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Semiconductor Startup Strategy – Positioning Innovation Across the Value Chain

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Many semiconductor startups begin with technology that is differentiated: a breakthrough process, component, sensor, device architecture, or materials innovation. Yet strong technology alone does not determine whether the company will become a scalable business. One of the most common failure modes appears earlier and more quietly: the startup chooses the wrong product boundary.

This mistake often starts with an attractive demo or reference design. The team connects the technology to a compelling end application, shows a believable use case, and creates something that resonates with investors, strategic partners, or prospective customers. However, the demo does not yet resolve the questions that determine whether the product can become a business: who will manufacture it, who will package and integrate it, who will own the full solution, who will sell and support it, which partners must be economically motivated to participate, and where the margin pool actually sits. In semiconductor startups, these questions are strategic from day one. They shape the company's customers, partnerships, capital requirements, defensibility, and time-to-revenue.

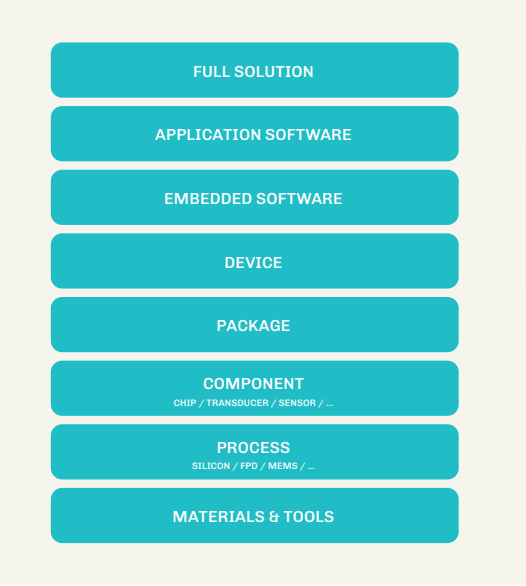
Semiconductor companies operate in one of the most structurally complex industries on earth. Unlike software or SaaS startups, semiconductor innovation spans a multilayered value chain, from the physics of materials and wafer processing to end applications and systems integrators. So, semiconductor startups cannot define the MVP by looking only at the end application or the voice of the end customer.

They must define where the product sits in the value chain and which layers the company will own, partner for, or deliberately leave outside its scope. In semiconductors, MVP definition and value chain positioning are inseparable. The MVP is the smallest defensible position in the value chain that can be manufactured, integrated, sold, supported, and scaled. For this reason, founders cannot rely on traditional entrepreneurship frameworks alone. Approaches such as those outlined in *Disciplined Entrepreneurship* or *The Lean Startup*, while valuable as general methods, implicitly assume a flexible product boundary and a minimum viable product (MVP) that resides near the application layer. In semiconductors, these assumptions often break down.

This whitepaper explains why classical frameworks fail when applied literally and why semiconductor startups must anchor their strategy in a rigorous value chain analysis. It introduces a method for determining where in the chain a startup should focus, how this relates to MVP definition and beachhead market selection, and how these early decisions influence manufacturability, margins, customer definition, defensibility, and time-to-revenue.

Understanding the Semiconductor Product Value Chain

The figure below introduces the multilayer value chain structure that defines semiconductor products:



Materials & tools

The materials and equipment used to implement the production process. Examples include lithography, deposition, and metrology and inspection tools.

Process

The fundamental process in which the basic component is produced. Some examples are CMOS process for (digital) logic chips; flat panel display (FPD) process for flexible displays and sensors; and MEMS (Micro-Electro-Mechanical Systems) process that combine mechanical components, electrical circuits, and sensors or actuators to create devices such as gyroscopes, microphones, pressure sensors, and accelerometers. Their production requires advanced to extremely advanced fabs, which necessitate high to very high investments.

Component

The component being produced by the fab, based on the engineers' design. This can be a digital chip with a particular function (e.g., processors), a specific sensor (e.g., gyroscopes, microphones, pressure sensors, or accelerometers), or an analog transducer. For a semiconductor startup, this is usually the core of the innovation.

Package

Packaging is needed to protect the sensitive component and enable it to interface and connect with other components and the external environment. These packages are also processed in fabs, but they are usually less advanced and less expensive fabs than those described in the "Process" section.

Devices

A combination of packaged components. This can be on a carrier, such as a printed circuit board, that holds the packaged components and establishes communication between them.

