech focus, the fundraising process is often difficult, inefficient and expensive for all stakeholders involved. The conversion rate of initial investor conversations to commitments is low, often in the singledigit percentage range. And sometimes startups and investors realize later that they would have been a good fit. Clearly, existing reports, recommendations, napkins, requirement checklists and sample pitch decks have not resolved this persistent discrepancy.

Drawing on our experience, the experiences of our deep tech startups, discussions with late-stage investors, including insights into their decision-making processes, and systematic analysis, we have developed the HTGF Deep-Tech-Matrix. We believe this matrix represents the missing piece of the puzzle.

2. Approach
a. Analysis of the HTGF portfolio for the success factors of deep tech startups

HTGF is the most active early-stage investor in Germany and one of the most active in Europe. Since 2005, nearly 800 investments have been made, of which more than 200 can be categorized as deep tech. This large number provides many insights and offers critical understanding regarding the development of deep tech startups. To determine what sets deep tech startups apart from other companies, we defined a list of over 40 parameters and gathered extensive data from historical and active startups.

The parameters included obvious indicators such as financing dynamics, volume of financing rounds, valuations, intervals between financing rounds, or dilution of founders. Other relevant parameters were related to the team, including the composition of the team, and the structure of the company before the first equity financing round. In addition, we considered also less obvious parameters. These included, for instance, the evaluation of research efforts conducted prior to the founding of the company (resources, relevant publications, patents, etc.) or the assessment of success in acquiring non-dilutive funds or spin-off conditions (e.g., IP transfer from the university). In terms of technology, we compared parameters such as the level of development prior to the initial investment, the level of innovation, an estimation of technological challenges, etc. Finally, we analyzed various market-related parameters, including e.g. unit economics, traction, market size, dynamics, market understanding, etc.

The review of all parameters indicated that successful deep tech startups differed from non-successful ones, particularly with regard to their understanding of their current and future technology readiness and market position.

They had developed a significantly better understanding of their equity story. Other parameters, for instance team, IP, the volume of grants raised or the structure of the company, are of course still relevant. However, these criteria were also fulfilled just as well by less successful or even insolvent startups. As described repeatedly in other reports, some of the criteria remain basic requirements – for example, a strong team. In terms of the extent to which these known, mandatory prerequisites are fulfilled, we did not discern any clear correlation for success or non-success (in our portfolio, i.e. companies that at least received initial investments). The systematic and consistent difference for success or non-success in later financing rounds among deep tech startups always seems to relate to the two parameters mentioned. To further validate this hypothesis, interviews were conducted with late-stage investors.

b. Interviews with late-stage investors

The central question in our interviews with late-stage investors was: "What key factors determine the successful financing of deep tech companies, especially in Series A and Series B?" The investors' answers provided crucial insights into the assessment criteria and also highlighted problems in accurately classifying deep tech startups. The interviews of 15 different late-stage investors showed a high degree of consistent observations.

Team

A strong team was a must-have for all investors. It should be able to execute the technology development and manage market risks.

Tech

For all investors surveyed, a solid scientific foundation was of central importance. A solid tech or IP stack, which often includes trade secrets and patents, is considered to be the basis for a sustainable competitive advantage ("moat"). While Series A still carries engineering risk, most investors believe the scientific work should be complete (e.g. "Series A = Engineering risk remains, Science is done. Not necessarily revenues, but customer interaction with PoCs, LOIs, etc."). The requirements for these criteria vary depending on the startup's phase. Startups facing both an emerging market and low technology readiness (so-called "double bets") were excluded by all investors and would not be funded

Go-to-market strategy

Some investors consider a clear go-to-market strategy (GTM) and initial traction to be crucial. For other investors, revenue is not necessarily required. They assess existing interaction with customers and appropriate validation through other indicators such as proof-of-concept (PoCs) projects. In line with other reports, investors expect the scaling of software as more expensive than hardware, due to the typically high marketing costs and the lack of a "long tail," i.e. a business model where cumulative revenue is driven by selling many niche products or serving numerous small customer segments. Hardware, on the other hand, takes longer to start scaling but is easier to scale once a product-market fit (PMF) is achieved. Another important factor is the proof of value, which should have been confirmed.

