April 2023 · Julia Hess, Wiebke Denkena,
Jan-Peter Kleinhans, Pegah Maham

Who is funding the chips of the future?

Analysis of global semiconductor startup funding activities

Stiftung
Neue
Verantwortung

Think Tank at the Intersection of Technology and Society

Acknowledgements

We would like to thank Oluwabimpe Abiodun Lawal for the support with the creation of the dataset, Lisa Koeritz and Aanya Dandass for their help during the data collection and verification process, Christian Laesser and Alina Siebert for their advice regarding the design and creation of the visualizations, Luisa Seeling for her support in editing the text, and Sebastian Rieger and Justus Römeth for helping us spread the word about this publication.

The programs “Artificial Intelligence & Data Science” and “Technology and Geopolitics” at SNV are made possible by the generous support of Stiftung Mercator.

Executive Summary

With multi-billion-euro investments in new semiconductor fabs and government subsidy packages measuring tens of billions of euros, it is easy to forget that startups play a crucial role in the global semiconductor ecosystem, especially in times when there is a huge demand for innovative semiconductor products that meet the rising compute demands of artificial intelligence. While private and public investors have paid more attention to software startups than hardware startups in the last decade, the last years have seen a flurry of activity in semiconductor startups. But in which countries is this activity concentrated? Where are semiconductor startups emerging, and who is funding them?

A better understanding of the global semiconductor startup ecosystem should be of interest to policy makers who are thinking about long-term industrial policy to strengthen their domestic semiconductor ecosystems. This is especially important in times when most of governments' attention focuses on the technological competitiveness and market positions of their incumbents, for various geopolitical reasons. Of course, it takes much more than just money to foster a vibrant domestic semiconductor startup ecosystem. Nonetheless, in this quantitative analysis of global startup funding activities in chips, we want to provide a first glimpse at this vital part of the semiconductor value chain. We connect the dots between the geographical distribution of startups and investors and map the activities of startups along the semiconductor value chain.

Our findings provide a basis for better understanding funding activities within the international semiconductor startup landscape by analyzing 1418 funding rounds from 1144 startups in which 2741 investors participated. Even though it is only a first examination of a rather underexposed pillar of the semiconductor ecosystem, we want to highlight some key take-aways that are promising starting points for further analyses: Examining the strategies of investors reveals geographical differences. Our data show that investors from China, the US and Israel tend to focus on their domestic ecosystem (95%, 67% and 92% of transactions go to local startups, respectively), while others, such as investors based in Japan or Taiwan, have a more diverse portfolio. Overall, our analysis of startups activities concludes that China is by far the country with the largest domestic ecosystem and chip design is the process step where most startups, across countries, are active.

Table of Contents

Authors

Semiconductor Ecosystem Expertise

Lead: Julia Hess
Project Manager
Technology and Geopolitics

Jan-Peter Kleinhans
Project Director
Technology and Geopolitics

Data Science and Visualization

Lead: Wiebke Denkena
Project Manager
Artificial Intelligence & Data Science

Pegah Maham
Project Director
Artificial Intelligence & Data Science

1. Introduction

In the aftermath of the highly disruptive shortages in many industries, from automotive to health and consumer electronics, and in light of the increasingly tense geopolitical situation, policymakers have recognized the strategic relevance of semiconductors as a foundational technology. There is a lot of policy attention to strengthening the resilience of the global semiconductor value chain and the technological competitiveness of domestic or regional semiconductor ecosystems.

While public debates and policy measures in many countries, including those in Europe, are currently centered mainly on subsidizing semiconductor manufacturing, the importance of a healthy and vibrant domestic semiconductor startup ecosystem often goes unnoticed. However, funding activities in the semiconductor startup ecosystem are an interesting marker of technological innovation. Thus, in this analysis, similar to our previous work on global semiconductor research and development activities (see “Who is developing the chips of the future?”)[1], we want to provide a first glimpse at global funding activities in semiconductor startups through a quantitative analysis.

To this end, we analyzed the geographic distribution of funding activities in the global semiconductor ecosystem from 2020 to 2022, based on a manual collection of information about funding rounds. We are specifically interested in the differences between countries and the potential geopolitical implications: Which country is leading in terms of investor activity? Which country do most semiconductor startups come from? What process steps in the semiconductor value chain are most startups active?

In a nutshell, we present three important insights derived from several of the charts provided below.

1. Investors from countries such as **China, the US, and Israel are focused on investing in their domestic startup ecosystems.** A few others, such as **Japan and Taiwan, show more diverse activities targeted toward foreign ecosystems.**

2. Based on our dataset, **chip design is the process in which the majority of startups are active.** Specifically, over half of the startups in our dataset are involved in chip design.

3. **China is leading both startup and investor activities.** Across all process steps in the value chain, China is the country with the most startup activity. This reflects their efforts toward self-sufficiency. Additionally, the largest number of investors in our dataset is from China.

These insights will be explained in more detail in the following sections. Before diving into the analysis, the next sections first provide an overview of our methodology and the central concepts of our analysis. We then provide the key insights from our quantitative analysis. Every paragraph consists of three parts: *what you see, what it means,* and *limitations.* For further information on our methodology and its limitations, please consider *Annex 1*.

2. Data and methodology

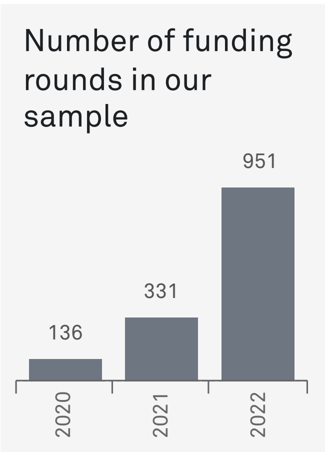
2.1 Understanding the data

The starting point of our analysis is a monthly series of blog posts about semiconductor startups published on SemiEngineering (Semiconductor Engineering) by Jesse Allen.[2] SemiEngineering is an important source of information on the semiconductor industry that combines insights into the technological aspects and market dynamics of the field.[3] The monthly startup blogposts describe current funding rounds of semiconductor startups, with brief profiles about the startups' products, headquarters, investors, and, if available, the funding amounts.

After collecting the data from SemiEngineering, we complemented it with additional information from Crunchbase.[4] This allowed us to fill in gaps from the SemiEngineering blogposts regarding headquarters of startups and investors, participating investors, and the amount of funding per funding round.

Then, we manually categorized the activities of the startups along the semiconductor value chain based on our knowledge of the semiconductor industry. For further information on this method and its challenges, please read *Annex 1B* regarding *Startup categorization*.

Figure 1



The representativity of our dataset cannot be guaranteed. Since the primary source of information for our study is blog posts published by a single journalist, it is uncertain how many startups and funding rounds are not covered in the articles and difficult to completely rule out potential biases. For example, we observed a substantial increase in the number of funding rounds mentioned in the monthly blog posts over the span of three years *(Figure 1)*: In 2020, 136 funding rounds were mentioned, while the number rose to 951 in 2022. This increase could indicate a rise in the number of funding rounds occurring within the semiconductor ecosystem over time, or it could suggest that the journalist has recently delved more thoroughly into the topic, which could potentially mean that our analysis is biased. It is also possible that both factors have contributed to the observed trend. In order to gain a better understanding of the representativity of our sample, we compared our results with other analyses of semiconductor startup activities. While sample sizes differ substantially between different sources, broad trends such as the steep rise in funding activities over the last three years, are confirmed across reports. For further information, please read *Annex 1A*.

2.2 The central concepts of our analysis

Startups usually raise money from one or multiple *investors* in *funding rounds*. For example, if five investors participate in a funding round of a startup, we count this as five *transactions (investments)* in our analysis. Obviously, a startup can have multiple funding rounds, each including multiple participating investors and, thus, multiple transactions. *Transactions* **(individual investments by investors in a funding round) form the basis of our analysis.**

Figure 2 exemplifies the varying degrees of transparency about the money raised per funding round. Throughout the last three years, Chinese startup CIX Technology went through at least three different funding rounds, based on our dataset.

Figure 2

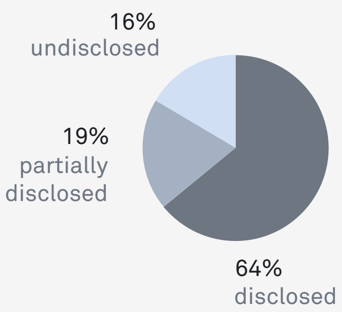
Types of funding rounds in our sample using the example of startup CIX Technology

The amount of money for one of the funding rounds was fully *disclosed* – CNY 100 million (shown in blue). Another funding round for CIX Technology in our sample (shown in orange) was only *partially disclosed* because the respective blog post only included a vague formulation like “tens of millions of yuan” about the funding amount and no more specific information was available via Crunchbase. In such cases, we used a minimum and a maximum estimate for the funding amount; in the above example, “tens of millions of dollar” was interpreted as $ 20–90 million. The last type of funding round contained in our dataset are *undisclosed rounds* (shown in purple) – in these cases, we have no information about the funding amount at all. For our analysis, we neither differentiate between the funding round type, also known as investment stages (Pre-Seed Funding, Seed Funding/Angel Round, Series A/B/C Funding, …) nor the investor type (individuals, established venture capitalists, angels, venture capital firms, private equity firms, etc.).