Embedded software

No hardware solution is complete without software. Embedded software is low-level software that communicates directly with the device(s) and provides functionalities such as initialization, calibration, and artifact reduction. It offers a programmer's interface for the application software.

Application software

The higher-level software that implements the application that will be visible to the end user. It encompasses a wide range of applications, such as AI models (which include an extensive set of applications of their own), displays, object detection, and data storage.

Full solution

The product in which the application fits. Examples include servers, smartphones, laptops, cameras, and drones.

Each layer has different actors, economics, qualification requirements, failure modes, and customer expectations. Determining which layers are covered in the MVP is an essential decision for startups. It determines their target customers, pricing, gross margins, strategic partnerships for the remaining layers, and the resulting integration and support burden.

Why MVP Positioning Inside the Value Chain Is Critical

Traditional entrepreneurial frameworks look at products primarily at the application level. The problem with these generic frameworks is that they ignore the MVP's position within the value chain.

The figure below demonstrates this. Most entrepreneurial frameworks look (only) at the application level and ask highly relevant end-user questions at the application level, as indicated in the figure. Based on the "voice of the customer," they then select one specific application as the beachhead. This ignores the fact that semicon products are, in most cases, not at the top of the application stack. This approach creates MVPs that exist only as demos or reference designs — appealing in presentations, but disconnected from the realities of process transfer, packaging tolerances, device integration, embedded firmware requirements, and application software. In semiconductor deeptech, you cannot define an MVP without defining where it sits in the value chain, as this has a huge impact on many critical factors that can make or break a startup.

Here is a list of items to consider when analyzing the value chain and defining the MVP's place within it:

Full solution

The company needs to understand the full solution and its end customer. In one way or another, the full solution must be built (almost always with partners), and sold to the end customer (probably not by the company, but by another

Customer research	Notes
End user	Who will be using the product? This person should become the champion of the product (but is not necessarily the buyer).
Application	What is the task that is dramatically improved by your new venture?
Benefits	What is the actual value that the end user would gain from using your new product? Time savings? Cost savings? Additional profit?
Lead customers	Who are the most influential customers that others look to? Early adopters and/or lighthouse customers.
Market characteristics	What about this market would help or hinder the adoption of new technologies?
Partners / Players	Which companies do you need to work with to provide a complete solution that integrates in the customer's workflow?
Size of the market	How many potential customers if you reach 100% of the market? What does this represent in Euros?
Competition	Who is a competitor from a customer's perspective?
Complementary assets required	What else does the customer need to get the full solution?

Minimum Viable Product

company higher in the value chain) in an attractively sized market.

Customers for the MVP

It will define your customers' level in the value chain and the market characteristics at that level. This has a profound impact on your sales and customer support organization, as well as the cost thereof.

Partnering to build the full solution

A thorough analysis needs to identify which layers are already covered by other suppliers. It defines your potential partners for the final application product, and clarifies which part of the solution the company can own. Failing to address this or addressing it too late might lead to an incomplete, unsellable product.

Partnering to build credibility

In most cases, startups struggle to be perceived as reliable long-term suppliers by prospective customers. Compared to incumbents, they typically operate with limited financial resources, have less leverage within the supply chain, and are inherently viewed as higher-risk partners. Customers may fear supply disruptions, insufficient support capacity, or the possibility that the startup may not survive long enough to support a critical product deployment.

For that reason, partnering with established companies is not only important to complete the full solution — it is also essential to build market credibility. Strong partners provide reassurance that manufacturing, integration, support, and long-term supply continuity can be maintained at the level customers expect.

Building these partnerships requires strategic positioning, strong negotiation capabilities, and a willingness to share part of the value creation with other players in the ecosystem. While this may reduce short-term revenue capture, it significantly increases the probability of successful market adoption and scalable growth. For many semiconductor startups, credibility through partnerships is a critical element of successful market introduction.

Win-win

You can create a partnership at a level below you in the value chain (e.g., process), alongside you (other components that complete the device), or above you (software layers or the full product). Your MVP needs to be carefully positioned to create a win-win with all partners who collaborate with you to deliver the full product. This requires careful analysis of volumes, costs, margins(!), capabilities, and capex in your startup, as well as how these factors affect the business case for your partners. The complete picture needs to align across the entire value chain.

Process suppliers (foundries) need special attention. The business case for them is driven by an attractive combination of volumes and margins. Often, the company's high-risk offer to the foundry must compete with its existing low-risk business. So, the company's proposition needs to make a compelling case for the foundries to invest time and resources in your proposal.