Fundraising requirements

However, due to the often very long product development cycles of deep tech, the classical taxonomy of Series A, i.e. the starting point for commercial scaling, is usually not viewed as appropriate. Several investors consider Series A as a "second round" and do not expect revenues but still high technological risks (e.g. "We consider a Series A in deep tech as the 2nd round, with TRL 5, no revenues, high risks – in our view this is rather still Seed."). A current problem in the deep tech sector is the lack of successful exits that could serve as clear role models (suitable north stars). This makes it challenging to present the exit perspective in emerging markets.

3. The deep tech disconnect, taxonomy and metrics

This section discusses the indicated disconnect between investors and deep tech founders in detail. In the subsequent chapter, the HTGF Deep-Tech-Matrix is then introduced as a solution to the problem and a tool for analysis and planning.

For deep tech founders, the commercial potential of their invention often feels undeniable. They have achieved breakthrough technology in their labs, secured strong intellectual property rights (IPR), and the way to provide disruptive benefits to customers is obvious. They have world-class experts on board and more knocking on their doors. The path forward appears clear: taking the technology out of the lab, growing the team, and unveiling innovation to the world. The opportunity is tangible, and raising money should be easy! Venture capital firms should be queuing up! However, many founders encounter significant friction with investors who often dismiss the opportunity as "too early" or express concerns about the absence of revenue, capital intensity (CAPEX), or scalability.

Clearly there is a disconnect between the startup's offering and the expectations from investors. This disconnect is mostly not due to a lack of quality or potential on the startup's side but originates from a fundamental misalignment. Traditional VC models have been largely shaped by funding software startups in the last 20+ years. And in SW/SaaS the world is different.

SaaS and software startups typically operate using lean structures, leveraging standardized (e.g. cloud-based) infrastructure. This allows them to develop, iterate, and optimize prototypes and products quickly, often with a small team. Because the technical entry barriers are relatively low, differentiation is rarely based on unique technology. Instead, success hinges on rapid iteration, superior user experience, and aggressive go-to-market execution. Startups must outpace competitors by moving fast and building brand visibility—often requiring significant marketing investment. As a result, speed and execution excellence are of the essence and determine the success of the startup.

When Software startups raise money, they typically have a minimum viable product (MVP) and some initial user or customer validation. They either crack the market within two years and start scaling rapidly, or the story is over (and the investment is gone). Venture capital firms, therefore, prioritize evaluating the team, the MVP, and initial customer validation. The factors—speed, execution capability, and initial traction—are central to the SaaS investment thesis.

Deep tech timelines
at the core of the disconnect

Due to the necessity to develop a physical product and build capacity, deep tech companies start scaling revenues later.

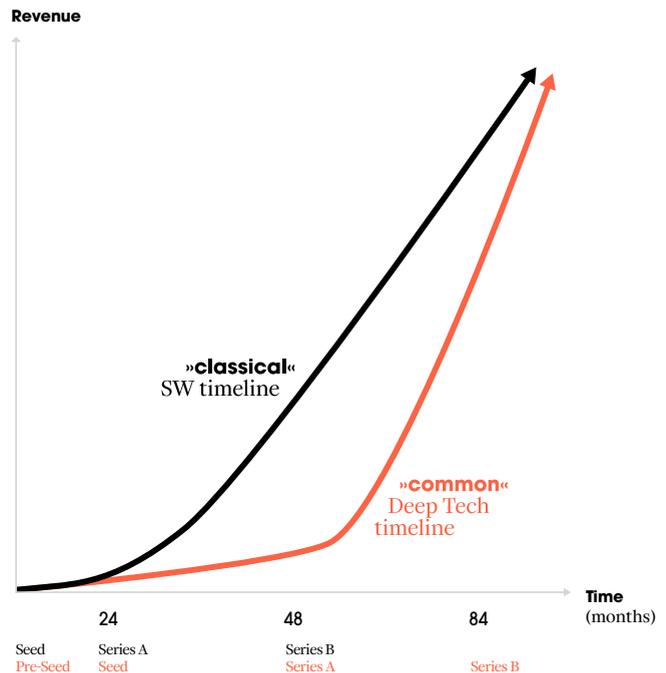We estimate the time from founding a company to the point of scaling to be

24 months for Software SaaS   >48 months for Deep Tech

But after 7 years revenues are comparable*

This creates
a disconnect with traditional VC-Expectations

Deep-Tech Funding
starts at „pre-Seed"

Revenue

»**classical**«
SW timeline

»**common**«
Deep Tech
timeline

Time
(months)

	24	48	84
Seed	Series A	Series B	
Pre-Seed	Seed	Series A	Series B

However, this pattern does not apply to deep tech startups.