Figure 3 shows that out of the 1418 funding rounds we tracked, around **19% have partially disclosed** amounts and around **16% have entirely undisclosed** funding amounts. Thus, **our analysis mainly focuses on transactions as a marker for investment activity** instead of the transactional value of a specific funding round. We count every transaction taking place in a funding round with different investors, regardless of the exact amount. Accordingly, the number of transactions does not allow any conclusions to be drawn about the investment amount.

Figure 3

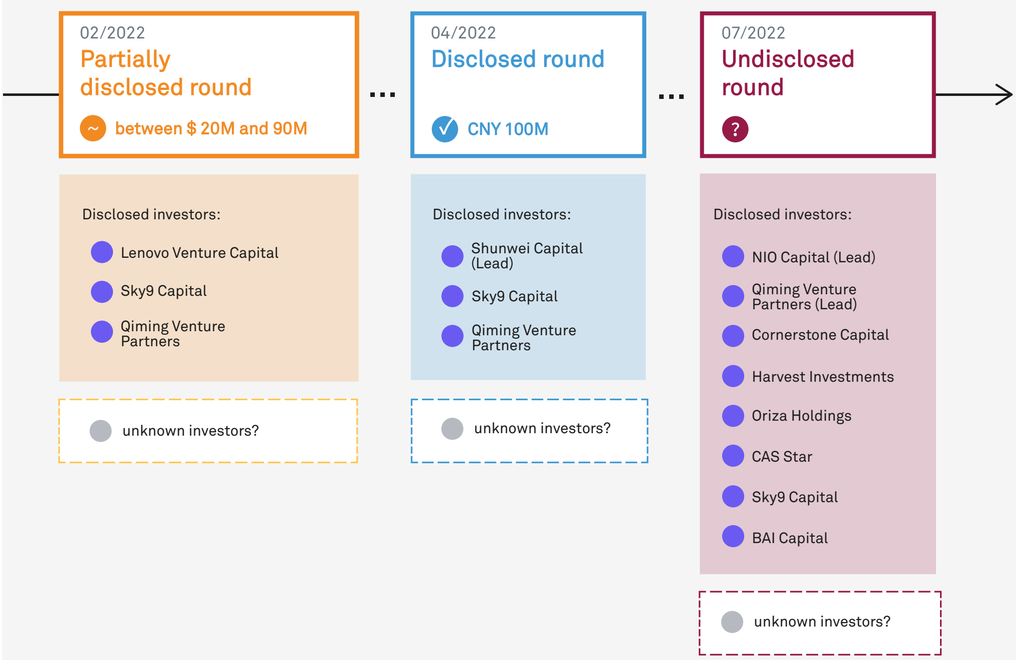
Available information about funding amounts



The unknown funding amount is not the only uncertainty at play regarding the analysis of funding rounds, because we can never be certain that all investors are publicly disclosed, even after complementing the blog post with data from Crunchbase (see *Figure 4*). Difficulty in determining the countries of origin of some investors represents another challenge encountered in this study. For further information, please refer to *Annex 1C.*

Figure 4

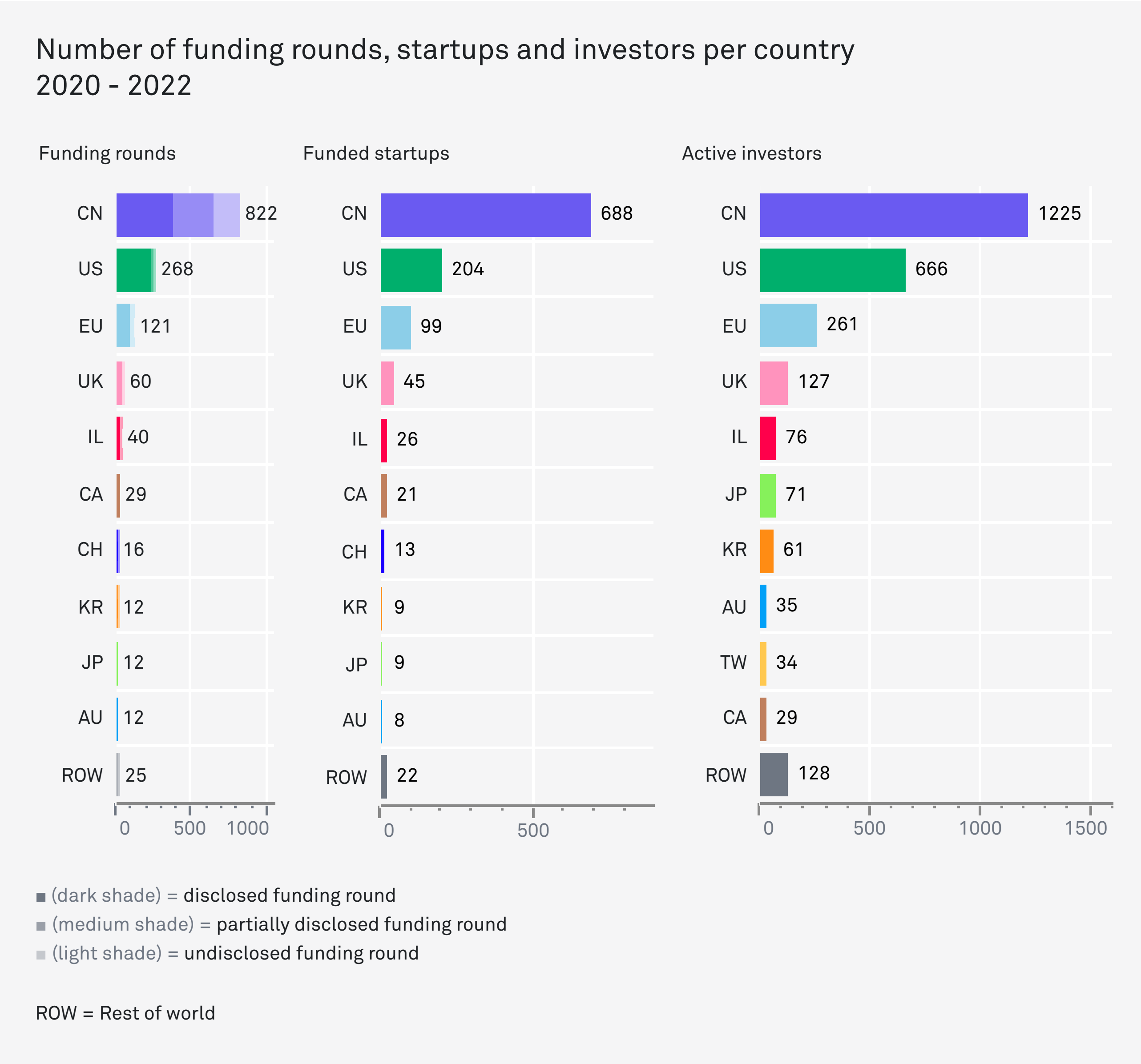
Available information on investors in our sample using the example of startup CIX Technology



3. Results

3.1 The geographic distribution of funding acitivities

Figure 5



What you see

Figure 5 shows the number of funding rounds, startups, and investors per country that we collected.[5] As an example, our dataset tracks 1225 investors (graph on the right) and 688 startups (graph in the middle) in China. According to the left graph, Chinese startups received funding in 822 funding rounds from January 2020 to December 2022 (382 disclosed, 269 partially disclosed, and 171 undisclosed; see shading). Importantly, the left chart about funding rounds does not give any insight into (a) how many investors participated in each funding round or (b) the origin, that is, headquarters location, of the participating investors. Both will be provided in *Figure 6* in the following section.