Time-to-market

The race-to-revenue dictates that you simplify the technical challenge as much as possible and focus on your core innovation. Startups tend to overextend themselves and underestimate the challenges and complexity at each layer of the value chain. It is more important to go to market faster in a smaller part of the value chain than to be slowed by the (often underestimated) complexity of other parts.

Expertise

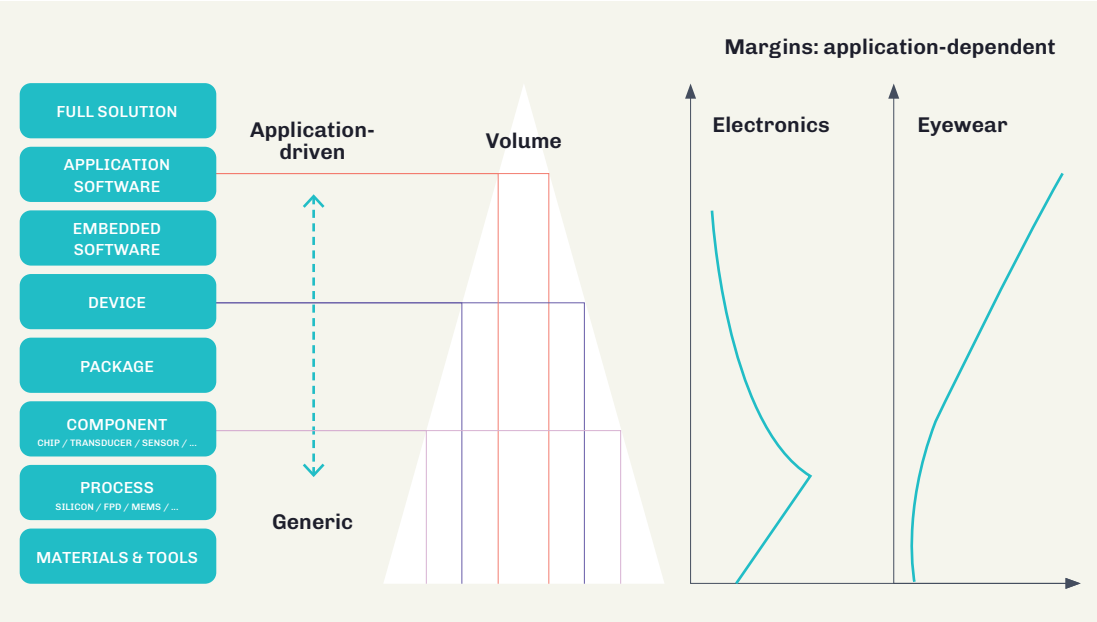
Every new part of the value chain requires new expertise, which can be brought in through partnerships. It is much harder to build that expertise in a startup, as its founders usually start from the core innovation rather than the layers around it. This is especially true with the application layer. It is tempting to think that developing the application software yourself will result in a more attractive business with higher margins. Even if this is true, the time lost to go to market to develop the application (with the startup often needing to build expertise from scratch) might mean losing precious momentum.

Moat

You need to own (at least) that part of the value chain where your technology is defensible and patented. If you need to outsource that part of your technology, you are outsourcing your secret sauce, placing the company in a vulnerable position.

Insufficient focus on the MVP's position in the value chain is one of the primary reasons semiconductor startups mess up the go-to-market, have unfinished and low-quality products or, even worse, never reach a working product. The next sections describe questions and challenges to consider when defining the boundaries of your MVP.

Generic Products Versus Application-Oriented Products



Products lower in the value chain tend to be more generic, while the higher you go, the more application-driven the technology becomes. This reflects fundamentally different strategies for the company.

We assume that when the company launches a product, part, or all of the production will be outsourced. Generic technologies lower in the value chain usually enable higher volumes. That enables easier win-wins within the supply chain and allows lower-cost production. Products on the application layer usually (though not always) enable higher margins at lower volumes, making it harder to reach a win-win with suppliers. As already stated, the business plan, MVP definition, and place in the value chain need to create a win-win situation with supply partners.

A fantastic product definition that can make the company rich, but that no supply partner is willing to produce, is a no-go!

It is also essential to consider margins at each level. Do not automatically assume that margins higher in the value chain are better. There are many industries (e.g., health system solutions) where this is true, but several others where it is not. A good example is the smartphone space, where cellular communication chipsets typically have margins exceeding 50%. However, the Android OEMs are at much lower margins due to intense competition; brand promotion, logistics, retail, warranty, and marketing costs; inventory risks, and commoditization pressure*. So it is essential to include realistic margin estimates in your value chain analysis.