In deep tech, a scientific or technological breakthrough is the foundation. Startups must build a physical product. Reaching a product prototype that can be tested and then scaled with customers requires several (around four) years of technical development. This includes assembling a full team and transitioning from lab to fab before sales ramp-up can begin. Often, significant funding and high capital expenditure are required to create first-of-its-kind (FOAK) solutions, including FOAK production facilities. Once this stage is achieved, the difference provided to customers is disruptive. Based on scientific findings and newly implemented principles, the startup enables its customers to approach a key problem completely differently or to solve it for the first time. Accordingly, its narrative must center around that unique, massive customer problem that only the startup is capable of solving.

<u>a. The deep tech connect</u>

It is apparent that the disconnect between deep tech and typical software developments can be attributed to their inherently different nature. It is therefore even more important for deep tech founders to be able to effectively articulate their deep tech narrative to successfully engage with other stakeholders, particularly investors and customers. From our point of view the following key points are indispensable and must be included in the narrative:

Focus on the massive customer problem that is being addressed (for the first time) and that creates a disruptive opportunity. For the first funding round, initial positive feedback from potential customers about the problem and a potential product should be obtained to make the case.

Demonstrate how the unique science/technology breakthrough, that nobody else can copy, will be able to address that problem and why the team can develop a fitting product.

Outline the full financing roadmap, starting with pre-seed. As development takes much longer, often more than three or four years, before customers start scaling the product, two financing rounds should be planned before Series A, which is traditionally associated with the start of market scaling in software/SaaS. Highlight the major steppingstones of this journey.

In summary, SaaS startups iterate rapidly, scale without significant CapEx, and demonstrate traction early. Deep tech, by contrast, requires years of development before a product reaches the market. Consequently, success in deep tech demands a new playbook.

To help creating the startup-specific playbook we have developed a new tool, that is introduced next.

b. Expectations in the various phases

(Metrics and Requirements)

The following table provides a structured overview of key performance indicators (KPIs) and investor expectations across each funding stage defined in the suggested taxonomy. These metrics span several critical aspects: Technology Readiness Level (TRL), market validation, customer traction, team, funding volume, and valuation.

	Pree-Seed	Seed	Series A	Series B
Tech	TRL 4 Unique/Disruptive Science Identified IP Protection started	TRL 5 Small scale demo working first IP granted	TRL 5/6 MVP ready for product engineering execution Science proven more IP filed	TRL 8/9 Product ready for Scaling
Market & Product	Application Hypothesis exists Potential Market disruption identified	Disruptive Target application & Customer Problem are identified Huge Market identified	Application & Pain point confirmed incl. quantified value hypothesis	Data based GTM strategy defined & execution started Expansion strategy defined
Commercial		Business case hypothesis discussed with customers Buying center & Purchase motivation understood	PMF understood and quantified Payed PoC Implementations >100k€	PMF proven USP & Value proven Pricing reflects value add Pipeline value >10M€
Team	Science covered in the team Candidate for real Product Leader	Successful hiring of key contributors across Org-Chart Functions	Organization prepared for Engineering execution C-Level extension / re-org as required	Organization prepared for scaling Key people ready for joining or on board
Round Volume	1–5 M €	3–10 M €	>10 M €	>20 M €
Pre-Money	3–10 M €	5–30 M € (1.2–2.0 x Post-Money)	12–80 M € (1.5–2.0 x Post-Money)	>100 M €
Revenue + Orders	0 €	0–0.5 M €	0.1–2 M €	>5 M €
Public funding	50 %	50 %	25 %	10 %

The metrics are based on analysis across the HTGF portfolio and aligned with external research. They are intended as directional guidance, not rigid thresholds – helping startups benchmark their development and structure their fundraising with investor expectations in mind.

Importantly, grant funding should be viewed as complementary, not equivalent to equity investment. While grants offer non-dilutive support in early phases, venture capital brings strategic value, including industry insights, business development support, and scaling expertise.

4. The HTGF Deep-Tech-Matrix

The HTGF Deep-Tech-Matrix can be utilized to plan and explain the journey of deep tech startups, as well as identifying the primary challenges along the way. The Matrix is based on the two dimensions "technology readiness" and "market". Of all the parameters examined in our analysis, these two (as detailed below) stand out in particular.

