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Semicon R&D in NL

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Main findings

It is remarkable how a small country like the Netherlands has built such a thriving innovation ecosystem in the global and competitive semicon industry. At first glance, the Dutch semicon ecosystem appears to be prospering in terms of R&D, with total R&D investments growing in line with – and even outpacing – revenues. The 'Big 5', the five largest Dutch semicon players (i.e., ASML, ASM, NXP, Nexperia, and Besi), are doing well in this regard. However, upon closer inspection, the sector faces several challenges that need to be addressed to secure the future success and innovation of this ecosystem.

When looking at the medium-sized semicon companies in the Netherlands in particular (in this report we refer to this group as the Mid-tier), we find that this group is unable to grow R&D expenditures with their revenues. This group is lagging behind and their share in total semicon R&D is rapidly declining. We analyze the causes of this quite unknown and invisible trend and provide suggestions for potential solutions to be considered. We believe that it is crucial to curb the trend, because of its impact on the semicon ecosystem in the Netherlands. While we appreciate it is difficult to fix the challenges the Mid-tier is facing, the stakes are extremely high.

The erosion of the Mid-tier R&D threatens the innovation success of the broader Dutch ecosystem. The Mid-tier entities play a pivotal role in the Dutch semiconductor ecosystem, as co-innovation between the Big 5 and midsized entities is a fundamental aspect of the semiconductor sector globally and has been a critical success factor in the Netherlands specifically.

R&D is essential for remaining competitive in the global semiconductor market, preventing commoditization, and avoiding related margin pressures. While a gradual relative decrease in R&D expenditure may release resources in the short term, it will inevitably impair long-term innovation capabilities.

Any forgone R&D opportunities from the private sector in the Netherlands, estimated to exceed €200 mln by 2030, represent a significant loss given the existing R&D gap in the country (2.1% of GDP in 2023 compared to the target of 3% of GDP spent on R&D).

Main findings of our study include the following:

- Semicon is one of the most R&D-intensive sectors globally (in terms of the rate of R&D spending as a percentage of revenue). The European semicon industry invested 14% of revenue into R&D in 2023.

- The Big 5 represent currently 80% of semicon R&D spend in the Netherlands and are showing a very positive trajectory, which we want to maintain and foster. This requires continuous efforts to sustain a competitive and attractive investment climate, in a geopolitically heated bidding race.

- Around the Big 5 players there is a group of 20-30 core mid-tier players (the 'Mid-tier', with revenues of €50 mln up to €1.5 bln) that currently represent 17% of total R&D spend. Finally, startups and scale-ups (the 'Incubators') also play a critical role in R&D and radical breakthroughs. They represent up to 2.5% of total semicon R&D in The Netherlands.

- The R&D investments of the Big 5 are growing in line with (even outpacing) their revenues. However, this is not the case for the Mid-tier. Mid-tier's R&D investments have been lagging their revenue growth over past years.

- The share of this Mid-tier group in total semicon R&D investments has already significantly shrunk from 26% in 2018 to 17% in 2024. Without fundamental the R&D share of the Mid-tier will further decrease to 11% in 2030.

- Root cause for these developments are (i) decreasing R&D affordability (due to increasing price and margin pressures), (ii) a lack of R&D talent, and (iii) the R&D input-output gap: increasingly higher stakes and complexity are stifling the valorization and management of the returns on these investments.

- Amongst other things, Mid-tier companies should counter margin pressure through operational efficiencies and a reevaluation of their portfolio (next to continued innovation). More effective R&D might contribute to maximizing the output of investments through professionalization and strategic governance. Continued and extended public support will also help companies in their R&D trajectory.

- Finally, we should not forget about the next generation of Dutch champions. The Innovators are essential for groundbreaking innovation across existing technologies and emerging ones that will play a pivotal rule in the future, such as photonics and quantum computing.

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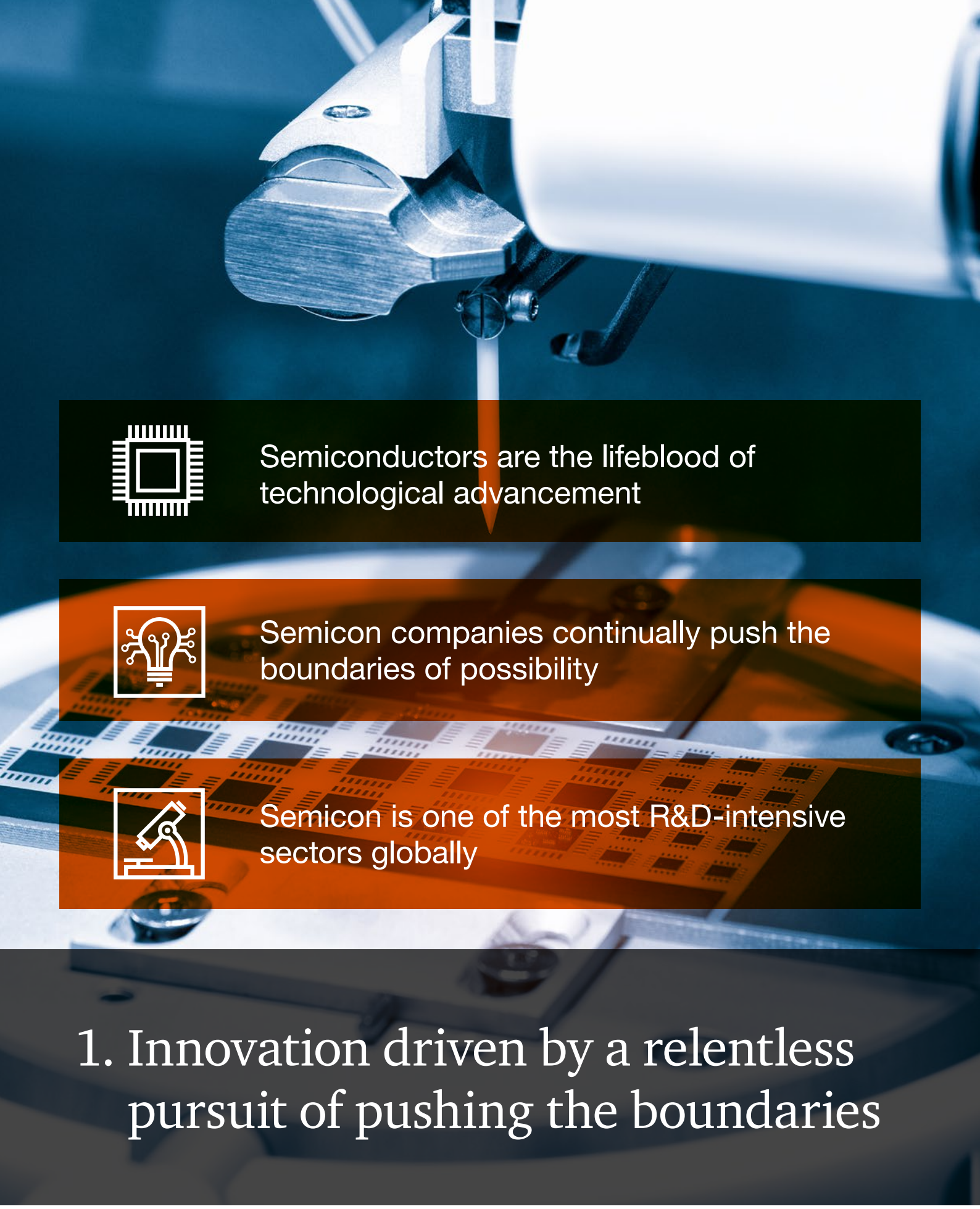


Semiconductors are the lifeblood of technological advancement

Semicon companies continually push the boundaries of possibility

Semicon is one of the most R&D-intensive sectors globally

1. Innovation driven by a relentless pursuit of pushing the boundaries

Relentless technological advancement

Semiconductors are propelling us into the future, transforming industries and reshaping our everyday lives. In the vast landscape of global industries, the semiconductor sector stands as a paragon of relentless innovation, allowing for the miniaturization and enhancement of electronic devices, making them faster, more efficient, and more powerful. Semiconductors have been the driving force behind technological evolution over the last decades, sparking the fundamental transformation of many industries throughout the world. The critical importance of semiconductors in our modern world cannot be overstated. As the backbone of every electronic device – from smartphones and electric cars to advanced medical equipment and AI data centers – semiconductors are the lifeblood of technological advancement.