* It must be said that Apple is a notable exception due to its brand recognition.

Strategic Focus: Own the Layer Where Your Differentiation Lives

A semiconductor company should be built around the layer with the strongest unique differentiator. Outsource everything else as much as possible.

Startups that try to cover too many layers dilute scarce engineering resources, extend timelines, and create failure points. Semiconductor startups often end up simultaneously managing process development, chip design, packaging, device integration, firmware, application software, and end solution — far exceeding the capabilities of an early-stage company. This often leads to missed milestones, poor product quality, and delayed customer traction.

There are cases where the initial differentiation is in a layer that the startup cannot (fully) own.
A typical example is a company with a differentiated technology process that must run in an external fab to produce the differentiating component.

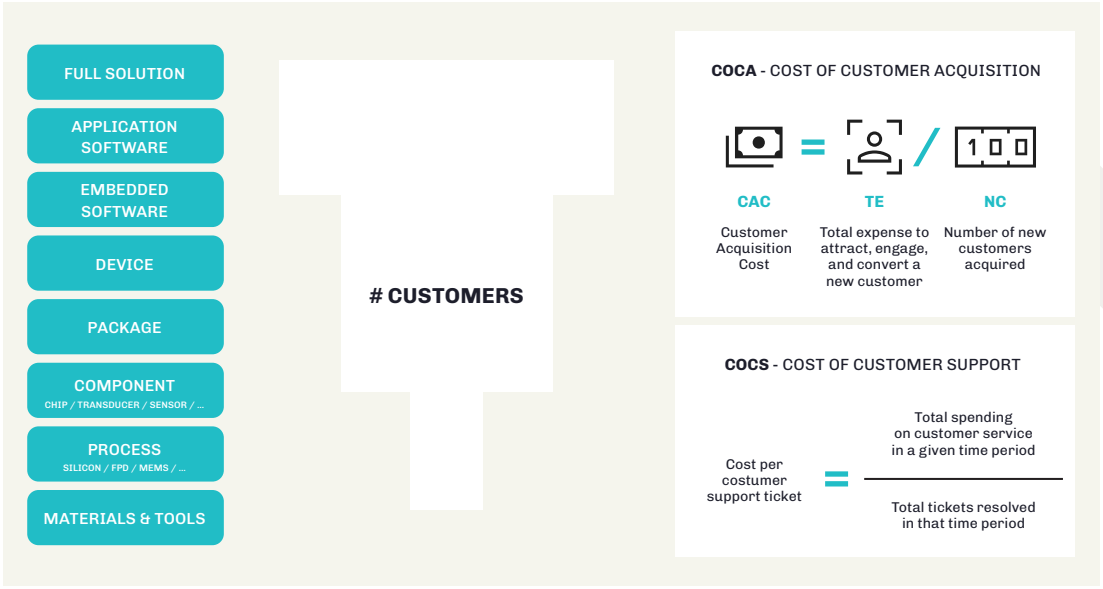
In that case, the company must build an additional moat (e.g., patents, software, or design) on top of the outsourced layer. If that is not possible, you should fundamentally question the company's capacity to become a product scale-up company.

The company must determine which layers:

- anchor the USP (e.g., novel transducer physics or proprietary signal processing tightly coupled to hardware);
- can be supported by partners without losing defensibility;
- can be added later once the company has capital and maturity.

This requires realistic leadership and discipline, combined with excellent partnership building.

Commercial Effort: COCA and COCS Along the Value Chain



Analyzing the commercial effort to generate product revenue is another important element of value chain analysis and positioning. The image above introduces two crucial concepts: cost of customer acquisition (COCA) and cost of customer support (COCS), and positions them across the value chain.

Lower layers in the value chain usually have fewer customers with higher volumes. Each of these customers is technically extremely demanding. Higher layers dramatically increase the number of customers, and the markets there are usually more fragmented. This analysis can be formalized by applying COCA and COCS. The results of this analysis can quickly indicate the type of market access a startup with scarce resources can realistically support. The choice will also heavily impact the size and cost of the commercial aspect of the organization.