What it means

Country activities regarding funding rounds, startups, and investors differ significantly. From all the startups that were funded and active investors that we tracked over the last three years, **China is clearly the most active country globally.** In our sample, we found more than three times more funded startups based in China than in the US and six times more than those in the EU[6]. A plausible explanation for China's strong engagement in the semiconductor startup ecosystem is that it has focused on building and strengthening a domestic semiconductor ecosystem for more than a decade.[7] State-linked investment funds such as the "Big Fund" target China's technological competitiveness in foundational and emerging technology sectors.[8] This is also reflected in the "Made in China 2025" industrial upgrading plan, with the goal of reaching 70% self-sufficiency by 2025.[9]

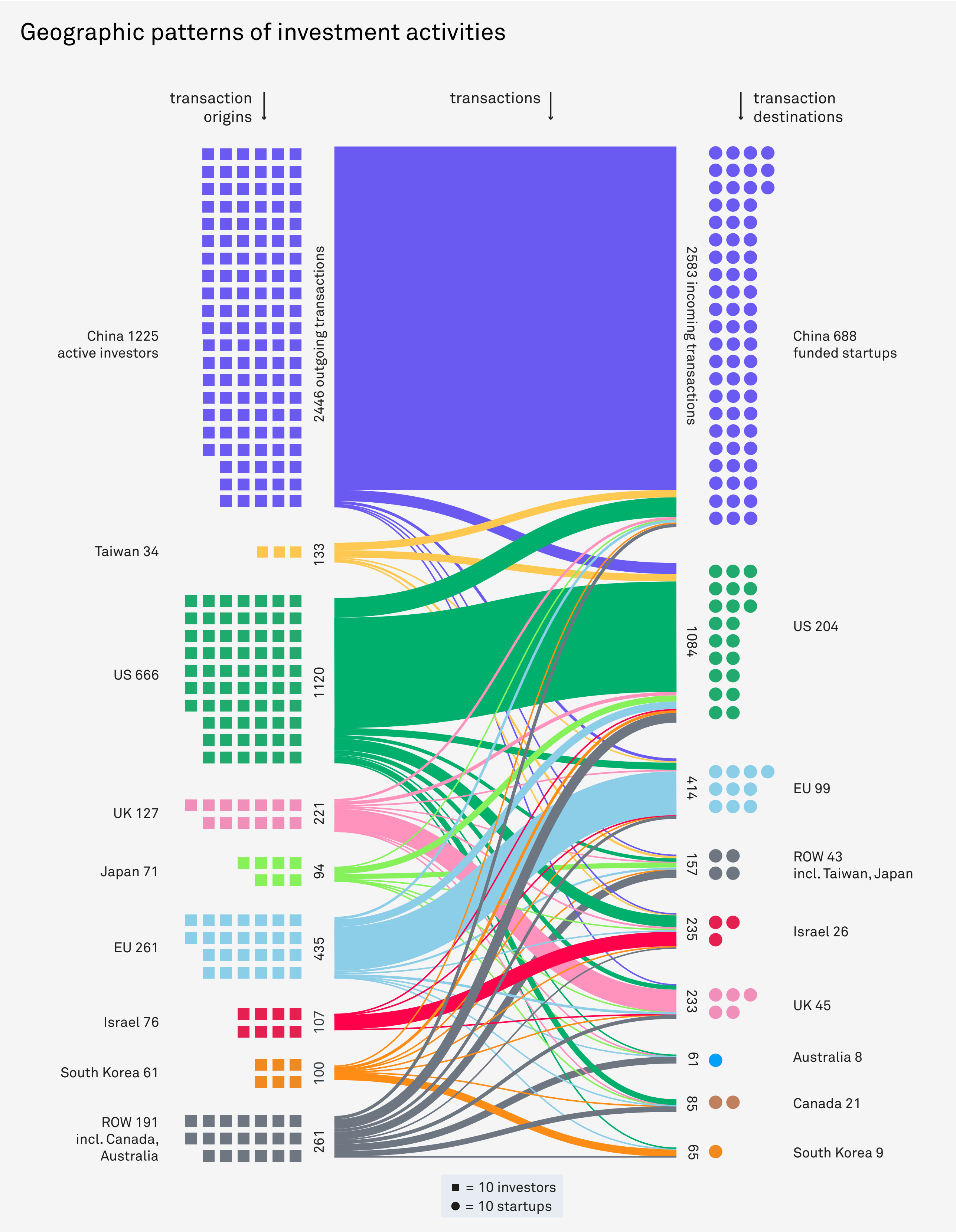
In addition to Chinese investors, a **significant number of investors from the US were involved in funding rounds** throughout the past three years. **Japan and South Korea are home to a noteworthy concentration of investors** that were active during this period, but only have a small number of startups. **China also has the most undisclosed or partially disclosed funding rounds** and, thus, less transparency than the other countries depicted in the chart. Every second funding round in China does not seem to be completely disclosed in terms of the funding amount.

Limitations

When drawing conclusions from *Figure 5*, please consider the limitations described. Our dataset may not include all startups and investors participating in funding rounds, potentially leading to data selection effects *(Annex 1A)*. Additionally, the accuracy of our analysis may be affected by incorrect headquarters locations *(Annex 1C)* and instances in which companies have multiple names *(Annex 1D)*.

3.2 Who invests where?

Figure 6



What you see

Figure 6 shows the geographic patterns of investment activities during the last three years. Reading the Sankey diagram from left to right shows *investors* (colored rectangles, left) and their *transactions* (center) with *semiconductor startups* (colored circles, right) by country.[10] Every rectangle represents ten investors, and every circle represents ten startups. The left side of *Figure 6* shows the top nine transaction origin countries, whereas the right side shows the top nine transaction destinations. Therefore, countries displayed on the left are not identical with those on the right. Taiwan and Japan are only shown separately on the left side and Canada and Australia are only shown separately on the right side. On the respective other side, these countries are grouped under rest of world *(ROW)*. Importantly, the funding amount is neither considered nor displayed in this chart. **The chart shows the number of transactions** (i.e., how many times investors invested in startups). In addition, **pie charts** in *Annex 2* **show the relative distribution of incoming and outgoing transactions for every country** in detail.

How to read Figure 6 (left to right): In our dataset, there are, for example, 76 investors from Israel that made 107 transactions (individual investments through funding rounds). The major share of those transactions flows into startups in Israel (92%), 7% go into US startups, and 2% go each into startups based in the UK and the EU. The relative shares mentioned are shown in the additional pie charts (see *Annex 2*).

How to read Figure 6 (right to left): In our dataset, 26 startups headquartered in Israel received 235 transactions. Among these, 42% came from Israelian investors, 34% from the US, and the rest came from the UK, the EU, South Korea, and other countries. Again, additional pie charts in *Annex 2* provide exact shares of transactions.

What it means

One notable difference among global investors is their preference for domestic versus foreign startups. For instance, **in countries such as the US, Israel, the UK, and China, investors tend to prioritize funding startups based in their own country.** By contrast, **investors from Japan, South Korea, and Taiwan are more likely to invest in foreign startups.** As an example, only 6% of transactions (investments) from investors in Taiwan go to startups in Taiwan.

On the opposite end of the spectrum, there's China, where startups only receive limited foreign investments (90% of investments in Chinese startups come from Chinese investors), and Chinese investors are almost exclusively focused on their domestic ecosystem (95% of their transactions go to Chinese startups). Importantly, the rather miniscule 10% share of transactions from foreign investors to Chinese startups still amounts to 253 transactions – more than the total number of transactions received by UK startups. With the intensifying US-China technology rivalry, these numbers already went down compared to before 2020[11] and will, most likely, go down further with the planned outbound investment screening in the US.

Second, for startups in every country listed in *Figure 6,* investors from the US are the second largest group, after domestic investors. In Canada, they even form the largest group. For example, for European startups, 72% of transactions (individual investments) came from investors in Europe and 12% came from US investors. Similarly, 13% of all transactions made by European investors are targeted toward the US, followed by 4% each to the UK and China, and 71% are going into the domestic startup ecosystem.

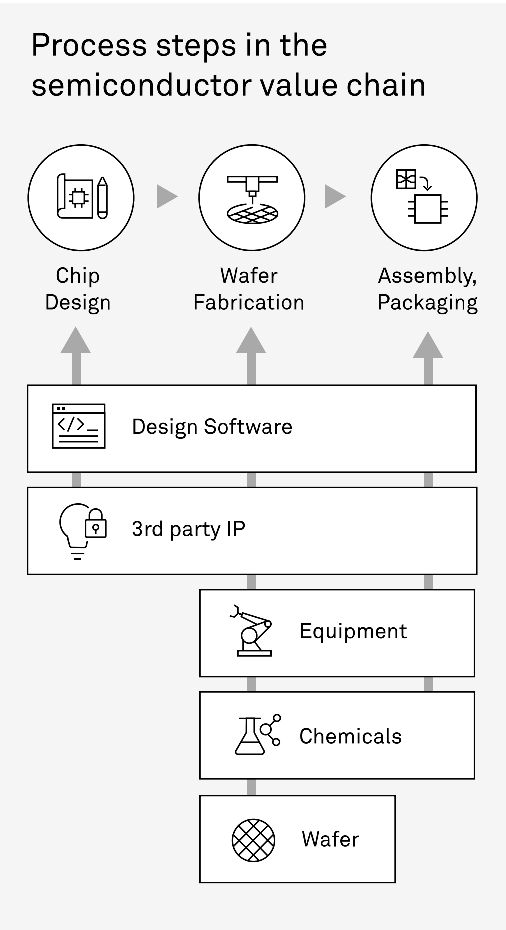
Limitations

When drawing conclusions from *Figure 6*, please consider the limitations described. Our dataset may not include all startups and investors participating in funding rounds, potentially leading to data selection effects *(Annex 1A)*. Additionally, the accuracy of our analysis may be affected by incorrect headquarters locations *(Annex 1C)* and instances in which companies have multiple names *(Annex 1D)*.