More (than) Moore

Semicon is always pushing for Mo(o)re. Companies within this sector continually push the boundaries of possibility, ensuring they remain at the forefront of technological advancements, fueled by the endless moving finish line of Moore's law (stating that the number of transistors on a chip doubles every two years). On the hand the industry is aiming to continue this law and miniaturization ('More Moore'), through e.g. augmented lithography and advanced materials. At the same time, alternative methods are being explored to achieve more computing capacity per unit area ('More than Moore'), through e.g. heterogeneous integration and 3D die-stacking technologies (advanced packaging). All these technical challenges continue to boost innovation across the entire value chain and various domains, including material science, chip design, capital equipment, electronic and mechatronic suppliers, fabrication and back-end technologies. And innovation extends beyond product development. It permeates throughout companies, driving process improvements and sparking new business models generating new growth, such as those centered around repair and re-use.

Unparalleled innovation

What makes innovation in semicon so special? The relentless drive for progress is unparalleled, reflected in the industry's remarkable intensity, focus and speed of innovation. This innovation is truly global, supported by exceptional talent and close collaboration (co-innovation) across the value chain and ecosystem.

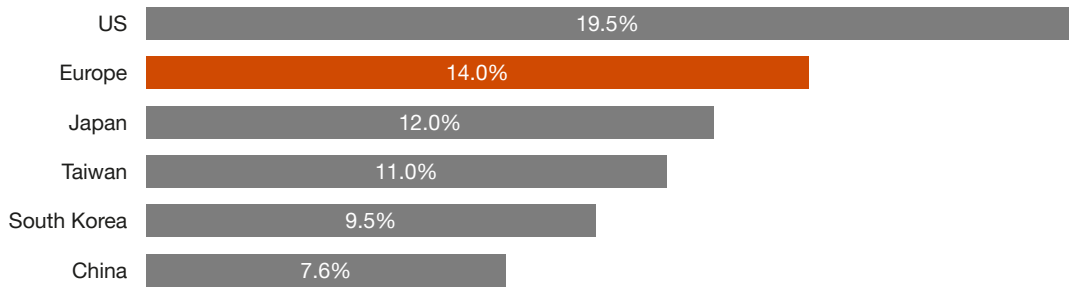
High R&D intensity aligned with role in value chain

A key driver of Semicon's success is its substantial investments in R&D, making Semicon one of the most R&D-intensive sectors globally (in terms of the rate of R&D spending as a percentage of revenue). The European semicon industry invested 14% of revenue into R&D in 2023.

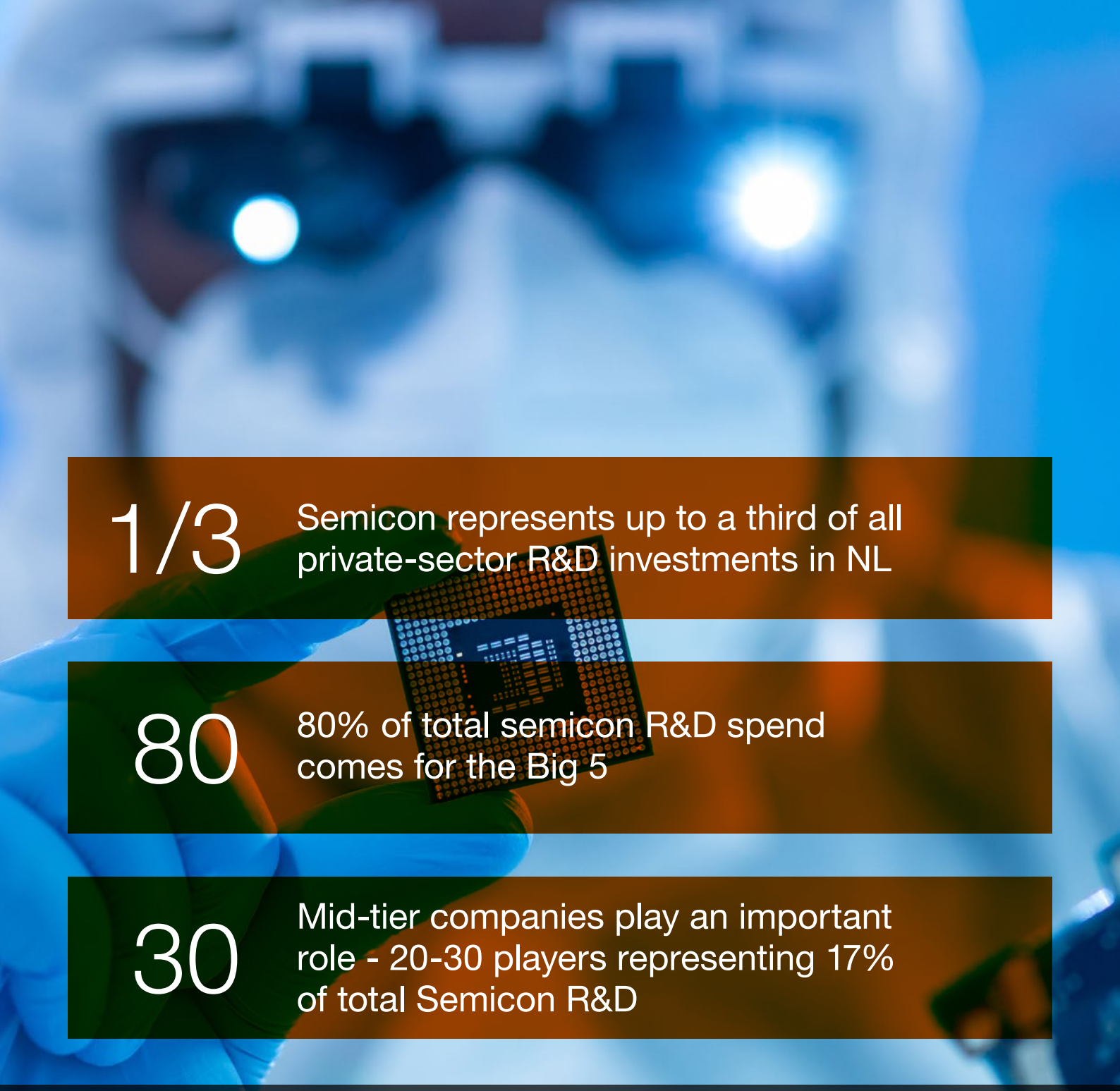
The variations in R&D intensity reflected in Figure 1 can be attributed to the roles and contributions of the different regions and countries in the semiconductor value chain. With the US, Europe and Japan leading in upstream (including design and capital equipment), Taiwan and South Korea in (advanced) chip production, and China in downstream (incorporating chips into final goods). So, R&D efforts are strategically aligned with the value chain.

Similarly, the R&D intensity varies across companies, depending on their role in the value chain and business model. Fabless companies, such as NVIDIA and Qualcomm, often exhibit the highest intensity due to focus on innovative chip design. Integrated Device Manufacturers (IDMs) like Intel, Samsung and NXP also maintain high R&D intensity, investing heavily in both design and manufacturing technologies to stay competitive (despite increasing pressure on this model). Equipment manufacturers, including Applied Materials, ASML, ASM and Besi, also demonstrate high R&D intensity. In contrast, Outsourced Semiconductor Assembly and Test (OSAT) providers generally have lower R&D intensity.

Figure 1 Semicon R&D expenditures as percentage of revenues



Source: Semiconductor Industry Association (SIA)



1/3 Semicon represents up to a third of all private-sector R&D investments in NL

80 80% of total semicon R&D spend comes for the Big 5

30 Mid-tier companies play an important role - 20-30 players representing 17% of total Semicon R&D

2. Semicon's diverse and rich ecosystem is the innovation engine in the Netherlands

Semicon is a key driver of R&D in NL

While we recognize that the semiconductor industry is a truly global and highly interconnected sector, our research puts the spotlight on R&D in the Dutch semicon ecosystem to see what is happening there, in relation to global R&D developments. Our *previous research* already found that the semicon ecosystem is a true innovation engine in the Netherlands, representing up to a third of all private-sector R&D investments in the Netherlands, and almost half of all Dutch patent applications.