Technology maturity or readiness can be described by employing the familiar TRL (technology readiness levels) terminology. Successful deep tech startups know precisely when each individual technological step will be reached, which exact sub-steps have to be accomplished, which milestones are required, and what can already be presented to customers as a product. They have a better understanding of the required

transition from scientific discovery to engineering execution and know when their technology is ready for market implementation.

Understanding market dynamics is the other essential dimension that is often underdeveloped in deep-tech startups. Our investigation shows that late-stage investors, above all, evaluate whether a market is proven or unproven, early or mature. And of course, they assess the size of the addressed market and the dynamics, i.e. expected growth potential, in the market.

ⓘ

Hence, the HTGF Deep-Tech-Matrix visualizes the positioning of a deep tech startup across these two dimensions:

The Technology Readiness Level (TRL)
reflects the degree of maturity of the core technology and adheres to standard and widely recognized definitions (e.g. NASA TRL standards or EU Horizon framework): From scientific breakthrough (1-2), proof-of-concept (TRL 3–4), demonstra-tion in the addressed field (5-6), to production-ready (TRL 8–9).

The Market dimension
encompasses several parameters that assess the certainty for a huge market. It spans from unclear market potential to proven blockbuster markets (>€100B). Our analysis indicates that the essential differentiators are unproven vs. proven market, market size, and expected dynamics.

To facilitate the use of the matrix and enable effective comparison across different cases, it is crucial to maintain a consistent nomenclature rather than defining an excessive or insufficient number of clusters (rows and columns). Each "cell" in the matrix represents a specific combination of technological maturity and market evaluation. The journey of a successful deep-tech startup can be visualized as a stepwise progression through this matrix, with the aim of moving to the top-right, that is, ready-to-scale technology in a proven large market. Let us walk through the key zones step by step and define the taxonomy:

Technology
Readiness Level

Engineering Execution	9	Series B
	8	
	7	
	6	Series A
TRL	5	Seed
	4	Pre Seed
Proof of Concept	3	
	2	No Money
Scientific Breakthrough	1	

1	2	3	4	5	6
unclear if there is a market at all	Niche market	Established niche, first indications of scaling	High momentum, clear indications of scaling	Mainstream Market (>10 bn. €)	Blockbuster Market (>100 bn. €)

unproven   **proven**

Market
Certainty for a huge market

1. No Money Land

Many scientific projects start here—deep in fundamental research with unclear application or market demand. Here, the technology may be impressive, but it lacks a use case. There is no commercial traction, no defined customer, and no clarity on the market opportunity. A startup in this zone is typically not investable from a VC perspective – the balance between market opportunity and TRL is considered not attractive. Another category of startups that fall into this zone are startups that are already well advanced in terms of technological development (e.g. TRL > 6), but there is no attractive market in sight for the planned product. This is often summarized in the term "technology in search of a problem". These cases are also a reason why the curve does not reach the vertical axis, and even startups with TRL9 of the product are unable to raise money. A similar argument applies to the curve close to the horizontal axis. As long as technology is still too far in fundamental research and there is no validation of the concept at all, financing through VC is practically impossible. Accordingly, the curve cannot reach the horizontal axis.

2. Pre-Seed Zone

Once a credible use case hypothesis emerges, supported by early technical feasibility and IP, a project moves into pre-seed territory. The goal at this stage is to show that the technology can address a relevant customer problem and that initial interest or feedback supports market potential. It is about moving from a "technology push" to an "application pull". This stage is grounded in a solid scientific foundation and structured formulation of several relevant use-case hypotheses.

3. Seed Zone

In this phase, the startup validates its core application through customer interactions—such as letters of intent (LOIs), pilot projects, or paid proof-of-concept engagements. Technological development advances to small-scale prototypes or demo systems. Teams start growing, and execution planning begins. Initial customer validation, early signs of traction, and preliminary demo implementations are key. The target application is identified and refined based on early customer feedback.

4. Series A Zone

This is usually a significant milestone in the journey of deep tech startups. With science risk resolved and a successful proof-of-concept, the focus shifts to engineering execution and commercial validation. Key elements at this stage include a minimum viable product (MVP), successful technical pilots, initial commercial contracts or orders, and a credible go-to-market (GTM) strategy. The use case must be clearly validated—both technically (no remaining science risk) and commercially (customer engagement and order intake).