3.3 A value chain perspective: Mapping startup activities

Up to this point, our analysis of funding activities in the semiconductor ecosystem has focused solely on the geography of investors and startups. By incorporating the activities of startups into specific production and process steps, we can gain a more comprehensive understanding of where most startups are active in the value chain. To provide a context for this approach, we will briefly outline the semiconductor value chain and its unique characteristics.

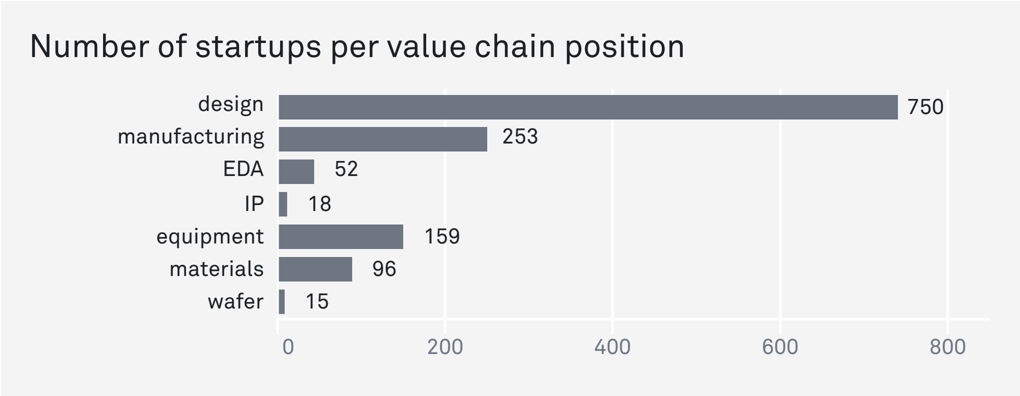
Figure 7



The semiconductor value chain is rooted in a transnational division of labor that leads to high levels of economic efficiency and innovation, as well as strong interdependencies in a highly specialized and complex ecosystem.[12] It can be divided into three production steps: chip design, wafer fabrication (also called front-end manufacturing), and assembly, test, and packaging (also called back-end manufacturing). Equally important are the supplier markets providing critical inputs for semiconductor design and manufacturing: IP and EDA (Electronic Design Automation) software for chip design, equipment, materials, and wafers for front-end and back-end manufacturing (see *Figure 7*).

Globally, there are a few key countries that play an important – sometimes indispensable – role in one of the process steps or supplier markets: the US, Taiwan, South Korea, Japan, the EU, and, increasingly, China. None of these countries has an entire production stack in their own territories. Instead, there is close collaboration across borders along the whole value chain and its supplier markets to develop competitive products. For example, US fabless (design) companies rely on Taiwanese foundries to manufacture their chips. The foundries themselves rely on more than 50 different types of equipment and up to 400 different chemicals, primarily from the US, the EU, and Japan. Sometimes, specific inputs can only be provided by a single company. Due to these highly concentrated markets and the need for close collaboration to stay innovative and competitive, there are strong lock-in effects between fabless companies and foundries for contract manufacturing, as well as between equipment and materials suppliers and fabs. In our previous publications listed in *Annex 4*, we explain the setup as well as the characteristics of the semiconductor value chain in more detail.

Figure 8



What you see

When classifying the semiconductor startups that received funding over the last three years, we used the value chain framework described in the previous section. *Figure 8* shows the production (design or manufacturing) or process steps (EDA, IP, equipment, materials, and wafer) in which the startups in our dataset are active. We do not differentiate between front-end and back-end manufacturing.

A high variance in the number of startups in each segment becomes apparent. **The number of startups active in design is the largest (750), while those active in IP and wafers is particularly small (18 and 15, respectively).** It is important to understand that one startup can be attributed to more than one category. One example of this is CelLink. The startup is active in chip design and manufacturing. Thus, it is counted twice in the above chart – for the design and manufacturing categories. Consequently, the numbers displayed in this chart do not represent the number of startups in our dataset but the number of activities in different segments over the last three years.

What it means

Chip design is by far the area in which most startups are involved. **More than every second startup in our sample that has received funding during the last three years is involved in chip design.** This can be explained by the rise of special-purpose chips in response to the growing number and variety of chips needed for cars or other AI-based products.

The shift from general-purpose computing to application-specific chips offers room for startups to enter the chip design market, designing semiconductors tailored to a specific end product. This is particularly evident in AI chip startups developing special-purpose processors to cope with the constantly growing need for computing in data centers or end-user devices.[13] According to market analysts, the AI market is expected to grow to more than $1.6 trillion by 2030.[14] Thus, the rising demand for AI chips is filled by a quickly growing number of AI chip startups.

Apart from the demand for new kinds of chips, chip design is an attractive field for investors because it has the highest value add (50%) in the semiconductor value chain and relatively low upfront investment costs compared to semiconductor manufacturing. Chip design has lower entry barriers than other process steps in the semiconductor ecosystem, and no expensive manufacturing equipment or clean rooms are needed. However, compared to a classical software startup, which can operate "from the garage" and quickly reach a stage where revenues are earned, the design of a new chip can take years, during which the startup makes no revenue at all. Overall, chip design is thus a risky and capital-intensive endeavor, requiring a lot of patience during every step of the process – from the initial design to fixing problems in the semiconductor when they are first taped out, as this can sometimes require a redesign.[15]

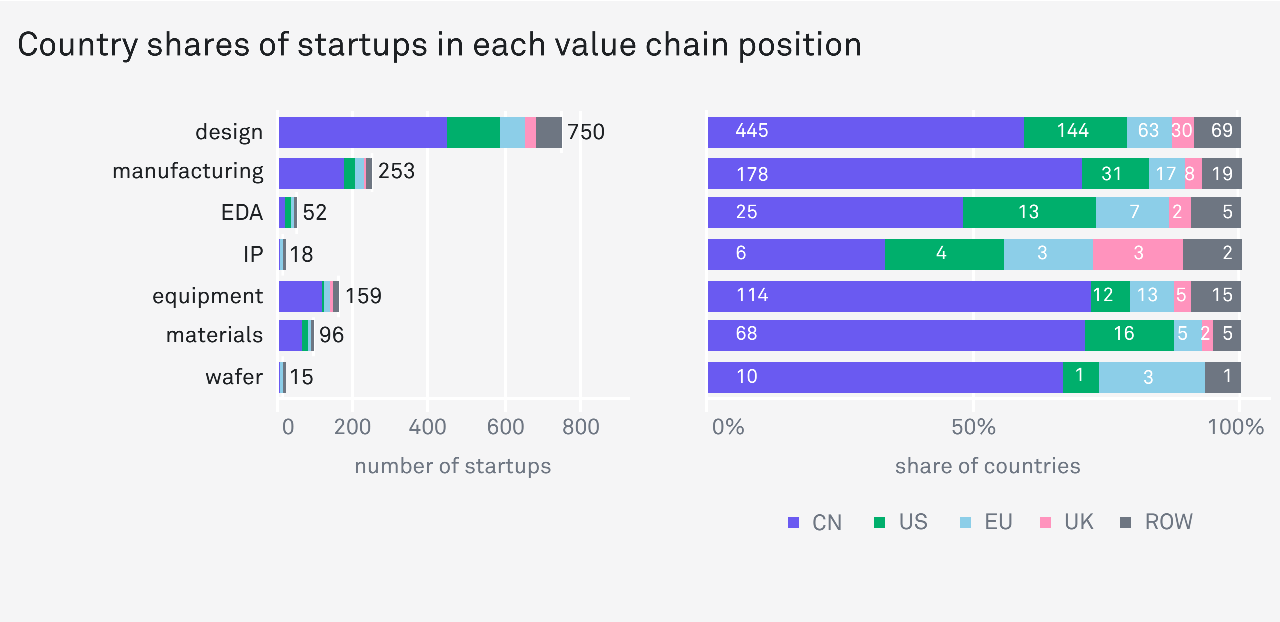
Limitations

When drawing conclusions from *Figure 8*, please consider the limitations described. Startups might be significantly more active in one segment than in the other. For this analysis, we counted all segments equally. For example, a startup developing EDA software might also sell semiconductor IP, but the vast majority of revenue is generated from selling EDA software licenses. Nonetheless, the above chart maps such a startup as "+1" for EDA software and "+1" for IP. See *Annex 1B* for a full description of the categorization process.