The semicon R&D landscape in NL is diverse and rich

The Netherlands has a leading role in the domain of Capital Equipment (representing ~85% of the Dutch semicon workforce), Specialty Integrated Device Manufacturers (IDMs) (~5% of the Dutch semicon workforce) and Photonics (~2% of the Dutch semicon workforce). The ecosystem consists of various types of companies with variating levels and models of R&D, depending on their role in the value chain and business model. All the R&D investments and efforts in semicon are also relevant for other advanced high-tech markets (the semicon 'halo'). For example, suppliers with a more diversified portfolio of multiple synergetic high-tech markets benefit from R&D spillover effects, where the success and innovation in semicon permeate and stimulate advancements in other fields (and vice versa).

It is undisputed that the triple-helix model, the teaming up of government, the private sector and knowledge institutions, is also playing a significant role in the success of the Dutch semicon ecosystem and its innovation track record. For example, research institute TNO accompanied ASML on its voyage to develop its EUV technology, supporting on the development of the reticle handler (to meet EUV's extreme accuracy and cleanliness requirements), the level sensor (for fast and accurate mapping of the wager topography), the dynamic gas lock, and wager clamps. TNO has continued to support ASML (and its suppliers) on a wide range of innovations until today. In terms of photonics, PhotonDelta is a real catalyst of the Dutch industry. Recently, Demcon has partnered with TNO and the University of Twente to accelerate low-energy modulation of silicon nitride (SiN) photonics chips (partially funded by PhotonDelta). Other thriving platforms supporting the triple-helix model are Brainport Eindhoven, High Tech Campus, and Oost NL.

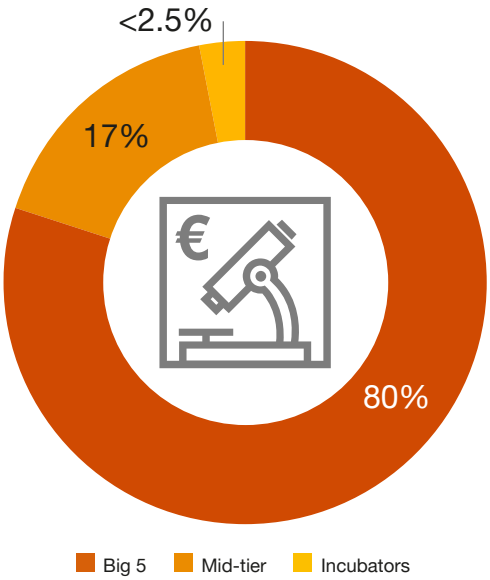
As a result of this well-functioning ecosystem. The Netherlands has a leading position in multiple domains, including capital equipment, chip design, high-performance/mixed-signal chip production, and packaging. The Netherlands is also a frontrunner in new technologies such as integrated photonics. The established ecosystem is a magnet attracting global skilled talent, international innovators, and investors. However, this success might be challenged by a structural shortage of talent, and attractive industrial policies in other regions so we should not take it for granted.

Majority of R&D comes from Big 5, but Mid-tier companies and Incubators also play vital role

Successful semiconductor ecosystems are renowned for their strong innovation and collaboration (ecosystem play) between large incumbents, midsized players but also smaller players. We see this in Silicon Valley and Hsinchu Science Park for instance. We also see this here in the Netherlands.

We distinguish three main clusters of companies in the Dutch semicon R&D ecosystem. First there is the 'Big 5', the five largest Dutch semicon players (i.e., ASML, ASM, NXP, Nexperia, and Besi). They represent currently 80% of R&D spend in the Dutch semicon sector. Around the Big 5 players there is a group of 20-30 core mid-tier players (the 'Mid-tier', with revenues of €50 mln up to €1.5 bln) that actively invest in R&D. The Mid-tier currently represent 17% of total R&D spend. Finally, startups and scale-ups (the 'Incubators') also play a key role in R&D. They represent up to 2.5% of total semicon R&D in The Netherlands.

Figure 2 Share of total semicon R&D investments in the Netherlands (2024)



Sources: CBS, Gain.pro, annual reports, KvK, TNO, PwC Strategy& analysis

The Big 5 have high levels of R&D. Activities are conducted both in-house, through partnerships and outsourced to R&D contract suppliers – to develop proprietary technologies and maintain a competitive edge. These companies also trigger R&D initiatives with Mid-tier players across the value chain. These large companies also invest in new ventures. ASML and NXP for instance participated in the €100 mln funding round in Smart Photonics two years ago.

The Mid-tier actively invest in R&D, unlike many midmarket companies in other sectors which do not have own R&D activities. The Mid-tier are companies that are well known in the industry but rarely see the spotlight in the broader economic and public scene. It is a mixed group of companies, ranging from chip design and manufacturing companies to suppliers, who are essential to the success of the Dutch semicon ecosystem. Predominantly consisting of advanced suppliers, they play a significant role not only in their own R&D efforts but also in supporting the Big 5 and other global semicon giants who purchase their products and services. The Big 5 and Mid-tier mutually reinforce each other in this way.

Incubators represent a smaller share of total R&D spend in semicon, up to 2.5%, but they play a disproportionately crucial role in driving radical breakthroughs and preparing for new future successes in the semicon sector, such as photonics and quantum. These highly innovative start-ups and scale-ups aspire to either evolve into new champions or have their technology absorbed and leveraged by established champions. In the textbox below we highlight some of the challenges these start-ups face and some of the successes we should cherish.

Collaboration is at the core of the Dutch R&D ecosystem

R&D efforts are diverse and multifaceted. Leading semicon companies first of all engage in direct R&D investments in-house, dedicating significant resources to develop proprietary technologies and maintain a competitive edge. Additionally, contract R&D with partners and suppliers allows firms to leverage external expertise and share the risks and costs associated with innovation.

The Dutch semicon ecosystem has been built up through close collaboration and ‘co-opetition’ over more than forty years. This tightly-knit network allows for extensive collaboration and joint innovation between larger and smaller players across the value chain. The formal and informal networks and personal connections that exist and have been built up over the past decades, particularly in the Brainport region, further strengthen this collaboration around R&D and innovation projects. This has resulted in a pivotal role for the Netherlands in the global semiconductor landscape.

Open innovation models are also prevalent, encouraging collaboration with universities, research institutions, and other industry players (e.g. platforms such as Brainport Industries) to foster a broader exchange of ideas and accelerate technological breakthroughs.

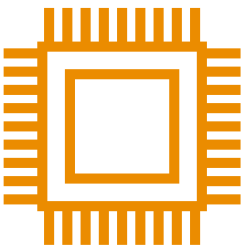
These varied R&D approaches collectively enhance the industry’s capacity to innovate and adapt to evolving market demands.

Government fosters R&D through incentive schemes, which are well patronized

Government also plays a key role in providing a positive context for innovation with effective incentives mechanisms for R&D. The ‘innovation box’ is one of the key mechanisms to support companies in pursuing innovation initiatives. Last year the Ministry of Economic Affairs and the Ministry of Finance ordered an evaluation of the effectiveness of the innovation box for the period 2013-2022. Conclusion was that the innovation box has an adequate reach within the target group of companies. The innovation box benefits all companies which are able to turn their R&D efforts into a taxable profit. The benefit is granted per company and the taxable Dutch profit related to innovation is effectively taxed at a lower percentage under the regime of the system. This system is in line with the OECD and aims for more innovation by creating a level playing field whilst supporting the aim of the Dutch government in building and maintaining a knowledge-based economy.

Next to the innovation box, there is also the WBSO (research and development promotion act). This mechanism is considered by most companies as more relevant to support their R&D activities, even though government spend for WBSO is lower than for the innovation box. The benefits of WBSO are more equally spread across users. Also, WBSO is used by more companies including smaller companies. 63% of allocated benefits under WBSO are for SMEs.

Besides these tax incentives, companies frequently benefit from grants and public funding provided by governments and international organizations, which support strategic research initiatives and infrastructure development. Broader schemes such as Project Beethoven and Brainport Development also indirectly supporting the R&D private agenda.



The R&D dynamics of the Incubators is somewhat different – both in terms of R&D intensity and challenges

In terms of R&D intensity, for most Incubators, the costs and investments are outpacing and exceeding the benefits. During the initial leading up to the market launch of the first product, up to 80% of funding is typically allocated to R&D expenditures, with the remaining 20% directed towards SG&A expenses.

Some of the key challenges faced by Incubators include:

- **War for talent:** There is a general scarcity of skilled and technical talent. Although the overall quality-of-life proposition in the Netherlands is perceived as very attractive, competitive compensation is a non-negotiable to attract international experts (underscoring the increasing demand for a favorable treatment of stock option plans in the Netherlands).