5. Series B Zone

By now, the product should be ready to scale. This stage is about proof of repeatability and market expansion. A robust GTM strategy must be in place, backed by real market data. Revenue traction becomes critical, and market potential must be clear and quantified (i.e. market size in the billions). At this point, both the scalability of the GTM strategy and the existence of a significant market opportunity must be convincingly demonstrated.

The HTGF Deep-Tech-Matrix is an intuitive tool that combines the taxonomy, requirements of investor, and essential valuation factors for startups. It acts as a roadmap, aiding startups in planning their equity story, setting meaningful milestones, pinpointing pivotal moments, developing a coherent narrative, communicating effectively, and meeting investor expectations. The matrix includes comprehensive descriptions of each phase, the defined milestones, and actionable insights for startups. It creates a much-needed common language for deep tech investments.

Case studies

To illustrate how the deep tech matrix is applied in practice from our perspective, several case studies of successful deep tech start-ups are presented. These case studies show how the matrix can be used to guide start-ups through their development, overcome challenges and fundraise successfully. The examples show the effectiveness of the matrix in different industries and technology areas.

2023   Proxima Fusion

2012   SimScale

Example: Proxima Fusion ⊙ proximafusion.com

Elevator Pitch

Proxima Fusion aims to build a commercial fusion power plant – offering safe, clean, and limitless energy.

Description

Proxima Fusion is advancing early-stage fusion power technology, aiming to deliver safe, clean, and limitless energy. While the basic principles of their technology have been validated, the company is in the nascent stages of development with significant technical risks tied to a still low Technology Readiness Level (TRL). Their path forward is defined by clear milestones, meticulously outlined sub-steps, and a focus on overcoming engineering challenges. Operating within the expansive and mature energy market, valued in the multi-trillion-dollar range, Proxima Fusion's equity story is bolstered by investor conviction in both the feasibility of implementation and the capability of their world-class team to bring this transformative technology to life.

Matrix Journey

Proxima's journey follows basically a vertical line from the bottom right to the top right. The company addresses a massive, well-understood market (energy) – i.e. market column 6 –, but with high TRL risk, starting at around TRL 2. Therefore, their equity story focuses on overcoming technological challenges with clearly defined milestones, precisely described sub-steps, and extending the team. The bubble size in the matrix refers to the volume of the respective financing round. Their ability to define a de-risking roadmap is critical to investor interest. Despite being early in TRL, the clarity of market potential and planned engineering path makes the opportunity compelling.

»Moonshot«

Technology Readiness Level

9

8

Engineering Execution 7

6

TRL 5

4

Proof of Concept 3

2

Scientific Breakthrough 1

Series B

Series A

Seed

Pre Seed

No Money

1	2	3	4	5	6
unclear if there is a market at all	Niche market	Established niche, first indications of scaling	High momentum, clear indications of scaling	Mainstream Market (>10 bn. €)	Blockbuster Market (>100 bn. €)

Market Certainty for a huge market

unproven   proven

Example: SimScale

⟩ simscale.com

Elevator Pitch

SimScale democratizes access to high-performance engineering simulations via the cloud.

Description

SimScale's mission is to democratize access to high-performance engineering simulations by leveraging the power of cloud technology. Traditionally, the market for engineering simulations has been dominated by professional 2D and 3D CAD tools, with penetration among simulation experts reaching saturation in the 2000s (2D) and 2010s (3D). Despite the advancements in the field (e.g. by players such as Ansys, Autodesk, Dassault, and Solid-works), simulation tools remained largely inaccessible to a majority of engineers. In large enterprises, only 1 in 25 engineers had access to simulation tools, and access among SMEs was even more limited. This significant gap in accessibility underscores SimScale's market and transformation opportunity. By moving simulation to the cloud, SimScale transcends traditional boundaries and enables a broader user base that previously lacked access to CAD technologies. This involves not only making simulation tools available online but also ensuring they are user-friendly enough to be utilized by engineers without extensive academic or technical backgrounds. The combination of an untapped market, cloud-based high-performance technology, and a focus on usability positions SimScale at the forefront of a transformative shift in the engineering simulation industry.