Our dataset may not include all startups and investors participating in funding rounds, potentially leading to data selection effects *(Annex 1A)*. Additionally, the accuracy of our analysis may be affected by instances in which companies have multiple names *(Annex 1D)*.

3.4 Regional breakdown of startups activities

Figure 9



What you see

Similar to the previous chart, *Figure 9* shows how many startups in our dataset are active in each segment. One startup can be assigned to, and thus counted for, multiple categories. Additionally, in *Figure 9*, the colors indicate the proportion of startups for each country in each segment. The left panel displays the absolute numbers, while the right panel shows the relative shares per country. The white numbers in the bars in the right graph indicate the absolute number of start-ups per country in each category. For example, there are 445 Chinese and 144 US startups active in design. As shown in the figure, across all segments, Chinese startups account for the largest share, often making up more than half of the startup activities.

What it means

Countries show different patterns regarding their activities in different semiconductor production and process steps. **According to our data, China is the most active country in every market of the semiconductor startup ecosystem.** There appears to be no prioritization of specific segments; the activities of Chinese startups can be found everywhere along the value chain. One plausible reason for this is China's pursuit of self-reliance. To become less dependent on foreign (especially US) technology providers, China heavily invests in its domestic semiconductor ecosystem.

The **US startups play the second most important role in our dataset in several markets along the value chain, for example in design, EDA and materials.** Compared to China, and even though the absolute numbers are small, the share of US startups differs between the categories. Their focal areas of activity mirror their strong suits in the transnational semiconductor value chain. US companies have a high market share in chip design, due to US fabless companies (e.g., Qualcomm, Nvidia, and AMD) and system companies (e.g., Apple, Tesla, and Google). As the licensing of EDA software is strongly connected to chip design, they also play an important role in this market.

The lower number of activities displayed in the chart for other countries makes it difficult to draw conclusions. However, based on the limited data available, it seems that the **EU's activities are less targeted toward specific production and process steps.**

Limitations

When drawing conclusions from *Figure 9*, please consider the limitations described. Startups might be significantly more active in one segment than in the other. For this analysis, we counted all segments equally. For example, a startup developing EDA software might also sell semiconductor IP, but the vast majority of revenue is generated from selling EDA software licenses. Nonetheless, the above chart maps such a startup as "+1" for EDA software and "+1" for IP. See *Annex 1B* for a full description of the categorization process.

Our dataset may not include all startups and investors participating in funding rounds, potentially leading to data selection effects *(Annex 1A)*. Additionally, the accuracy of our analysis may be affected by instances of incorrect headquarters locations *(Annex 1C)* or in which companies have multiple names *(Annex 1D)*.

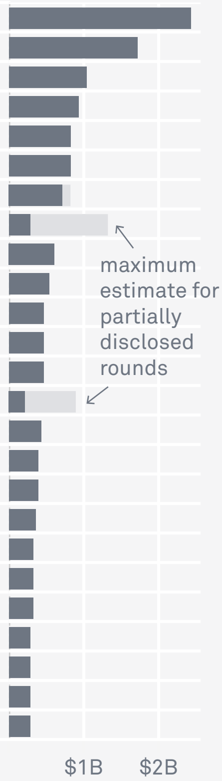
3.5 Startups with highest funding amount

Figure 10

Highest-funded startups in our sample

Horizon Robotics	CN	design, manufacturing	2
Eswin Technology	CN	design, manufacturing, wafers	0
Chipone Technology	CN	design	0
SambaNova Systems	US	design	0
Unisoc	CN	design	0
Vital Thin Film Materials	CN	materials	0
CanSemi	CN	manufacturing	0
Zhaoxin Semiconductor	CN	design	0
SJ Semi	CN	manufacturing	0
Moore Threads	CN	design, manufacturing	1
Innoscience Technology	CN	design, manufacturing	0
Ancora Semiconductor	TW	design	0
PsiQuantum	US	design, manufacturing	0
Black Sesame Technology	CN	design	2
Hejian (UniVista)	CN	EDA	0
Vastai Technologies	CN	design	0
Enflame Technology	CN	design	1
Graphcore	UK	design	0
Iluvatar CoreX	CN	design, manufacturing	0
Lihao Semiconductor Materials	CN	materials	0
MetaX Integrated Circuits	CN	design	0
MegaRobo Technology	CN	equipment	0
Groq	US	design	0
Viiyong Electronic Technology	CN	design	0
Fujian Deer Technology	CN	materials	0

undisclosed rounds ↑



What you see

This table shows 25 startups in our sample that received particularly high amounts of funding in disclosed rounds, or potentially high amounts through undisclosed and partially disclosed funding rounds throughout the last three years. This changes the perspective from looking at funding activities (measured in number of transactions) to *the accumulated funding amount*[16] *a specific startup has received over the last three years*. The left-hand side of the table lists the names of the startups. The second column displays their headquarters. The third column shows the segments in which the startup is active. The fourth column indicates whether there are undisclosed funding rounds in our dataset. Lastly, the fifth column shows the accumulated funding amount raised in disclosed or partially disclosed rounds in US dollar. The dark grey bars show the amount of funding that was raised in disclosed rounds. The light grey bars indicate the funding that was potentially raised additionally via partially disclosed rounds.

What it means

A look at the 25 startups that raised the most funds supports many of the key takeaways we presented earlier. First, of the 25 startups ranked in this chart, 20 are headquartered in China. Our data show that China is very active in terms of transactions; however, the transactional values could be lower than the transactions from investors headquartered in other countries. **The overview of highest-funded startups in our sample suggests that Chinese semiconductor startups not only attract a large number of transactions but also raise high funding amounts.**

Second, chip design is not only the production step most startups that were funded during the last three years are active in. **The top-funded startups in our sample indicate that chip design is also the segment with the highest funding amounts.** Of the 25 startups ranked in this chart, 18 are active in chip design.

Third, the chart suggests that the EU lags behind China and the US regarding large funding amounts. **Among the startups with particularly high funding amounts in our sample, not a single one is based in the EU.**

Limitations

Figure 10 comes with several limitations. First of all, our sample might be missing important startups and funding rounds because they were not mentioned in the SemiEngineering blogposts. For example, due to a funding round not covered by our sample, the Chinese startup GTA Semiconductor is missing in *Figure 10*, even though it raised more than $1B over the last three years.[17]

Second, the **exact transaction value is not disclosed for every funding round**. Thus, a funding round that is (partially) disclosed or completely undisclosed could account for a significant amount of funding and change the ranking. We included estimates for partially disclosed funding rounds (light grey bars in the chart).

Lastly, startups that appear in our sample under different names, which we were not able to normalize, might appear in the list of top startups in a wrong position (or not at all) because we could not aggregate their funding amounts *(Annex 1D)*.

4. Conclusion

This paper presents a first analysis of global semiconductor startup funding patterns, with the goal of providing first insights into this vital part of the semiconductor value chain. Although the data analysis comes with caveats, it highlights some interesting general trends regarding countries' activities at the startup level. Interestingly, our observations about the startup ecosystems in different countries reflect how countries are positioned in the global value chain and how they each attempt to strengthen their competitiveness – or even achieve independency – in different ways.

The elephant in the room is the sheer number of Chinese investors and startups. The latter innovate across the entire semiconductor value chain, from semiconductor materials to equipment, fabs, and, ultimately, the chips themselves. This high level of activity can be explained by China's attempts to lessen its dependence on foreign (especially US) semiconductor technology suppliers. Achieving import substitution ultimately means that Chinese semiconductor companies have to "reinvent the wheel" in many areas of the value chain.

During the last three years, the US has been the second most active country regarding the number of active investors and funded startups. Interestingly, even though the major share of investments stays within their borders, US investors are equally involved in funding rounds for startups all over the world – from China to Japan and Europe, to name just a few. US startups are centered around chip design, an area in which they are already leading.

Our data reveal further interesting insights with regard to the activities of individual countries in Europe. We have included a breakdown of individual European countries activities regarding funding rounds, funded startups and active investors in *Annex 3* to supplement *Figure 5.* Similar to our past quantitative analysis of semiconductor research[18], this figure shows that **most activity in the EU by investors and startups is concentrated in a few member states.** Based on our sample, the majority of EU investors comes from Germany, France, the Netherlands, and Belgium. On the side of semiconductor startups, our dataset shows the most activity in Germany, France, Finland, the Netherlands, and Sweden. With newly established initiatives, such as the European Innovation Council's "Accelerator Challenge," which focuses on chip design[19], having a better overview of "who is funding what and where" in the global semiconductor ecosystem becomes increasingly relevant for innovation and industrial policy in the EU.

Lastly, this publication can also be seen as an invitation to get in touch with us to learn more about our work analyzing the global semiconductor value chain. We would also love to hear from you if you identified an error in our analysis. The underlying data of our analysis was published on our website along with this Data Brief.