- **Funding:** While funding has improved significantly in recent years, with e.g. more (deep)tech funds, ongoing support from Invest-NL, the RVO Seed Capital scheme, and initial unlocking of pension funds, funding remains a challenge in the Dutch and European context. There is a general deficiency of funds, and many investment funds lack a deep understanding of the underlying semicon technology, which is crucial given the relatively large investment tickets (tens of millions of euros). Public funding is also difficult to obtain due to strict EU competition laws. This scarcity of resources leads to avoidable development delays, and even worse, an exit of promising start-ups to countries like the US (see also our recent study on Unicorns). Although subsidies can serve as fallback, they typically come with an associated administrative burden and delays.

  To truly maximize and unlock the full innovation potential, it is sensible to orchestrate and mobilize R&D efforts and public funding at a European level. While this is already partially underway through the EU Chips Act, it is simultaneously hindered by EU competition laws. The Digital Autonomy with RISC-V Europe (DARE) project is new promising strategic initiative for developing high-performance computing chips in Europe.

  Singapore could serve as valuable inspiration for the EU and the Netherlands. It has become one of the most attractive and supportive ecosystems for deep-tech startups, thanks to its financial and tax incentives, advanced R&D infrastructure, robust investment ecosystem with substantial (venture) capital, and talent-friendly visa policies. All of these are backed by the government's long-term strategic commitment to innovation and technological advancement. The government provides generous grants and co-investment schemes that match third-party funding.

- **Industrialization:** R&D cycles within the semiconductor industry can be very long (sometimes extending beyond ten years), which makes it extremely difficult for Incubators to endure and fund the 'valley of death'. This also includes 'claiming your space' in the champions league. Successful industrialization requires collaboration with major industry players to unlock both production capacity (from suppliers) and demand (from customers) at scale. This often creates a catch-22 situation where customers are hesitant to commit until a minimal critical production capacity is secured, which in turn requires additional customers or funding. Essentially, to get past this tipping point necessitates a 'leap of faith' from a partner or trusting customer. This underscores the importance of co-innovation and partnering with customers during the R&D phase to build trust and ensure alignment.

Despite all these challenges, the Netherlands has already produced many worldclass players and continues to foster numerous promising Incubators:

- **Photonics:** The Netherlands is a frontrunner in integrated photonics, boasting a robust ecosystem with several key players in design, production, and testing. These central parties (such as SMART Photonics, LioniX, PHIX and EFFECT Photonics) form a solid foundation, ensuring the maturity of the underlying technology. Building on this strong base, a flexible layer of start-ups is emerging, specializing in the application side of photonics (including IT, healthcare, defense, energy, automotive and agrifood). With such a diverse portfolio of specialty players, the Netherlands is well-positioned to hedge its bets and maximize its chances of profit. However, scaling remains a challenge, making production costs high. Increasing applications and volumes will be crucial to reaching a critical mass and tipping point, ultimately reducing prices and costs.
- **Nearfield Instruments:** Founded as a spin-off of TNO, Nearfield is a semiconductor metrology equipment company developing and delivering ground-breaking process control metrology solutions for the worldwide advanced semiconductor I.C. manufacturing industry.
- **Axelera AI:** Axelera AI is a leading provider of purpose-built AI hardware acceleration technology for generative AI and computer vision inference at the edge.

Crucial to the success of the Dutch semicon hatchery are the outstanding technical universities, knowledge institutions (such as TNO), and supporting industry associations and platforms, such as HighTechXL, Brainport Eindhoven, the BOM, PhotonDelta and the Noviotech Campus.

Tax incentives

The Dutch government prioritizes sustainable innovation and offers several tax incentives to support enterprises engaged in research and development (R&D). Key incentives include the WBSO payroll tax credit and the Innovation Box, which provide significant financial benefits to innovative companies. Below, we have outlined these incentives on a (very) high-level basis.

WBSO Payroll Tax Credit
The WBSO (*Wet Bevordering Speur- en Ontwikkelingswerk*) allows enterprises to reduce payroll tax for employees working on technologically innovative projects. This tax credit offers immediate cash benefits, enhancing liquidity, especially for start-ups and expanding enterprises. In 2025, the WBSO benefit is 36% of the first €380,000 of R&D costs and 16% for costs exceeding this amount. For start-ups, the benefit increases to 50% of the first €380,000. The maximum benefit cannot exceed the total payroll tax due.

Innovation Box
The Innovation Box provides a reduced corporate income tax (CIT) rate of 9% on profits derived from self-developed intangible assets, compared to the standard Dutch CIT rate of 25.8%. To qualify, an enterprise must first be eligible for the WBSO. The Innovation Box applies to profits from innovative activities in the Netherlands, with specific entry criteria based on the size of the enterprise. Larger enterprises must have a patent or similar legal protection for the intangible asset or it must be considered software.

Expat Ruling
The expat ruling allows foreign employees to receive up to 30% of their salary tax-free to cover additional costs incurred while working in the Netherlands. This ruling aims to attract highly skilled employees and maintain the competitiveness of the Dutch business climate. From 2027, the tax-free allowance will be reduced to 27% for new applicants, with transitional provisions for those already benefiting from the 30% ruling before 2024.

Essential to semicon's success is keeping up its R&D intensity

R&D investments are outpacing revenue growth in NL

Big 5 are increasing R&D spend faster than revenue growth

3. NL Semicon R&D is overall showing a strong growth trajectory

Keeping up R&D investments with revenue growth is critical

Essential to semicon's success is keeping up its R&D intensity alongside a strong growth trajectory. Although semicon R&D intensity in Europe has slipped somewhat (from 17.4% in 2009 to 14% in 2023), the sector's ability to increase R&D spending in line with strong revenue growth is remarkable.[1] This underscores the critical role of consistent investment in innovation for the industry. R&D is crucial for securing a competitive edge and achieving technology leadership in this fast-paced global market.

To assess the progression and current role of R&D in the Dutch semicon sector, we have conducted extensive research and conducted interviews with CEOs, CFOs and CTOs of key players in the sector. As R&D intensity varies across companies, we looked at the evolution (growth) of R&D expenditures compared to revenues to assess the progression of R&D intensity, rather than an absolute benchmarking of intensity. We do this to reflect that depending on the activities, products and role in the value chain, R&D intensity may vary between companies.

Overall, R&D investments are outpacing revenue growth in the Netherlands

Looking at the aggregated R&D investments in the Dutch semicon sector from 2018 to 2024, we found that they are growing in line with – and even outpacing – revenues (see Figure 3). The compound annual growth rate (CAGR) for R&D investments is 15.1%, compared to a 12.8% CAGR for revenues. It is impressive how the sector has consistently increased its R&D expenditures in tandem with its robust revenue growth trajectory – demonstrating that for every additional euro of revenue, semicon companies are injecting at least €0,14 into the R&D engine.[2]

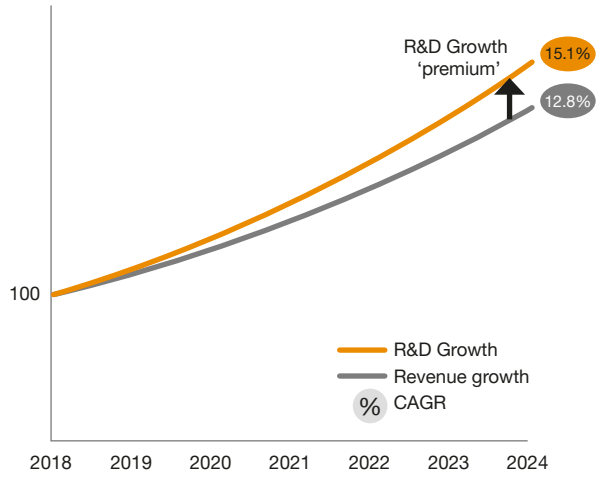
This highlights the sector's commitment to innovation and its importance for sustained growth. However, it is crucial not to take this success for granted.

Big 5 R&D are outperforming revenue trajectory even more

With 80% of R&D spend in semicon in the Netherlands, the Big 5 represent the majority of R&D investments. In addition, the Big 5 companies play a key role as initiators of innovation at suppliers throughout the value chain. The stakes of R&D are extremely high as technology advancement is key to retain tech leadership and competitiveness in the truly global semicon market.