Matrix Journey

SimScale's journey begins in a niche market, as they are targeting users who previously did not use CAD. On the technology side, they had implemented initial functionality early, and the general feasibility was plausible – although challenging, as the functions to be implemented are based on advanced physics, mathematics, and other disciplines. Therefore, regarding the matrix representation, the journey starts in the second market column and at a TRL around 6. From there, SimScale progresses to the top right. Guided by a clear GTM strategy and effective product management, they advance through the matrix by simultaneously developing the market and strategically enhancing their technology and product capabilities. Their journey illustrates how a strong GTM strategy and consistent customer traction can turn a niche into a proven, scalable market opportunity. An essential ingredient for repeatedly successful fundraising has been an outstanding presentation of the commercial narrative, which captures the major market opportunity, specifies the sub-steps on the product side and centers on the GTM strategy.
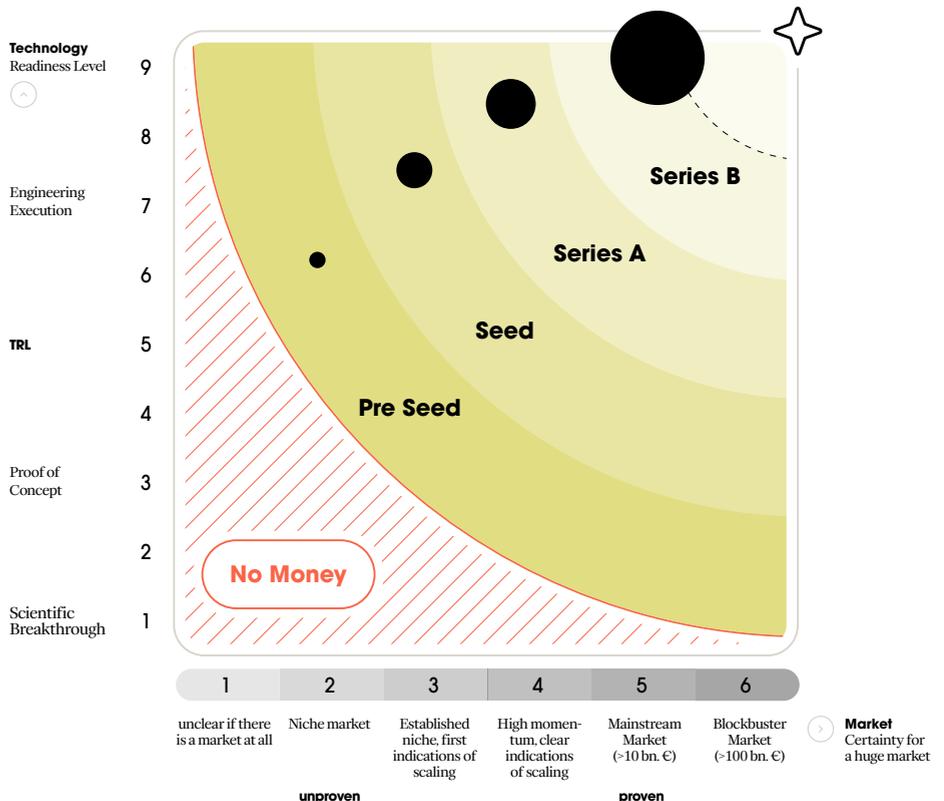
5. Conclusion

The HTGF Deep-Tech-Matrix serves as a guiding framework that enables deep-tech startups to better understand and plan their equity stories, identify value-inflection points, and effectively communicate their roadmaps. The matrix comes with a clear taxonomy and aligns expectations between deep tech founders and investors. This alignment fosters a better mutual understanding and enhances collaboration between all stakeholders by establishing a common language. For investors, the Matrix clarifies levels of complexity and de-risking appropriate for the various funding rounds. In this way, the HTGF Deep-Tech-Matrix contributes significantly to successful fundraising and the sustainable growth of flourishing deep tech companies, including the creation of new unicorns within the deep tech ecosystem.

6. Credits

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[6] Illustrationen erstellt unter Verwendung von ChatGPT und DALL·E

Contact
If you have any questions or would like to discuss
the topic further, feel free to reach out.

Dr. Gernot Berger
Senior Investment Manager

email g.berger@htgf.de

Dr. Olaf Joeressen
Senior Investment Manager

email o.joeressen@htgf.de

Yann Fiebig
Partner

email y.fiebig@htgf.de

Offices

HTGF Bonn
Baunscheidtstraße 17
53113 Bonn

+49 (0)228 823 00 100

HTGF München
Am Kartoffelgarten 14
81671 München

+49 (0)228 823 00 100

HTGF Berlin
Münzstraße 15
10178 Berlin

+49 (0)30 403 6648 00