5. Annex

Annex 1: Methodology and limitations

A: Data selection

Our analysis is based on a series of monthly blogposts published by a journalist over a 3-year time span. It is possible that the resulting sample of funding rounds is biased toward certain countries, startup categories, or other dimensions relevant to our analysis. Overall, the number of startups covered in the blog posts grew significantly over the observed period. Funding rounds for Chinese startups are mentioned much more frequently in the blogposts from 2021 onwards. This might be due to a significant expansion of the Chinese startup ecosystem during the last few years, due to a change in the level of detail in the blogposts over time (e.g., a change in the source of information or research method), or due to a combination of both.

Additionally, we would like to mention that the information we collected via Crunchbase might contain errors. Crunchbase is an open and collaborative platform that provides business information about private and public companies. Information is sourced via investment firms that directly submit updates to their portfolio and investment activity to Crunchbase but also, to a large extent, via community contributions. Although information on the platform is verified automatically by algorithmic systems and manually by a team of data analysts according to the Crunchbase website,[20] we cannot rule out inaccuracies and missing information in the Crunchbase data. The same holds true for the information collected via the SemiEngineering blogposts.

For a better estimate of the representativeness of our data, we compared our results with the number of funding rounds and the total funding amount mentioned in other reports analyzing the semiconductor ecosystem. Given that the methodology of these studies is not fully transparent, we do not attempt to explain similarities or differences.

Comparison of funding rounds and funding amounts with other reports

For 2022, our data found that semiconductor startups raised at least $22 billion funding (including minimum estimates for partially disclosed rounds), while Pitchbook reported a higher figure of $38 billion.[21] In terms of the relative share of China's chip startups, our data shows a 70% share, whereas the Pitchbook report indicates a 56% share.[22] Despite the variation in absolute values, the overall trend and the prominence of China's role in semiconductor startup financing are consistent across both data sets.

The most recent study from Strategic Semiconductors supports our findings on the development of funding activities in 2022.[23] Their analysis tracked approximately 1,290 deals, including battery startups, which is close to our count of 951 funding rounds, excluding battery startups. As the report states that nearly one-quarter ($9.4 billion) of the total funding amount was invested in battery startups, this difference likely accounts for the majority of the variance in the number of funding rounds between the two data sets.[24]

EqualOcean, a Chinese market analyst, reported that Chinese semiconductor startups saw 287 funding rounds in 2021, representing a 67.8% increase from the 171 deals in 2020.[25] In comparison, our data includes only 18 funding rounds for Chinese startups in 2020 and 132 in 2021. Despite the discrepancies in the number of deals, our data and other sources consistently confirm a strong surge in funding activities for both Chinese startups and semiconductor startups worldwide. Yet, this example shows significant gaps in some numbers of funding rounds in our data relative to other reports.

Additionally, Pitchbook data highlights that the global funding amount for semiconductor startups has more than tripled from 2020 to 2021, with a total transactional value of $9.9 billion across 170 deals in 2021.[26] Our data confirms this massive increase. Based on disclosed funding amounts, we see a jump from approximately $4.5 billion in 2020 to around $16 billion in 2021. This convergence in broad trends across different sources bolsters the validity of our analysis, emphasizing the substantial growth in financing activities for semiconductor startups, particularly in China.

Even with the acknowledged limitations in our data set, overall trends and key takeaways, such as China's significant role in the industry, remain consistent. Nevertheless, considering the notable gaps in our data relative to other reports, it is prudent to exercise caution when drawing conclusions, especially when interpreting findings with limited data coverage. Going forward, we recommend supplementing our data with more comprehensive sources to enhance the reliability and scope of future analyses.

B: Startup categorization

To analyze the activities of the startups in our sample with regard to the semiconductor value chain, we manually researched each startup and assigned it into one or multiple of the following segments: "design," "manufacturing," "IP," "EDA," "materials," "equipment," and "wafers." For example, a startup active in chip design and in IP licensing was assigned two segments: "chip design" and "IP." Additionally, if the core business model of the startup mentioned in the SemiEngineering blogposts was not directly related to the semiconductor ecosystem, it was not included in our analysis. This was often the case for startups innovating battery applications. Our dataset might still include a small number of startups that were incorrectly assigned a certain value chain segment, but we do not expect these to significantly affect the results of our analysis.

For practical reasons, and because the information was often not available in public online sources, we did not differentiate the activities of the startups any further; neither did we specify the main areas in which the startups were involved. The analysis of the startup activities thus assumes that each startup is equally active in every segment to which it is attributed. However, it is also possible that it is particularly successful in one of the segments, and the second one resulted from a development toward a more diverse portfolio or business model, such as a startup offering EDA software as the core product but also IP as a secondary product. Another possibility is that a startup's activity in two areas, for example, design and manufacturing, is the core of their business model and cannot be seen in isolation. Additionally, because of limited reliable sources, it was not always clear whether a startup was pursuing a fabless business model or whether it was also active in manufacturing. For this reason, our analysis might overrepresent or underrepresent certain startup activities.

C: Headquarters location

Our analysis is based on information gathered via SemiEngineering blogposts and additional information from Crunchbase. For 748 investors, no information about the headquarters country was available. In these cases, we manually researched each investor's name to find information about their headquarters via additional public online sources.

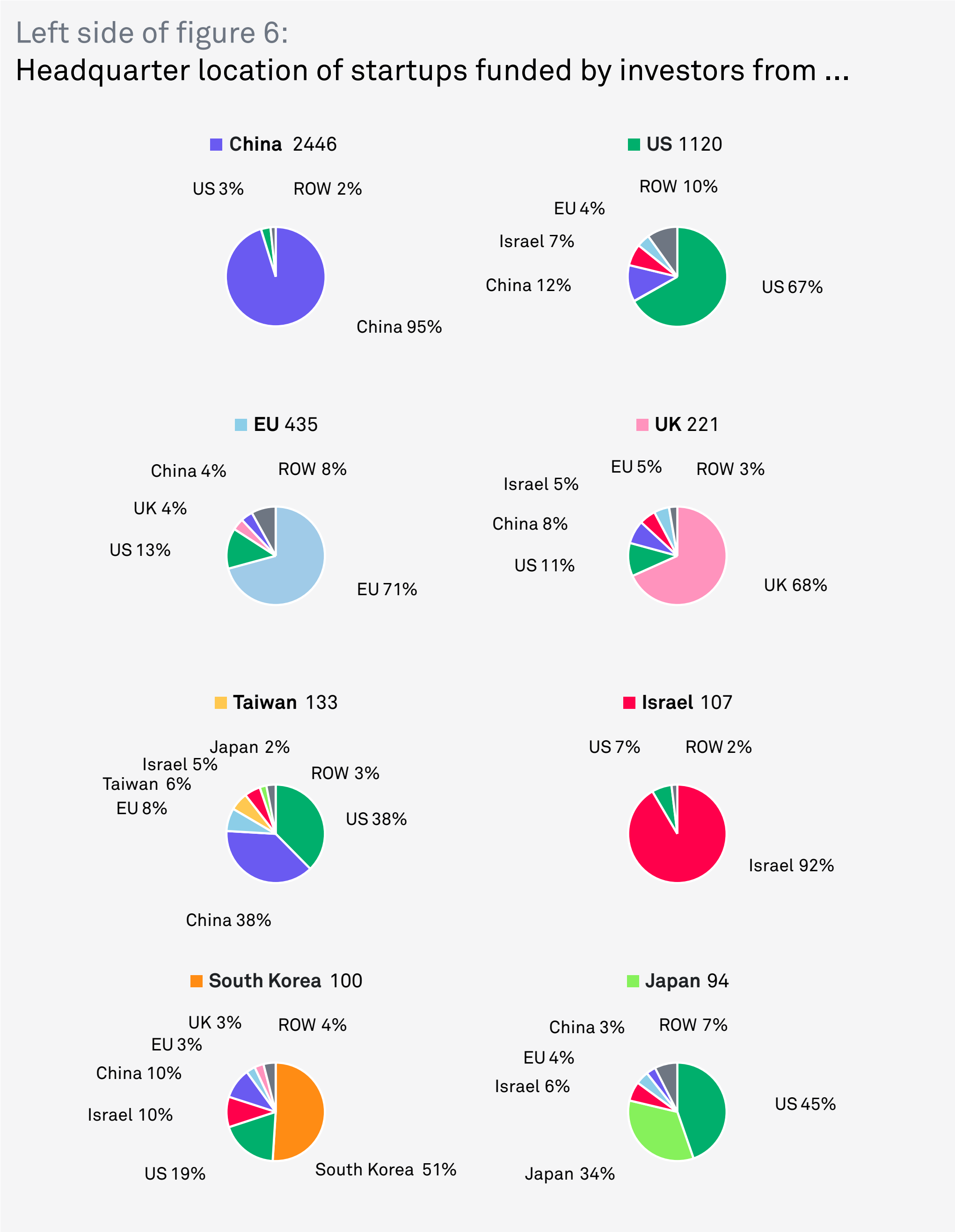
Since many of the investors in our sample operate globally and have multiple offices in different countries, the allocated headquarters do not always reflect the ultimate source of investment or show inaccuracy regarding the actual location of the investor. One example is GSR ventures. Its headquarters are in California, but it mainly operates in China. This problem is also mentioned in similar analyses, such as the CSET report on U.S. outbound investment into Chinese companies.[27]

D: Entity resolution

In the process of analyzing the startups and investors mentioned in specific funding rounds, we faced the challenge of startups and investors going by different names. This is particularly a problem in the Chinese ecosystem, as entities appear simultaneously by their Chinese names and their English translations. Thus, it could be that the same entity is counted more than once. We normalized our dataset by searching the data for an entity's spelling and translation variants and aligning them. However, we cannot guarantee that all names were normalized through this procedure or that all startups and investors were counted only once. We assume that there are still some name variants in our dataset that we did not discover or normalize. This might result in a slight overrepresentation of Chinese startups and investors in our dataset.