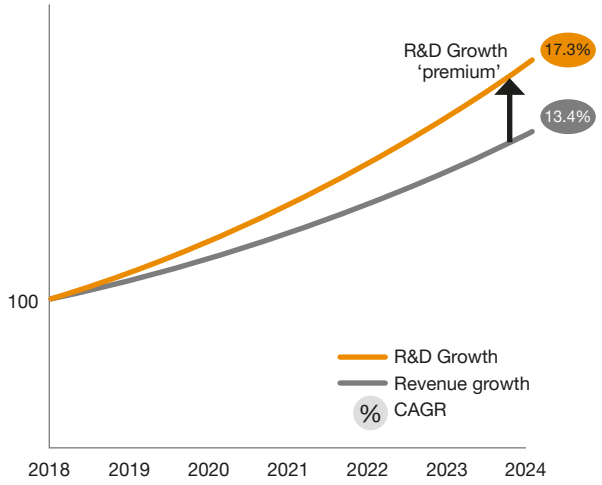
Overall, the Big 5 have realized strong revenue growth (13.4% CAGR). R&D spend with the Big 5 has even outpaced revenue growth over past years (17.3% CAGR), as reflected in Figure 4.

Figure 3 Growth of R&D expenditures and revenues of semicon sector in the Netherlands (indexed)



Sources: CBS, Gain.pro, annual reports, KvK, TNO, PwC Strategy& analysis

Figure 4 Growth of R&D expenditures and revenues of the Big 5 in the Netherlands (indexed)



Sources: CBS, Gain.pro, annual reports, KvK, TNO, PwC Strategy& analysis

1 EU Industrial R&D Investment Scoreboard, IC Insights, Semiconductor Industry Association
2 Assuming the average R&D intensity of semicon companies in Europe

These companies invest heavily in newly emerging technologies, with ASML for instance investing in holistic lithography, NXP playing a key role in the development of chips for 6G and post-quantum cryptography, and ASM driving advancements in its thin-film deposition technologies (including gate-all-around).

The success of the Big 5 hinges on several success factors. They continuously evolve their business model (e.g. extending into repair and re-use) and portfolio (e.g. new product and technology introductions). They excel in how they run and manage their R&D function. They fully unlock the potential of their ecosystems through fruitful collaborations with suppliers, partners, knowledge institutions, and universities. They effectively leverage public funds and grants and assertively invest in talent.

However, geopolitical context is intensifying bidding race for future innovation investments

Given the importance of the R&D spend of this group and their role in driving further innovation in the value chain with some of their suppliers, it is critical to maintain and further grow this R&D performance of the Big 5 in the Netherlands. The past years have shown great results, but in the light of increasing geopolitical pressure and R&D investment support from governments throughout the world, we should not take the R&D footprint of these players in the Netherlands for granted. In addition, factors like the changing customer base (geographically), the supplier ecosystem, the availability of highly skilled international R&D talent, and access to R&D incentives influence decisions as to where to scale up R&D activities. The bidding race for future R&D is on. With numerous countries and regions actively presenting enticing industrial policies and subsidies to attract semicon companies and stimulate new business and investment opportunities.

Project Beethoven and ongoing (semi)public initiatives to co-finance R&D are already helping. It is key to further hone these initiatives and support initiatives to retain and grow the Dutch R&D footprint of the Big 5. Given the high stakes and the geopolitical reality, it makes sense to mobilize and coordinate these activities at European level to ensure effectiveness of initiatives and avoid fragmentation.

11 Share of Mid-tier in total R&D shrinking from 26% (2018) to 11% (2030)

3.7x R&D eroding 3.7 times faster than natural trajectory for Mid-tier companies

200+ Foregone private R&D spend by 2030 will amount to €206 mln for Mid-tier companies alone

4. Group of Mid-tier companies is steadily losing ground

The Mid-tier play a crucial role

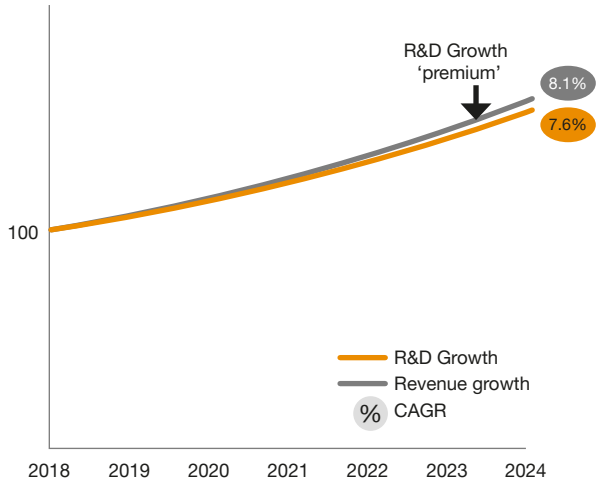
The Mid-tier represent a significant share (17% in 2024) of total semicon R&D investments in the Netherlands. They play a key role in innovation, both as independent innovators of new products, and as collaborators throughout the value chain (co-innovation), including with the Big 5 and other global semicon giants. Their innovation efforts grant the Mid-tier a license to operate in semicon and generally enhance their margin positioning. However, putting it metaphorically, these licenses are never permanently owned, and the 'rent', paid through continuous innovation, is due every day.

For this group of midsized companies, we specifically focus on those companies that are conducting R&D activities. As a matter of fact, only a smaller share of these companies has their own R&D activities. As we have mentioned before, we also acknowledge that these companies may spend a lower percentage of revenues to R&D, depending on the nature of their products and their role in the value chain. That is why we assess how revenues and R&D spend have been growing over the past years in relative terms to each other, and not in absolute R&D intensity (R&D spend over revenues) per company.

R&D growth not keeping up with revenue growth for Mid-tier

For Mid-tier players the situation is quite different than for the Big 5. While revenues of the Big 5 grew with a 13.4% CAGR over the last years, their R&D investments grew with a 17.3% CAGR, implying a significant 'R&D growth premium'. On the contrary, growth of the Mid-tier's R&D investments (7.6% CAGR) have been lagging their revenue growth over past years (8.1% CAGR), as reflected in Figure 5. It is important to note that this represents only the overall trend; there are also some Mid-tier companies with R&D spending that outpaces their revenue growth.

Figure 5 Growth of R&D expenditures and revenues of the Mid-tier in the Netherlands (indexed)

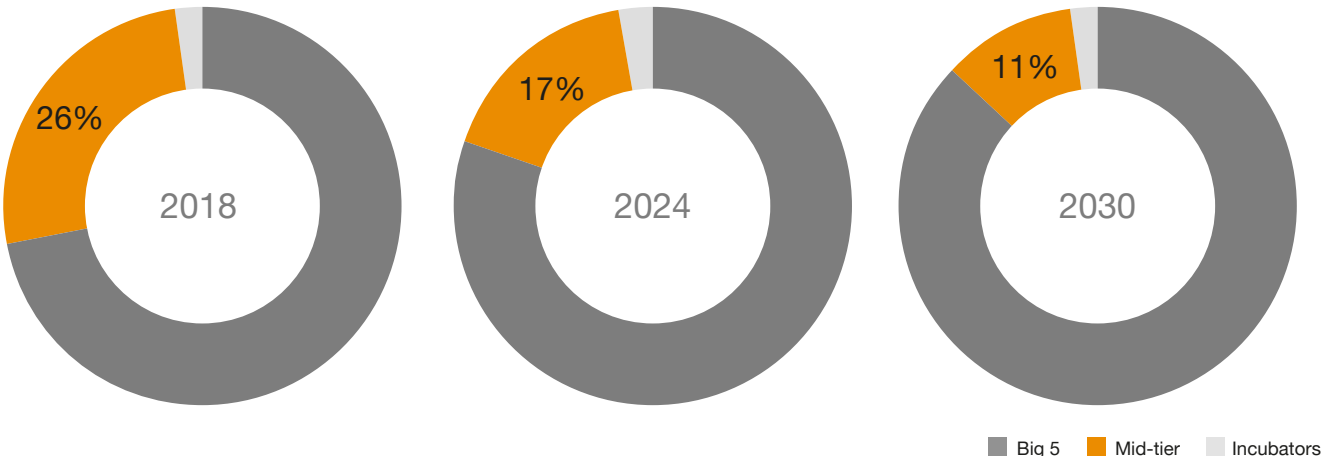


Sources: CBS, Gain.pro, annual reports, KvK, TNO, PwC Strategy& analysis

R&D slowdown leads to a concentration of R&D away from Mid-tier

The differences in revenue growth and evolution in R&D intensity compared to the Big 5, results in a striking increase in concentration of R&D spend away from the Mid-tier. The share of this Mid-tier group in total semicon R&D investments has already significantly shrunk from 26% in 2018 to 17% in 2024. Without fundamental change the trend will result in the Mid-tier's share to more than halve, to 11%, by 2030 versus 2018. This concentration also implies that the center of gravity in R&D in the Netherlands is more and more with the Big 5.