Selling chips, sensors, or transducers entails navigating long, technical design-in and design-win cycles with a relatively small set of highly specialized customers. The commercial effort is centered on influencing engineering teams and system architects; meeting strict performance, cost, power, and reliability specifications; and aligning with the customer's product road map. Success depends on deep technical

credibility, application support, and the ability to reduce integration risk. Once designed in, the revenue stream can be relatively stable and long-lasting, but the sales process is front-loaded, resource-intensive, and heavily dependent on technical differentiation.

Selling systems to end users means driving market adoption by clearly articulating and delivering a compelling value proposition to a broader and more diverse customer base. The commercial effort extends beyond technical fit to include ROI justification, budget approval, competitive positioning, distribution, branding, pricing, and after-sales support. Decision-making involves multiple stakeholders - technical, operational, and financial - and revenue must be continuously generated through customer acquisition, service quality, and lifecycle management. Success depends not only on product performance but also on market access, commercial execution, and the ability to scale demand.

Key Takeaways

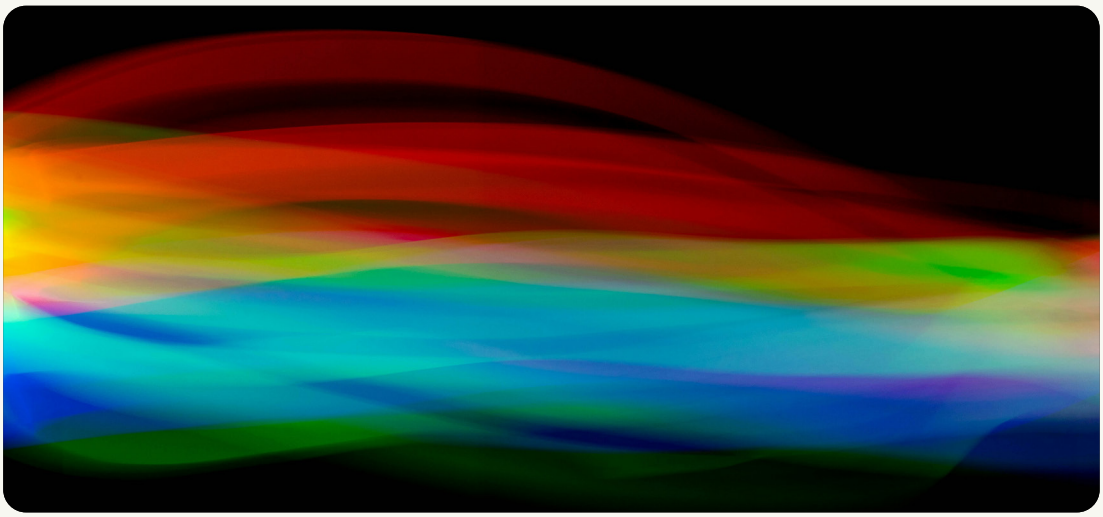
Value chain positioning is a company-defining strategic choice. It determines what the MVP actually is, who the first customer is, which partners are critical, which economics must align, and which layer the company can defensibly own.

The practical implications are clear:

- Define the product from application analysis, not from technology pushes, and translate that application analysis back into a precise value chain position.
- Understand customers, volumes, margins, qualification requirements, and partner economics at each layer before committing to the MVP boundary.
- Keep internal scope narrow and partner aggressively on non-core elements that others can execute faster or better.
- Include the complexity and cost of selling the product in the analysis, because the direct customer changes with the position in the value chain.
- Build customer credibility through partnerships with established companies.
- Extend the value chain only once the company has commercial traction, because the direct customer changes with the position in the value chain.

Early-stage teams must resist the temptation to build everything themselves, even if they believe they "could" do so. Overextension is a silent killer. The best semiconductor startups are the ones that know exactly which layer to own first, create win-wins around that position, and earn the right to expand only after the first product has proven its value in the market.