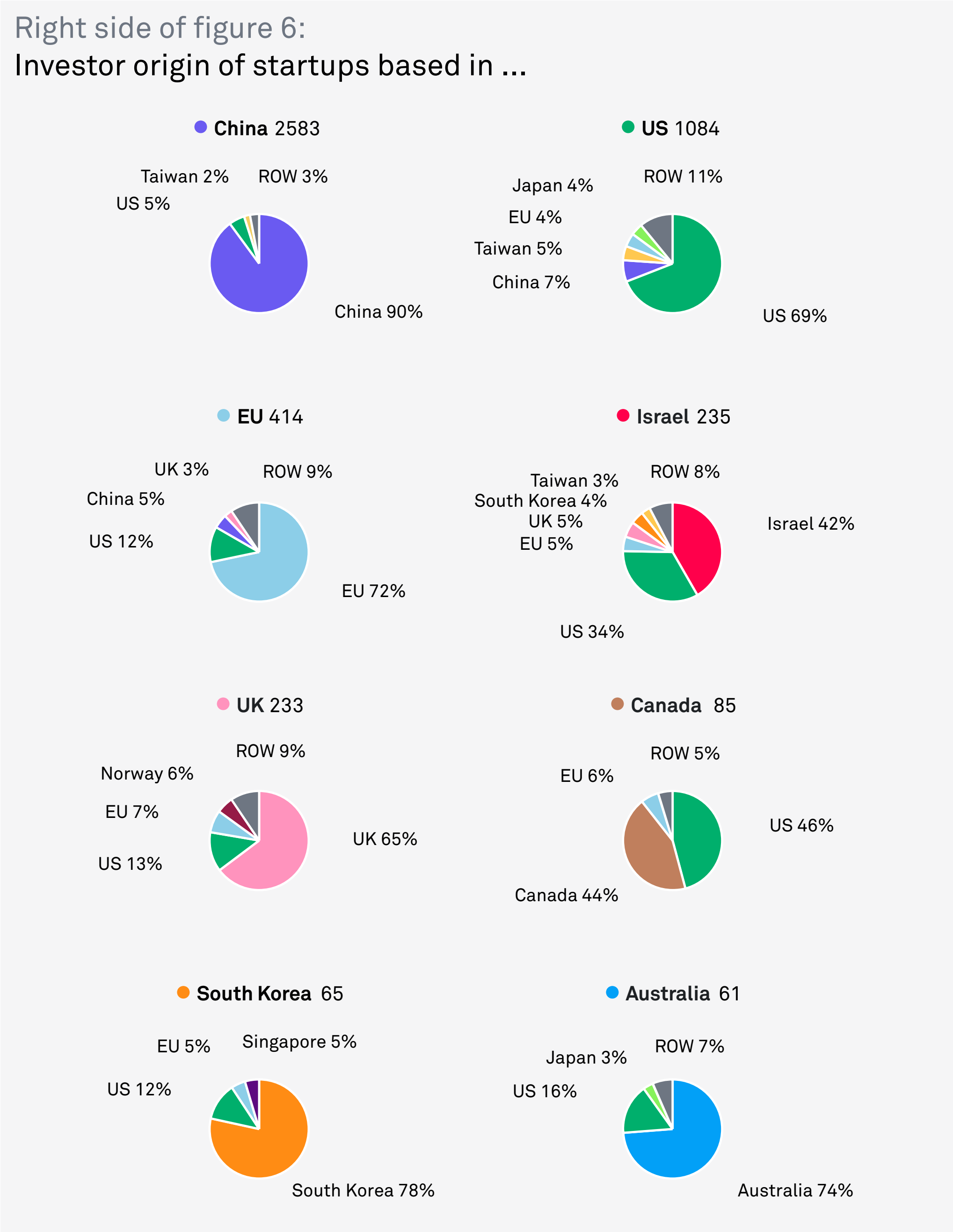
Annex 2: Incoming and outgoing transactions by country

Figure 11



For the countries with the most outgoing transactions in our sample, the charts show the relative share of startup headquarters countries. The total number of outgoing transactions is noted next to the country. For example, of the 435 transactions from EU-based investors, 71% went to startups based in the EU, 13% to US startups, 4% to UK startups, 4% to Chinese startups, and 8% elsewhere. Numbers might not add up to 100% due to rounding.

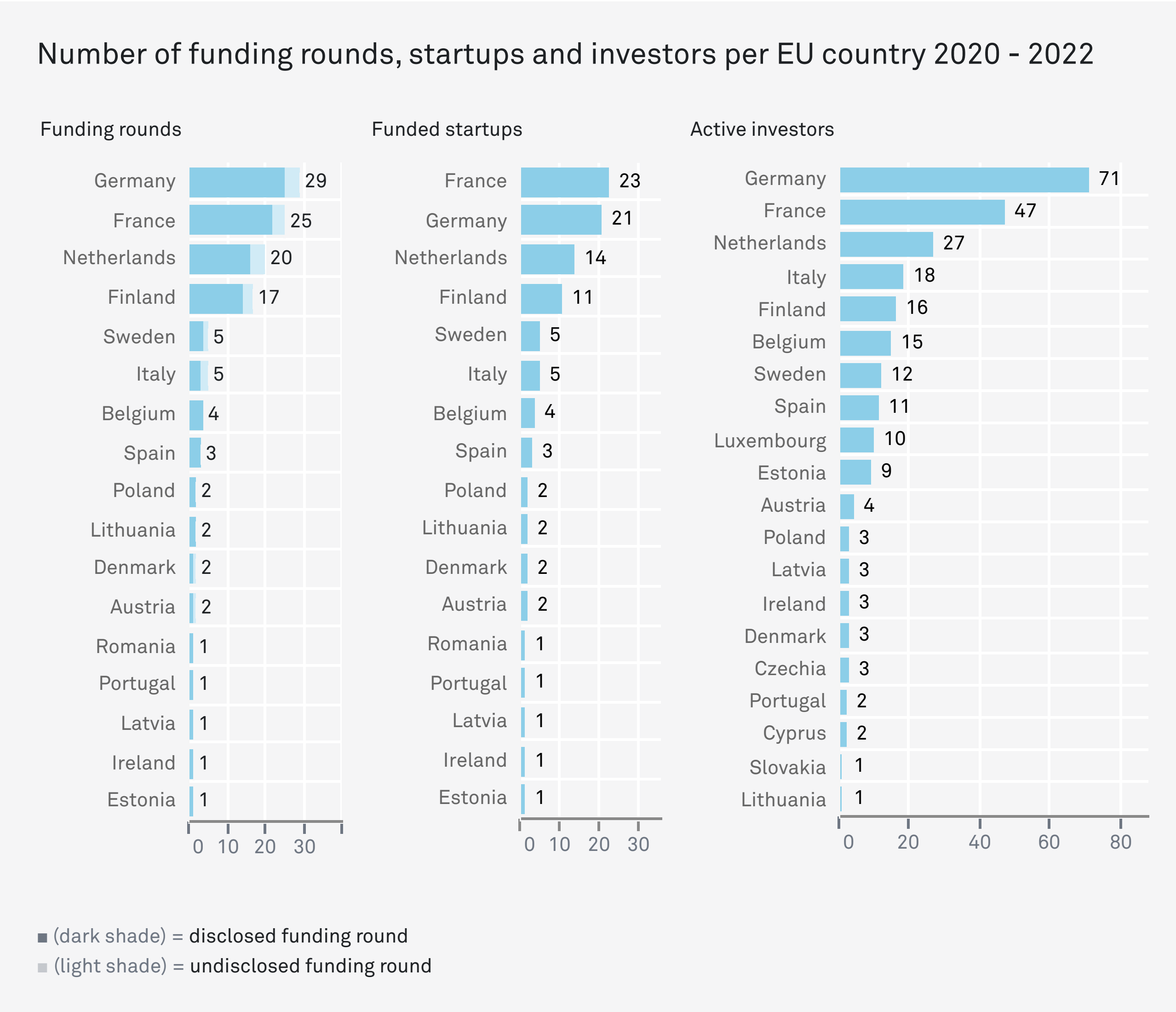
Figure 12



For the countries with the most incoming transactions in our sample, the charts show the relative share of investor headquarters countries. The total number of incoming transactions is noted next to the country. For example, of the 414 transactions to startups in the EU, 72% came from EU-based investors, 12% from US investors, 5% from Chinese investors, 3% from UK investors, and 9% from other countries. Numbers might not add up to 100% due to rounding.