Figure 6 Share in total NL private sector semicon R&D expenditures



Sources: CBS, Gain.pro, annual reports, KvK, TNO, PwC Strategy& analysis

Understanding the three main drivers of the shrinking share of Mid-tier

Based on our research, we have identified three distinct drivers for this shrinking share of R&D spend of the Mid-tier.

A 'natural' divergence

In many supply chains, tier suppliers tend to experience slightly lower growth compared to end-product manufacturers. This natural effect is logical and can be attributed to several factors, such as network effects, economies of scale, market power and gradual cost-down for technologies that are maturing. These dynamics result in an overall 2 percentage point slower revenue growth for the Mid-tier compared to the Big 5. This inherent divergence results in the first form of dilution of the Mid-tier's share in the total R&D base and is difficult to address.

However, the decline of the Mid-tier's R&D share goes 3.7 times faster than the natural effect only (as reflected on the righthand side of Figure 7; the pie charts on top in the yellow box include both the two avoidable effects and the natural effect). This is driven by two main factors: R&D hurdles, representing 60% of the aggravation effect, but also growth constraints, representing 40% of the effect.

R&D hurdles

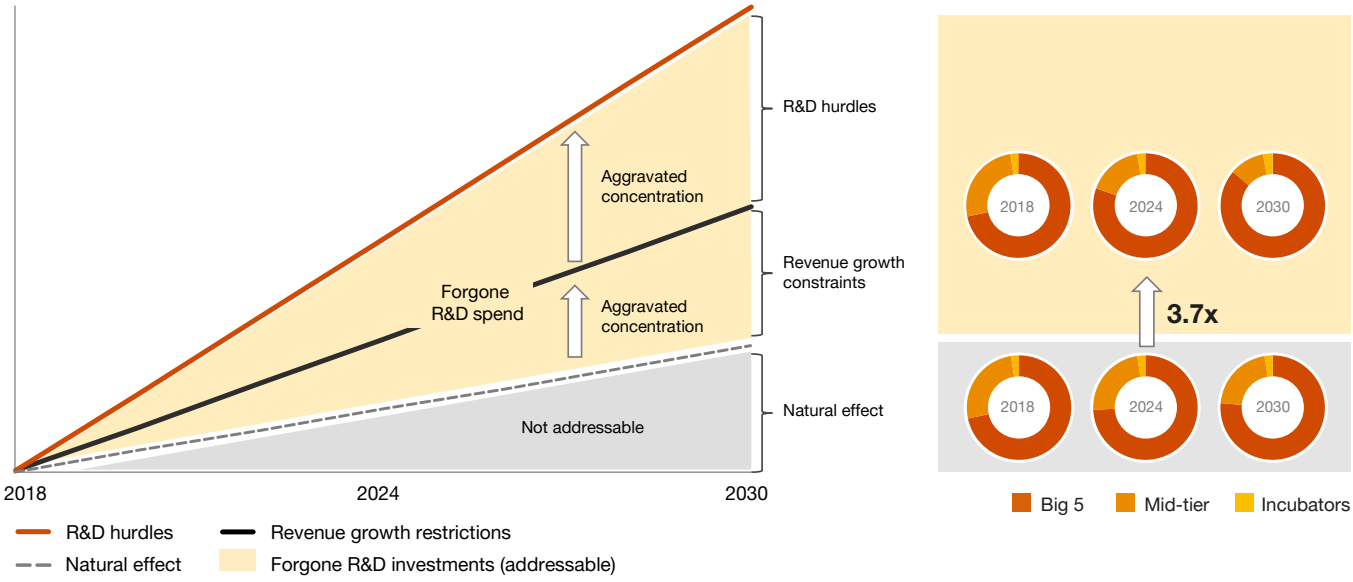
Regarding the R&D hurdles, while the Big 5 are showing an increasing R&D intensity, the R&D expenditures of the Mid-tier are lagging their revenue growth. This is due in part to a number of R&D challenges that these midsized semicon players specifically encounter: a lack of R&D affordability, R&D talent and R&D effectiveness. Given the importance of these factors, we detail them out in the next chapter.

Growth constraints

With regards to the effect from growth constraints, the Netherlands is facing major practical growth constraints including grid congestion, and a lack of space and talent.

These constraints particularly hinder the Mid-tier segment in their revenue growth (as analyzed in depth in our *Semicon in NL* report from last year). Lower revenues lead to a reduced ability to invest in R&D, resulting in slower growth of the R&D spends. Consequently, these growth constrains also limit the total absolute R&D expenditures, even with a fixed R&D intensity. While the current economic climate may result in slower growth and thus make some of the growth constraints less prevalent, these constraints have had a significant impact over the past few years. Based on our forecasts for the semiconductor sector (see our *2024 Global semicon report*), these constraints are expected to re-emerge by the second halve of 2025 or 2026. In our semicon in NL report from last year, we identified the root causes of these growth constraints (including grid congestion, and a lack of space and talent) for mid-sized players and potential solutions to be explored (the government needs to intervene to alleviate the practical growth constraints; in the meantime, suppliers can maximize their productivity through a set of strategic and practical measures).

Figure 7 Concentration effect of R&D in NL (2018 – 2030; indexed)



Sources: CBS, Gain.pro, annual reports, KvK, TNO, PwC Strategy& analysis

These constraints result in €400+ million in lost R&D investments

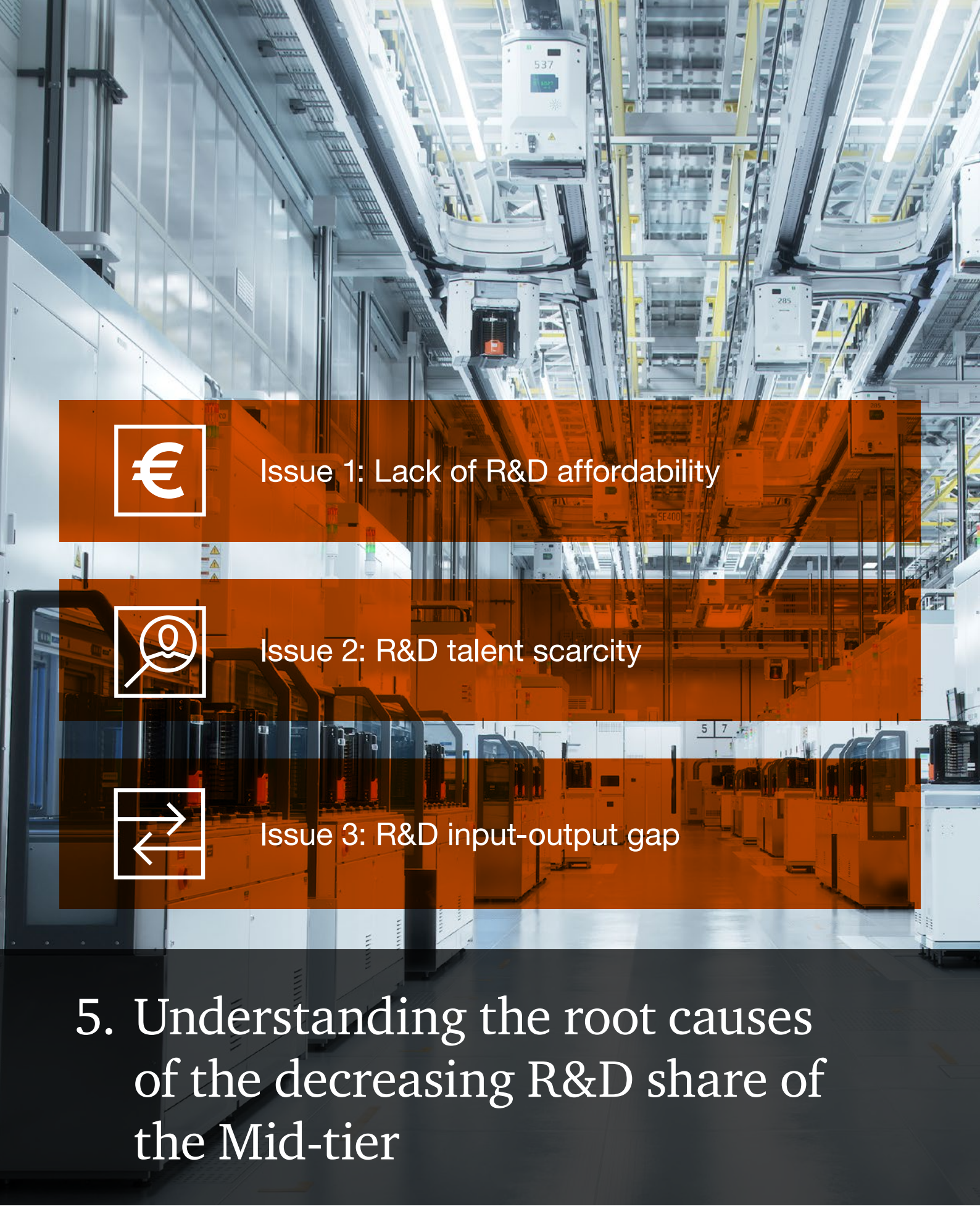
As reflected in Figure 7, the area highlighted in yellow represents the foregone R&D spend over the period 2018 to 2024. This amounts to €240 mln of private R&D from midsized companies only (i.e., excluding Big 5).