EXAMPLE



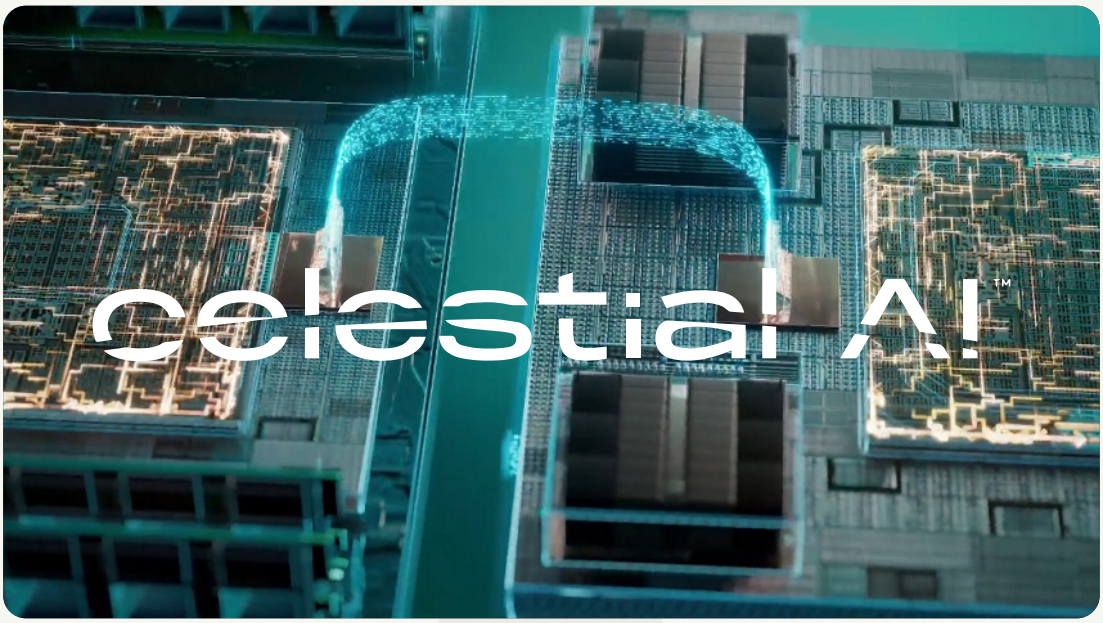
Low-cost specialty imager

This example illustrates the complexity of the value chain in the smartphone ecosystem and the delicate balancing act a startup faces in this ecosystem.
A company productizes specialty imagers that are so low-cost and high-volume producible that they enable new smartphone applications.

The company focuses on designing the specialty imager and the embedded software that unlocks its capabilities, and collaborates with multiple foundries to produce the imager for them. The company partners with generic imager companies to build its specialty imagers, then sells them to camera module makers, who package the imagers and combine them with other components for smartphones. Although the company could develop its own calibration software, it secured a partner with an existing solution to accelerate the go-to-market. The embedded software runs on an ISP (image signal processor); integrating that into the solution also requires cooperation with the company that supports that processor. The application software (skin analysis) is developed by companies specializing in these applications, in partnership with the company, to make the best use of the capabilities enabled by this new imager. That application software will then enable cosmetic companies to market their products based on skin analysis via this novel smartphone application.

While multiple stakeholders complicate this process, partnering effectively can enable consumer solutions that would otherwise be impossible to achieve!

EXAMPLE



A good example of disciplined market entry and value chain management is Celestial AI. The company maintained close customer intimacy from the beginning and continuously validated its assumptions against real market feedback. Through this process, management concluded that its initial product vision was too ambitious for the company's stage and that the competitive landscape was too crowded to create a sustainable advantage quickly enough. The company subsequently pivoted multiple times, each time narrowing its scope and focusing more aggressively on its core differentiator. This required difficult strategic decisions about what not to build, despite the temptation to cover a bigger part of the value chain.

At the same time, the company developed a highly strategic partnering approach, collaborating with established industry players to reduce adoption risk and secure credibility with customers.

These partnerships ultimately helped enable a design-win with a major datacenter customer.

The example illustrates several recurring themes in successful semiconductor startups: deep customer intimacy, continuous competitive analysis, disciplined product boundary definition, and a strategic go-to-market approach built around partnerships and credibility rather than technological ambition alone.

It lead to an extremely successful exit in record time.

About

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Peter Vanbekbergen is a deeptech investor and technology entrepreneur with extensive experience in semiconductor R&D, venture creation, and early-stage company building.

He has been involved with several deeptech semiconductor startups as a research manager, product development engineer, VP of engineering, CEO, investor, and board member.

As a co-founder of imec.xpand, he focuses on transforming breakthrough research into scalable startups and guiding founders through the complex lifecycle of deeptech commercialization.

imec.xpand

imec.xpand is one of the world's largest independent venture capital funds dedicated to early-stage semiconductor innovation. It targets ambitious startups where the knowledge, expertise and infrastructure of imec, the world-renowned semiconductor and nano-technology R&D center, can play a determining role in their growth.

imec.xpand has an outspoken international mindset towards building disruptive global companies and strongly believes that sufficient funding from the start is key to future success.

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