Annex 3: Funding rounds, startups and investors in Europe

Figure 13



Annex 4: SNV's previous publications on the semiconductor value chain

Challenges of a rising Chinese chip design ecosystem

Jan-Peter Kleinhans, John Lee, February 2023
Europe's Strategic Technology Autonomy from China: Assessing Foundational and Emerging Technologies

China Semiconductor Observatory – Baseline Report

Jan-Peter Kleinhans, John Lee, December 2022
China Semiconductor Observatory

Government's role in the global semiconductor value chain #3 – Analysis of the EU Chips Act: The Crisis Response Toolbox

Jan-Peter Kleinhans and Julia Hess, September 2022
SNV Policy Paper

Governments' role in the global semiconductor value chain #2 – Recommendation for the EU Chips Act: A long-term governmental mapping

Julia Hess and Jan-Peter Kleinhans, July 2022
SNV Policy Paper

Governments' role in the global semiconductor value chain #1 – Analysis of the EU Chips Act: Challenges of government monitoring of the supply chain

Jan-Peter Kleinhans, Julia Hess, and Wiebke Denkena, June 2022
SNV Policy Paper

China's rise in semiconductors and Europe: Recommendations for policymakers

Jan-Peter Kleinhans and John Lee, December 2021
SNV x MERICS Policy Paper

Understanding the global chip shortages: Why and how the semiconductor value chain was disrupted

Jan-Peter Kleinhans and Julia Hess, November 2021
SNV Policy Paper

Mapping China's semiconductor ecosystem in global context: Strategic dimensions and conclusions

John Lee and Jan-Peter Kleinhans, June 2021
SNV x MERICS Policy Paper

Who is developing the chips of the future?

Jan-Peter Kleinhans, Pegah Maham, Julia Hess, and Anna Semenova, June 2021
SNV Policy Paper

The lack of semiconductor manufacturing in Europe: Why the 2 nm fab is a bad investment

Jan-Peter Kleinhans, April 2021
SNV Policy Paper

The global semiconductor value chain: A technology primer for policymakers

Jan-Peter Kleinhans and Dr. Nurzat Baisakova, October 2020
SNV Policy Paper

6. References

1 Jan-Peter Kleinhans, Pegah Maham, Julia Hess, Anna Semenova, "Who is developing the chips of the future?",June 16, 2021. https://www.stiftung-nv.de/en/node/3085.

2 Semiconductor Engineering, December 23, 2021. https://semiengineering.com/category-see-more/?cat_id=51386&bns=2.

3 SemiEngineering is based on diverse set of relevant stakeholders bringing together expertise from chip architects, engineers, journalists, end users, industry organizations and standards bodies. They state that they provide independent information because they limit vendor involvement only to help in their role as experts offering context. SemiEngineering belongs Sperling Media Group LLC. You can find further information here. https://semiengineering.com/about-us/.

4 Crunchbase is a platform that provides business information, such as headquarters location, investors, funding rounds, and much more. See https://www.crunchbase.com. However, it lacks a clear structure and definition of what constitutes a “semiconductor startup”. As a result, we have chosen to use SemiEngineering as our primary starting point while also utilizing Crunchbase to search for additional information.

5 Figure 5 only shows entities for which we identified a headquarter country.

6 Whenever we talk about Europe or EU, we refer to EU27 Member States.

7 Jan Peter Kleinhans and John Lee, “Mapping China’s semiconductor ecosystem in global context: strategic dimensions and conclusions.” Stiftung Neue Verantwortung & MERICS, June 30, 2021. https://www.stiftung-nv.de/en/publication/mapping-chinas-semiconductor-ecosystem-global-context-strategic-dimensions-and.

8 Ngor Luong, Zachary Arnold, and Ben Murphy, “Understanding Chinese government guidance funds.” Center for Security and Emerging Technology, March, 2023. https://cset.georgetown.edu/publication/understanding-chinese-government-guidance-funds/.

9 Jost Wübbeke et al., “Made in China 2025.” MERICS, August 12, 2016. https://merics.org/de/studie/made-china-2025-0.

10 Figure 6 only shows entities for which we identified a headquarter country. It only shows transactions for which both origin and destination country were identified.

11 Jan Peter Kleinhans and Julia Hess, “Understanding the global chip shortages.” Stiftung Neue Verantwortung (SNV), November 16, 2021. https://www.stiftung-nv.de/en/publication/understanding-global-chip-shortages.

12 Jan Peter Kleinhans and Julia Hess, “Understanding the global chip shortages.” Stiftung Neue Verantwortung (SNV), November 16, 2021. https://www.stiftung-nv.de/en/publication/understanding-global-chip-shortages.

13 Saif M Khan and Alexander Mann, “AI Chips: What They Are and Why They Matter.” Center for Security and Emerging Technology, April 2020. https://cset.georgetown.edu/publication/ai-chips-what-they-are-and-why-they-matter/.

14 <?> John Koon and Ed Sperling, “New Uses for AI in Chips.” Semiconductor Engineering, August 11, 2022. https://semiengineering.com/new-uses-for-ai-in-chips/.

15 D/D Advisors, “Herd Mentality and the Lack of US Semis Investment.” Digits to Dollars, September 30, 2019. https://digitstodollars.com/2019/09/30/3042/.

16 All funding amounts were converted to USD. We used historical currency conversion factors to better approximate USD worth at the time of investment.

17 Agam Shah, "Absolutely fabless: Chip startup funding reaches record 20bn in 2021", February 2, 2022. https://www.theregister.com/2022/02/02/chip_startup_funding/.

18 Jan-Peter Kleinhans, Pegah Maham, Julia Hess, Anna Semenova, "Who is developing the chips of the future?", June 16, 2021. https://www.stiftung-nv.de/en/node/3085.

19 “Accelerator challenge: Emerging semiconductor and quantum technology components – Information day.” European Innovation Council, February 9, 2023. https://eic.ec.europa.eu/events/accelerator-challenge-emerging-semiconductor-and-quantum-technology-components-information-day-2023-02-09_en.

20 “The Crunchbase difference.” Crunchbase. Crunchbase Inc., July 21, 2020. https://about.crunchbase.com/products/the-crunchbase-difference/.

21 Priyamvada Mathur, "VCs take aim at semiconductor innovation" Pitchbook, March 4 2022. https://pitchbook.com/news/articles/vc-startups-semiconductor-ai-ml-innovation.

22 Priyamvada Mathur, "VCs take aim at semiconductor innovation" Pitchbook, March 4 2022. https://pitchbook.com/news/articles/vc-startups-semiconductor-ai-ml-innovation.

23 Ahmed Ben Slimane, "2022's US$38B in Semiconductor Investments." EE Times Europe, February 15, 2023. https://www.eetimes.eu/tracking-2022s-us38b-in-semiconductor-investments-for-startups/.

24 Ahmed Ben Slimane, "2022's US$38B in Semiconductor Investments." EE Times Europe, February 15, 2023. https://www.eetimes.eu/tracking-2022s-us38b-in-semiconductor-investments-for-startups/.

25 Shen Lu, "Chinese chip companies raised a record $11 billion in 2021." Protocol, February 23, 2022. https://www.protocol.com/bulletins/china-chip-funding-11-billion.

26 Priyamvada Mathur, "VCs take aim at semiconductor innovation" Pitchbook, March 4 2022. https://pitchbook.com/news/articles/vc-startups-semiconductor-ai-ml-innovation.

27 Emily S Weinstein, and Ngor Luong, "U.S. outbound investment into Chinese AI companies." Center for Security and Emerging Technology, February 2023. https://cset.georgetown.edu/publication/u-s-outbound-investment-into-chinese-ai-companies/.

Imprint

Stiftung Neue Verantwortung e.V.
Beisheim Center
Berliner Freiheit 2
10785 Berlin

T: +49 (0) 30 81 45 03 78 80
F: +49 (0) 30 81 45 03 78 97

stiftung-nv.de/en
info@stiftung-nv.de

Design:
Make Studio
www.make-studio.net

Layout:
Jan Klöthe
Alina Siebert