We have also conducted an analysis to assess the impact of the growth and R&D constraints for the Mid-tier for the years to come, based on anticipated Dutch sector revenue growth for this period. In case the growth constraints and R&D hurdles do not get addressed (and the concentration trend does not get curbed), the foregone cumulative R&D spend of the Mid-tier will amount to €206 mln by 2030. This amount is slightly lower than the foregone R&D spend of the previous six years (2018 to 2024), reflecting the lower growth rates of the semicon sector in terms of both revenue and R&D spend projected towards 2030.

> With regards to the effect from growth constraints, the Netherlands is facing major practical growth constraints including grid congestion, and a lack of space and talent.

Overall methodology

- To analyze the R&D spend in the Dutch semicon ecosystem, we employed a combined approach. First, we conducted a bottom-up calculation based on company information, interviews, and TNO R&D research. This was triangulated with a top-down approach based on CBS data.
- As R&D intensity varies across companies, we looked at the evolution (growth) of R&D expenditures compared to revenues to assess the progression of the so-called 'R&D intensity', rather than an absolute benchmarking of intensity.
- For representation purposes, we took the average R&D spend over six years to average out ad-hoc fluctuations on a year-by-year basis (based on the 6-year CAGR).
- By conducting this evolution analysis, we identified a gap in R&D trajectory between the Big 5 and mid-tier companies, resulting in a concentration of R&D.
- Next, we analyzed the underlying drivers of this gap and concentration trend, which are threefold: (i) the natural effect, (ii) revenue growth constraints, and (iii) R&D hurdles. We examined the first effect by assessing the natural growth difference (divergence) between the Big 5 and their suppliers, considering the supply-demand effect in the chain. We assessed the second effect (growth constraints), by analyzing the actual growth difference between the Big 5 and the Mid-tier, minus the natural effect. For the third effect, we applied the difference in evolution of R&D intensity between the Big 5 and the Mid-tier to the same revenue trajectory, to isolate the pure effect of the R&D hurdles.
- This report focusses on the semicon industry in the Netherlands. Since not all data was consistently available across all organizations and sources, we are using estimates and assumptions. We used a combination of annual reports, self-reported data, Gain.pro, Orbis, KvK, TNO, CBS.



Issue 1: Lack of R&D affordability

Issue 2: R&D talent scarcity

Issue 3: R&D input-output gap

5. Understanding the root causes of the decreasing R&D share of the Mid-tier

We conducted numerous interviews with key protagonists across the semicon ecosystem in the Netherlands, covering both Big 5, midsized players and startups to identify the key challenges in R&D. We supplemented these insights with our extensive experience in the semicon industry both within and outside the Netherlands. We identified several root causes that affect the Mid-tier in different ways, depending on their business focus, overall situation and role in the value chain. These root causes can be categorized into three main themes:

1. Lack of R&D affordability
2. R&D talent scarcity
3. R&D input-output gap

In the next chapter, we explore how these issues could be addressed or partially alleviated.

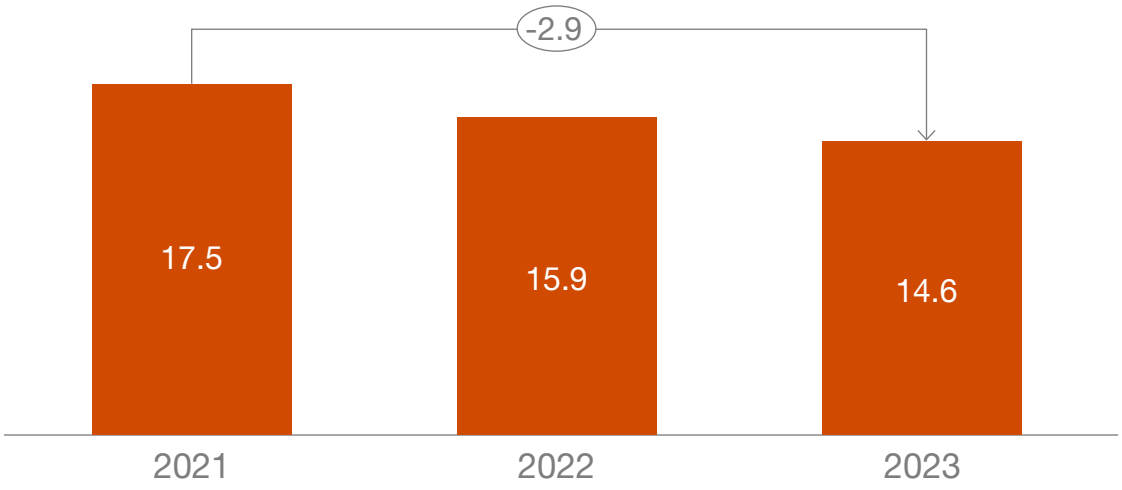
1. **Lack of R&D affordability**
   Even for committed innovators, affordability of R&D is a critical factor. Increasing price and margin pressure in the semicon value chain results in increasing pressure on R&D spend as companies seek ways to secure their profitability levels. We have observed price dynamics and margin pressure play out over time in many high-tech industries and semicon is not exempt from this.

   Given the typically lower margins of the Mid-tier, each stepdown in margin pinches very hard. Our analysis of a sample set of 20 representative Mid-tier companies reveals a weighted margin decline of 2.9 percentage points from 2021 to 2023 (see Figure 8). The vast majority of stakeholders we interviewed confirm this effect.

2. **R&D talent scarcity**
   Key requirement for R&D investments are availability of highly skilled talent. As found in our previous research, the semicon sector is experiencing significant labor shortages, with Europe likely to experience a shortfall of up to 350,000 professionals by 2030. Attracting talent to the Netherlands remains a key priority in this context. Especially for midsized companies who do not have the same HR support infrastructure or have a different employee value proposition compared to larger companies, attracting talent in the market can be a challenge, as was also confirmed in our interviews. This further exacerbates the challenge, making it difficult for midsized players to attract and retain the expertise needed to drive innovation.

   We already see a number of Dutch companies setting up advanced manufacturing hubs outside of the Netherlands, including related R&D activities, for example in Eastern Europe. Part of the growth in R&D spend for Dutch semicon companies is materializing outside of the Netherlands. The issue is that with these hubs abroad, not only the highly skilled engineering functions are stationed abroad but also interesting related technical functions move along.

Figure 8 EBITDA margin of Mid-tier (weighted margin of representative sample set of 20 Mid-tier companies, 2021-2023, %)



Sources: Gain.pro, annual reports, KvK, PwC Strategy& analysis

3. **R&D input-output gap**
   With increasing scale and increasing technology complexity, so does the R&D complexity. This is true for the what, the how, and the where you innovate. With such significant resources allocated to R&D, getting your innovation right is crucial.

   Overall, technology advancements are becoming more sophisticated, requiring more and higher quality resources. Innovation cycles are accelerating, and innovation increasingly occurs through close collaboration and partnerships (co-innovation). With growth comes larger innovation budgets, but also higher stakes.

   As a result, many companies struggle to maintain oversight across all innovation activities. This lack of transparency and control over R&D efforts is frequently cited by interviewees as a major challenge. These complexities are stifling the valorization and hinder the ability to measure the value of R&D investments, putting pressure on tracking and maintaining similar ROI levels on R&D (the 'input-output gap').

   For some companies, these dynamics can be demotivating or discouraging. When investment budgets are scrutinized, it may trigger a review and reconsideration of overall R&D spending and may even lead to ad-hoc R&D budget cuts.

These three root causes – lack of R&D affordability, R&D talent and R&D effectiveness – often reinforce each other as concentration of R&D increases, and the relative weight of the Mid-tier in R&D decreases.

Why is it important to address these issues now

We already see the effect from the challenges play out now and not addressing them would mean a further significant loss for the semicon ecosystem in the Netherlands. While we appreciate it is difficult to fix the challenges, the stakes are extremely high:

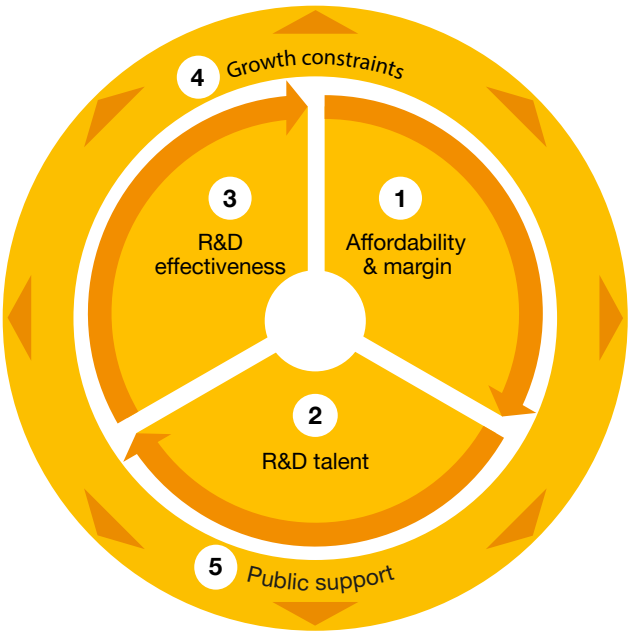
- Mid-tier R&D erosion puts the innovation success of the wider Dutch ecosystem under pressure. The Mid-tier play a critical role in the Dutch semicon ecosystem as co-innovation between Big 5 and midsized players is a key characteristic of the semicon ecosystem in general and has been one of the key success factors of the semicon ecosystem in the Netherlands in particular.
- R&D is critical to stay competitive in the global semicon market, to avoid commoditization and related margin squeeze. A gradual relative reduction in R&D spend may free up resources in the short term but will inevitably hamper the ability to innovate in the longer term.
- Any foregone R&D opportunity from the private sector in the Netherlands (estimated to amount over €200 mln by 2030, see Figure 7) is a miss in view of the already existing R&D gap of the country (2.1% of GDP in 2023 versus the objective of spending 3% of GDP on R&D).
- Maintaining critical mass in R&D for midsized players is important, to counterbalance the dominance of global players, for example in the war for talent.

In summary, we do not want the semicon ecosystem in the Netherlands to gravitate towards a concentrated model where only large players invest in R&D. A vibrant Mid-tier segment is crucial for the long-term success and sustainable innovation power across the ecosystem (as evidenced by successful ecosystems like Silicon Valley and Hsinchu Science Park).

6. Curbing the trend – call for action

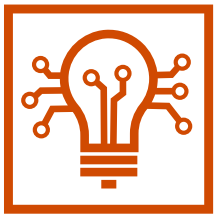
To curb the trend for the Mid-tier, we see five main themes that need to be addressed in parallel (see Figure 9). Each theme alone in itself will not solve the R&D challenge for the Mid-tier. A coordinated effort across all five themes is required. Given the endeavor, industry associations, industry cooperation platforms and the government need to see how they can help initiate and orchestrate some of the levers outlined below.

Figure 9 Five key themes to curb the concentration trend



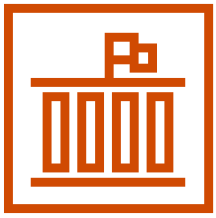
1. **Affordability and margin:** Countering margin pressure is key to avoid pressure on the affordability of increased R&D spend. This requires first and foremost to avoid any addressable margin leakage due to operational inefficiencies or work organization that is not fit for purpose for a company that has grown strongly over the past years and for instance doubled in size (e.g., way of working in the back-office and supply chain planning). The expected economies of scale from the past wave of growth in the sector and the aspired synergies that could go along are not always playing out for many of the Mid-tier. While many companies have shown a strong growth trajectory, operational complexity and a lack of thorough professionalization, standardization and automation are hindering the realization of cost and efficiency benefits of the increasing scale. Increased focus on process innovation (versus product innovation) may result in lower costs or higher production efficiency.
   Another important way to counter margin pressure is through both product and proces innovation.
   Additionally, some of the companies should take a fresh, comprehensive view on their portfolio (both products, services, segments and customers) to focus on the high value-add clusters with margins that allow for R&D spend. Some product/customer clusters may have been appropriate in the past in terms of focus but may have commoditized over time.

2. **R&D Talent:** Easing the complexities of getting international highly skilled engineering talent to midsized companies is key. This may involve working together or setting up new joint initiatives to bring talent to the Netherlands and investing more in employer branding. Mid to longer term, improving the curriculum in the Netherlands and increasing the throughput of STEM profiles will help. Midsized players need to find their role in these efforts too.



3. **Effective R&D:** History has shown that wrong decisions and ineffective spending can have dire consequences in the sector, with even incumbents facing the threat of obsolescence. It is not only about how much you spend on R&D. It is also about securing and optimizing the output of the R&D investments. Successful innovators do not cut on the input side – although a strategic rightsizing may be justified in certain situations – but instead focus on maximizing the output of their R&D efforts. Professionalizing the R&D function has become a table stake. It requires robust innovation governance to align R&D with the strategic company priorities and market context, ensuring that the technology and business teams are fully in synch. It requires making critical and coherent choices about where to innovate, having a clear roadmap and portfolio that balances short-term (tactical quick wins and incremental projects) and long-term goals (bolder and higher-NPV initiatives), and core versus emerging technologies. It also means deciding with whom to partner, and what and when to outsource. Streamlining the New Product Introduction (NPI) process can further reduce time to market. Effective R&D also demands full transparency, with real-time data and proven metrics to objectively measure and manage progress across the entire innovation portfolio. To achieve this, the Finance function and Technology functions need to work together closely and align on the innovation processes, metrics, and decision-making criteria to be used.

4. **Growth constraints:** While the overall semicon sector growth may be slow for 2025, addressing growth constraints for the future is warranted in anticipation of the next growth wave which may already kick in early 2026. This growth will further drive the ability to invest in R&D, also in the Netherlands. We have analyzed the full impact of the growth restrictions for the Mid-tier in our Semicon in NL report from last year. Alleviating these constraints requires government intervention to secure access to power, space and talent. Meanwhile, the Mid-tier can maximize productivity to and increase output within existing constraints by adopting enhanced standardization, automation, and embracing technologies such as AI and IoT.



5. **Public support:** Continued and extended public (government) funding and policies will also help companies in their R&D trajectory. Next to the available facilities incentivizing product innovation, it would help to also introduce instruments that support proces innovation. The Mid-tier should maximize the use of these supporting mechanisms. Ensuring competitive government support is vital, especially given the increasingly important role of semicon in the Netherlands and the intensifying global bidding race for future innovation investments and talent. Project Beethoven helps in improving infrastructure and influx of talent in the Netherlands, but is not enough, especially compared to the attractive and sizeable public funding initiatives in other regions. This need for strategic government co-funding is underscored by recent initiatives and industry requests for support, such as the sector-wide innovation program presented by the ChipNL consortium. Additionally, an attractive immigration scheme remains necessary to retain access to international talent. Ideally, all of this should be done in close coordination with like-minded international allies to foster growth and innovation, while enhancing national security and supply chain resilience.

> “While the overall semicon sector growth may be slow for 2025, addressing growth constraints for the future is warranted in anticipation of the next growth wave which may already kick in early 2026.

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